Mechanisms for assessing the sustainability of swimming-with-whales tourism in the Great Barrier Reef

Thesis submitted by
Matthew I. CURNOCK
in December 2010

for the degree of
Doctor of Philosophy

in the School of Earth and Environmental Sciences
and the School of Business & I.T.
James Cook University
Townsville, Australia

STATEMENT OF ACCESS

I, the undersigned, author of this work, understand that James Cook University will make this thesis available for use within the University Library and, via the Australian Digital Theses network, for use elsewhere. All users consulting this thesis will have to sign the following statement:

> "In consulting this thesis I agree not to copy or closely paraphrase it in whole or in part without consent of the author and to make proper written acknowledgement for any assistance which I have obtained from it."

I understand that, as an unpublished work, a thesis has significant protection under the Copyright Act and I do not wish to place any further restriction on access to this work.

Signature: _____ Date: _____

Matthew I Curnock

STATEMENT OF SOURCES DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

Signature: _____ Date: _____

Matthew I Curnock

ELECTRONIC COPY

I, the undersigned, the author of this work, declare that the electronic copy of this thesis provided to the James Cook University Library is an accurate copy of the print thesis submitted, within the limits of the technology available.

Signature: _____ Date: _____

Matthew I Curnock

DECLARATION ON ETHICS

The research presented and reported in this thesis was conducted within the guidelines for research ethics outlined in the *National Statement on Ethics Conduct in Research Involving Humans* (1999), the *Joint NHMRC/AVCC Statement and Guidelines on Research Practice* (1997), the *James Cook University Policy on Experimentation Ethics Standard Practices and Guidelines* (2001), and the *James Cook University Statement and Guidelines on Research Practice* (2001). The proposed research methodology received clearance from the James Cook University Experimentation Ethics Review Committee (approval number H-2376).

Signature: _____ Date: _____

Matthew I Curnock

STATEMENT ON THE CONTRIBUTIONS OF OTHERS

Stipend:

James Cook University Postgraduate Research Scholarship

Sustainable Tourism Cooperative Research Centre Supplementary PhD Scholarship

Faculty of Law Business and Creative Arts Doctoral Completion Grant

Project support:

James Cook University (JCU):

- School of Earth and Environment Sciences (Graduate Research Scheme): $1400
- School of Business (Graduate Research Scheme): $2599
- School of Business (International Conference Travel Grant): $1500
- School of Business Individual Research Account (Minimum Resources): $3000

Sustainable Tourism Cooperative Research Centre:

- CAUTHE conference attendance & STCRC PhD skills development workshops, 2007, 2008.
- International Conference Travel Grant: $1000

Great Barrier Reef Marine Park Authority (GBRMPA):

- Science for Management Award 2007: $1078
- Dwarf Minke Whale Tourism Monitoring Program (operational costs, 2006-2009): $4500

Minke Whale Project Fund:

- Fieldwork travel and equipment costs: $3000

Cod Hole and Ribbon Reef Operators Association (CHARROA):

- In-kind support (berth spaces): approx. $45,000

Supervision:

Dr Alastair Birtles (JCU School of Business)

A/Prof Peter Valentine (JCU School of Earth and Environmental Sciences)

Statistical support:

Dr Arnold Mangott

Susan Sobtzick

GIS support:
Dr James Moloney
Dr Alana Grech
The GBRMPA Spatial Data Centre

Field data collection and data entry assistance (Minke Whale Project volunteers):
Lauren Gregory, Sam Noonan, Miwa Takahashi, Jos Hill, Michelle Bingham, Vanessa Jaiteh, Sonia Levitt, Anita Giraldo, Kana Koichi, Jessica Maddams, Gloria Hidalga, Anna Taverna, Andrea Monge Rodriguez, Veronique Mocellin, James Livingstone, Faith Foster, Silvia Figaro Morelli, Putu Liza Kusuma Mustika (Icha), Rachel Amies, Raechel Littman, Laetitia Thevenot, Verena Reichel, Naomi Dart, Claudia Frey, Ingrid Cripps, Kelly Moody, Shanna Fredericks, Taylor Bodine, Samantha Gibbs, Wakana Manabe, Yoland Bosiger, Martino Malerba, Emily Gerard, Molly Goldie, Anne Caillaud, Chad Buxton.

Japanese translation of questionnaires:
Miwa Takahashi, Kana Koichi.

Website development and support:
Luis Sanchez, Cyberfactory.

DVD editing and production:
Bess Manley, Digital Dimensions.

Editorial assistance:
Susan Sobtzick

ACKNOWLEDGEMENTS

I would like to thank my PhD supervisors, Dr Alastair Birtles and A/Prof Peter Valentine, for their guidance, encouragement, patience and support over the many years we have worked together. I feel extremely privileged to have been given the opportunity to work on such an inspiring and rewarding project with you both. Thank you for sharing your wealth of knowledge about the whales, wildlife tourism management and ecologically sustainable development, as well as your passion for the whales and these subjects. To my associate supervisor, the late Dr Peter Arnold, who passed away in early 2006; my research design was shaped considerably by your early advice (including the title of this thesis) and it was a great privilege to have known and worked with you as part of the Minke Whale Project.

I am forever grateful to my parents for their love, generosity and support throughout my PhD (and of course through the rest of my life). You contributed the greater part towards the 'hidden costs' associated with my research (and student lifestyle) and gave me wonderful moral support and advice that helped me to overcome many challenges.

To my Minke Whale Project research colleagues Arnold Mangott and Susan Sobtzick: without a doubt, working in a team with you greatly enhanced the outcomes of my research and made it all the more the fun. Congratulations to you both on completing your own PhDs! Many thanks also to our wonderful and enthusiastic volunteers for their assistance with field data collection and data entry.

I would like to thank the Great Barrier Reef Marine Park Authority for their support for this research, by providing direct funding and through staff involvement in workshops and interviews. In particular, many thanks to Sarah Salmon, Dr Kirstin Dobbs, Dr Mark Read, Anne Caillaud and Philippa Mantel, as well as staff from the GBRMPA Spatial Data Centre. Many thanks also to Queensland Parks and Wildlife staff who participated in workshops and/or interviews, in particular Jesse Low, Wallace Macfarlane and Chad Buxton.

I am extremely grateful to the swimming-with-whales tourism operators, their staff and crew that supported my study and have supported the Minke Whale Project for more than a decade. Without their in-kind support (by providing vessel berths) and crew assistance with data collection this study would not have been possible. Special thanks go to John

and Linda Rumney (of *Eye to Eye Marine Encounters*), Mike Ball, Craig Stephen, Janine Lucas, Laurence Buckingham, Julia Sumerling, Kerrin Jones, James Hutchinson and Larry O'Driscoll (from *Mike Ball Dive Expeditions*), Louise Bernstein, John Marsden, Qamar Schuyler, Jaap Barendrecht, Andy Dunstan, Debbie Maynard, Ross Miller, Gareth Stephens, Emily Griffen, Dr Dean Miller, Brendon Robinson, Dr Julia Bowett, Gabrielle Vianna, David Dickson and the Grollo family (all formerly of *Undersea Explorer*; a tourism-funded research vessel concept originated by John Rumney), Peter Mauldon, Jack Brosnan, Colin Mailer, Sharryn Voelkering, Pam Fischer, Jane Finch and Andy Gradinger (of *Taka Dive*, now owned and operated by *Deep Sea Divers' Den*), John Graziano, Laurene Best, Sue Bertram, Demi Yokota, Kelly Maxwell and Molly Goldie (formerly of Nimrod Explorer, *Explorer Ventures*), Peter Wright, Chris Jones and David Miller (of *Poseidon Cruises*), John Joyce (of *Aristocat Cruises*), Dougie Baird, Russell Hore, Mark Shearer and Shane Down (*Silversonic*, Quicksilver Group), Marcus Oke (of *Floreat Reef Charter*) and Jack Nairn (formerly of *Reef Cruises*). Thank you also to all of the passengers on these vessels who supported my research and the Minke Whale Project by completing questionnaires and donating to the Minke Whale Project Fund.

Thank you to other organisations and people that supported and participated in this research and the Minke Whale Project, including the Whale and Dolphin Conservation Society (in particular, Dr Mike Bossley and Dr Deborah Benham), the International Fund for Animal Welfare (in particular Darren Kindleysides and Jorge Luis Basave), the Commonwealth Department of the Environment, Water Heritage and the Arts (now the Department of Sustainability, Environment, Water, Population and Communities; in particular Dr Muhammad Iqbal) and the Australian Marine Mammal Centre (in particular Dr Nick Gales). Thank you also to Maui Jim and Jo Fewster for providing myself and team members with excellent sunglasses to protect our eyes and help with minke spotting.

Special thanks to my wonderful wife [redacted] for helping and supporting me throughout my PhD candidature, including advice and troubleshooting with statistics, data collection, analyses, proofreading and editing, as well as helping me retain a healthy work-life balance.

Finally, I would like to thank the amazing dwarf minke whales of the Great Barrier Reef for the unforgettable experiences they have given me, which have been an ongoing source of inspiration and wonder.

ABSTRACT

An Australian Government sanctioned swimming-with-whales (SWW) tourism industry has developed in the northern Great Barrier Reef based on the austral winter migration of dwarf minke whales (*Balaenoptera acutorostrata* subsp.). Nine Reef tour operators were granted special SWW endorsements/permits in 2003 by the Great Barrier Reef Marine Park Authority, and the industry has remained capped at this level. Permit conditions require these operators to (i) comply with a Code of Practice when encountering the whales, and (ii) report details of all encounters using Whale Sighting Sheets. The cumulative impacts of this tourism activity are uncertain and there are widespread concerns about the sustainability of swim-with-cetaceans programs. The geographic remoteness of these interactions in the Great Barrier Reef poses additional challenges for monitoring the activity.

Adopting a 'sustainability science' approach, this study utilised a mixed methodology to investigate mechanisms for assessing the sustainability of this SWW tourism activity. Four studies were conducted over three minke whale seasons (2006-2008), which investigated:

(1) The spatial and temporal distribution of dwarf minke whale encounters and SWW tourism operators' effort in the Great Barrier Reef,
(2) The social values of dwarf minke whales and the SWW experience,
(3) Management of the SWW activity, and
(4) The development of sustainability objectives and indicators for future monitoring of the SWW activity.

Study One examined the distribution of minke whale encounters across the northern Great Barrier Reef (n=854) and compared these with industry searching effort and site use in this region. It was found that almost three quarters of encounters occurred when vessels were moored at popular Reef dive sites or when at anchor behind reefs (i.e. the whales approached and interacted with stationary vessels). Using vessel effort and the whale sightings data, whale encounter rates and proportions of total encounter time to total vessel effort were calculated for the 40 most frequently visited Reef sites, revealing a small number of encounter 'hot spots' with particularly high encounter rates. A trend over the six-year period 2003-2008 was observed, in which the number

of minke whale encounters and the total whale encounter time for the industry increased by approximately 90%. This growth was shown to be a result of increasing industry effort at the identified minke whale encounter hot spots, involving the same handful of SWW operators. Despite such growth, considerable latent capacity for further increases in minke whale encounters was found to exist among the nine permitted operators.

Study Two investigated the elements that contribute to the swimming-with-dwarf minke whales experience using passenger questionnaires (n=2,171), and identified a range of social values of the whales and the SWW experience held by the tourists and key stakeholders. Passenger survey responses indicated exceptionally high ratings of satisfaction with the SWW experience. Defining elements of the SWW experience that emerged included: (i) closeness to whales, (ii) the in-water setting, (iii) seeing many/multiple whales, (iv) the long duration of interactions, (v) inquisitive behaviour displayed by the whales, (vi) interactions occurring "on the whales' terms", (vi) the whales' aesthetic appeal and physical attributes, and (viii) a perception that the SWW encounters were well managed. Significant differences however in passengers' experiences were found on different vessels, with the greatest differences observed between live-aboard dive vessels and Reef day-trips. Passengers on live-aboard vessels were more likely to experience swimming-with-whales, saw more whales, got closer to them and gave higher ratings of satisfaction.

Social values associated with the whales and the SWW activity were identified using interviews with 16 stakeholder key informants, including industry personnel, Reef managers, NGO representatives and researchers. Industry respondents identified dwarf minke whales as one of the top wildlife experiences offered by their company. Management agency representatives perceived the SWW activity to be a good opportunity for engaging with the tourism industry and wider public, and for promoting the sustainable management of whale watching and the Great Barrier Reef. Other stakeholders identified the SWW activity as an opportunity to raise public awareness for whale conservation and expressed a keen interest in the ongoing evaluation and sustainable management of the SWW activity.

Study Three investigated the management of the SWW activity, including issues associated with on-the-water management of minke whale encounters by vessel crew,

as well as the broader management processes and outcomes of stakeholder workshops held over 2006-2008. An analysis of the minutes of seven stakeholder workshops revealed that they were highly effective for addressing management issues and implementing changes to the Code of Practice. Interviews with key informants revealed a high level of satisfaction with current management of the SWW activity, however industry respondents were aware of vessels without SWW-endorsements conducting whale swims and were not satisfied that this issue was being adequately addressed. Concerns were also expressed about future management of the SWW activity, in particular if the number of permitted SWW operators were to increase. Interviews with vessel crew (n=15) revealed differing management challenges for live-aboard vessels and day-boats, however a problem common to the industry is a high turnover of crew. Results from the passenger questionnaires showed an overall perception among SWW participants that their encounters were well managed, however significant differences were found between vessels. Key elements attributed to good management of minke whale encounters were identified, underscoring the role of vessel crew and the importance of good briefings prior to swims with the whales.

Study Four employed principles of Participatory Action Research to engage key stakeholders in an iterative process to develop species, location and industry-specific sustainability objectives. First, a suite of Quadruple-Bottom-Line sustainability objectives was developed based on relevant literature and with input from cetacean scientists, encompassing ecological, social, economic and management goals. Feedback from stakeholders helped to refine these draft objectives and explore issues relating to their implementation. The objectives were subsequently reviewed and fine-tuned in a series of facilitated stakeholder workshops, with 39 objectives being formally adopted by workshop participants. A range of potential sustainability indicators that draw on available industry and researcher-generated data were evaluated concurrently with this process.

Based on the findings of these four studies, a range of issues affecting the implementation of sustainability indicators for the Great Barrier Reef SWW activity are discussed. A Swimming-with-Whales Adaptive Management Model is proposed and management recommendations are given that are intended to assist stakeholders in the ongoing assessment and management of this activity.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

Chapter 3:

Chapter 4:

Chapter 5:

Chapter 6:

LIST OF FIGURES

PLATES

Chapter 1: Introduction and literature review

1.1 History and development of swimming-with-whales tourism in the Great Barrier Reef World Heritage Area

Dwarf minke whales (*Balaenoptera acutotostrata* subsp.) were first recognised as a distinct form of minke whale in the mid 1980s, based on distinctive colouration patterns and smaller size (with a maximum recorded length of 7.8m; Best, 1985). The taxonomic status of the dwarf minke is still unresolved. They are presently regarded as a subspecies of the northern hemisphere (or ordinary) minke (*Balaenoptera acutorostrara*) however they are only known to occur in the southern hemisphere (Best, 1985; Arnold, Marsh & Heinsohn, 1987; Arnold, Birtles, Dunstan, Lukoschek & Matthews, 2005), overlapping in distribution with the larger Antarctic minke (*Balaenoptera bonaerensis*) which is currently targeted by Japanese whaling vessels under their JARPA-II program ("*Japanese Whale Research Program under Special Permit in the Antarctic*"; Bowett & Hay, 2009).

Reports of encounters with dwarf minke whales in the Great Barrier Reef (GBR) Marine Park accumulated through the 1980s and early 1990s, with the majority involving live-aboard dive tourism vessels at popular dive sites along the Ribbon Reefs between Cairns and Lizard Island (Arnold, 1997). The whales were reported to approach vessels, scuba divers and snorkelers and remain in close proximity for extended periods, with the majority of encounters occurring June and July. The predictability of these encounters led to their increasing promotion in advertising by the dive tourism operators and the first 'dedicated' swimming-with-minke whales tours from the mid-1990s (Arnold & Birtles, 1999; Valentine, Birtles, Curnock, Arnold & Dunstan, 2004).

The first field studies of dwarf minke whales in the GBR commenced in 1996, with support from the live-aboard dive tourism and research vessel *Undersea Explorer* (Arnold & Birtles, 1999). Early observations of interactions between the whales, vessels and snorkelers/SCUBA divers, and reports of inappropriate behaviours promoted by some vessels, led to the proposal of a Code of Practice for managing

dwarf minke whale-diver interactions (Arnold & Birtles, 1999). Included in the Code were recommendations for crew to provide passengers with a briefing of Commonwealth legislation and regulations before entering the water swim with the whales (e.g. no swimming towards whales closer than 30m), and for passengers to hold onto ropes (attached to the vessel) at the surface, minimising their movements, and allowing the whales to approach voluntarily and move freely at all times (Arnold & Birtles, 1999).

In 2002 a workshop was held on the management of the growing swimming-with-whales (SWW) activity, bringing together tourism operators with a history of minke whale encounters, management agency staff and researchers. Outcomes of this workshop included an agreement by industry representatives to adhere to the proposed Code of Practice and the establishment of a broad objective to achieve a sustainably managed SWW industry (Birtles, Arnold, Valentine, Barnett & Dunstan, 2002; Minke Whale Project, 2002). In 2003 the Great Barrier Reef Marine Park Authority (GBRMPA) capped the industry and issued special endorsements enabling nine tourism operators to conduct swimming-with-dwarf minke whales activities under their Marine Parks tourism permits. Recipients of the SWW-endorsements included five live-aboard dive vessels regularly visiting sites along the Ribbon Reefs (four running regular itineraries and one charter operation), three day-vessel operations based in Port Douglas that utilise sites around the Agincourt Reef complex (see map below, Figure 1.1), and one to a charter company. Two conditions were attached to the SWW endorsements, including (1) compliance with the Code of Practice and (2) the completion of a Whale Sighting Sheet for every minke whale encounter, to be submitted to researchers for reporting results each season to the GBRMPA and to the operators (GBRMPA, 2006).

A six-year monitoring program of the SWW activity commenced in 2003 (the Dwarf Minke Whale Tourism Monitoring Program) in an attempt to evaluate the sustainability of the SWW activity. Key tasks of the Program included the evaluation of data provided by the industry in the Whale Sighting Sheets, and conducting bi-annual stakeholder workshops (pre- and post-minke season) to assess findings, review management issues and amend the Code of Practice as necessary (Birtles, Valentine, Curnock, Mangott, Sobtzick, & Marsh, 2010).

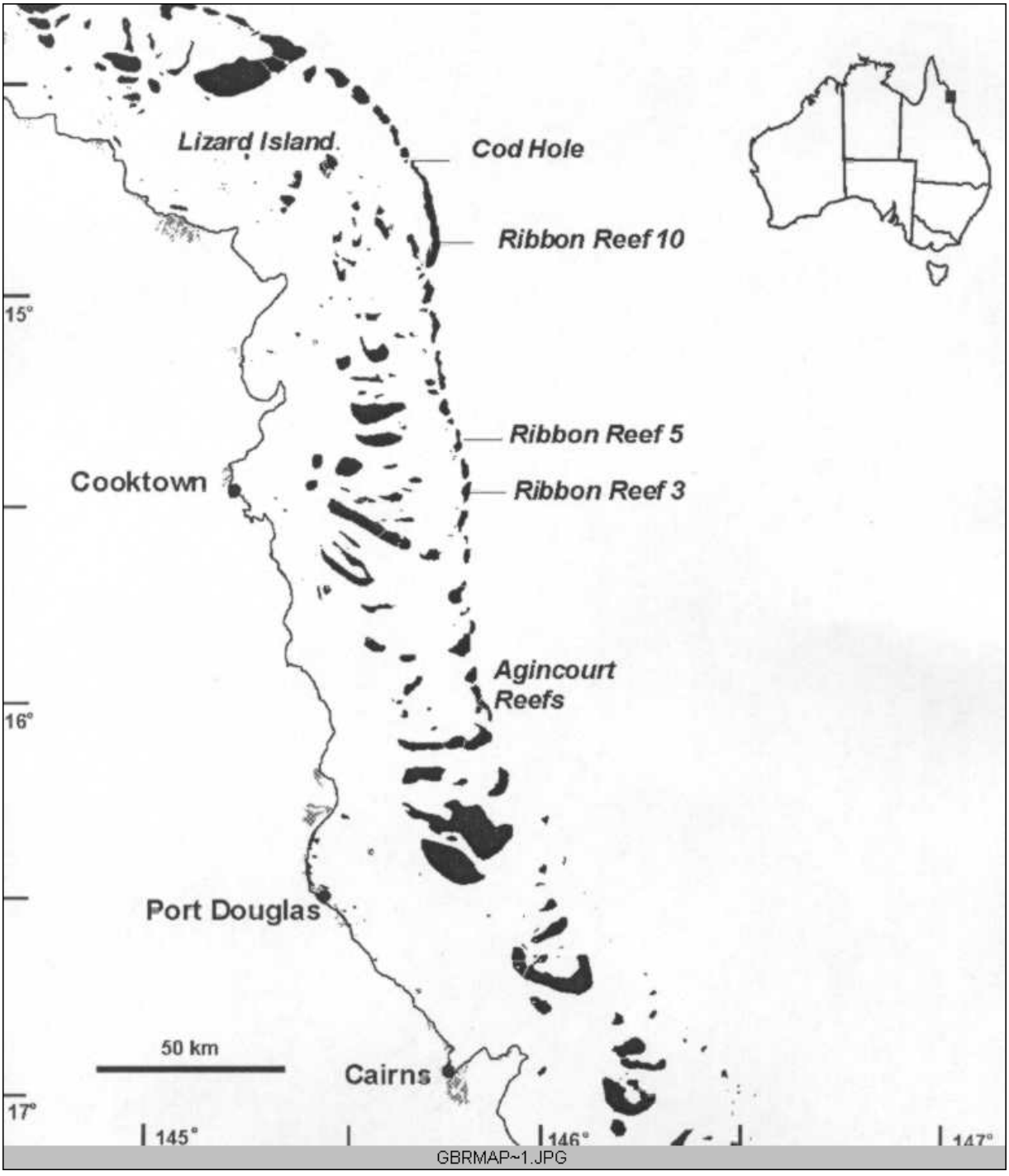


Figure 1.1 **Location of the Great Barrier Reef swimming-with-dwarf minke whales activity** (Map courtesy of Adella Edwards, JCU Cartography Centre)

1.2 The broader context: whale watching tourism

Whale watching as a worldwide tourism industry has grown phenomenally in recent decades (Birtles, Valentine & Curnock, 2001a; Hoyt, 2001; Hoyt & Hvenegaard, 2002; O'Connor, Campbell, Cortez & Knowles, 2009). Hoyt (2001) estimated that whale watching (including whales and dolphins) contributed more than US$1 billion annually to tourism industries worldwide, and grew through the 1990s at an average rate of more than 12% per year. The most recent worldwide review by O'Connor et al. (2009) found that more than 13 million people participated in whale watching in 119 countries, generating more than US$2.1 billion in ticket fees and tourism expenditures during 2008. In Australia, whale watching has grown at a rate of approximately 8.3% per year over the decade 1998-2008, involving over 1.6 million whale watchers in 2008 contributing approximately $172 million in total expenditure to the Australian economy (O'Connor et al., 2009). Most whale watching occurs in countries that are members of the International Whaling Commission (IWC), with many whale watching centres having been involved in whaling prior to the collapse of most whale populations and the IWC-imposed moratorium on commercial whaling of all whale stocks, in effect from 1986 (Hoyt, 2001; O'Connor et al., 2009).

Due to their large size, mammalian characteristics and perceived intelligence, whales and dolphins have become iconic in their appeal to wildlife tourists, and they are frequently portrayed in western media as 'cute', 'playful' and 'approachable' (Amante-Helweg, 1996; Shackley, 1996; Tremblay, 2002). Whale watching experiences have been shown to generate strong positive emotional reactions among participants (e.g. Orams, 2000; Valentine et al., 2004; Curtin, 2006). When presented in combination with appropriately designed interpretation, such whale watching experiences have the potential to enhance participants' knowledge and awareness of marine and environmental conservation issues (Orams, 1995; Townsend, 2003).

1.2.1 Impacts of whale watching tourism

Whilst whale watching provides social and economic benefits and is generally regarded as a sustainable alternative to commercial whaling, there are a growing number of studies revealing impacts of whale watching activities on targeted cetacean (i.e. whale and dolphin) populations. Frohoff (2004) reviewed a range of studies on the effects of human interactions on dolphins and found a high occurrence of reported stress-related behaviours observed in the context of social interactions with humans. Frohoff (2004) concluded that individual dolphins exposed to high degrees of contact with humans were at the greatest risk of injury, illness and death. In a review of vessel-based whale and dolphin watching tours and swim-with dolphins activities in New Zealand, Orams (2004) found that changes in behaviour in relation to human contact were common, however the impacts varied greatly between species, locations and type of interaction.

A widely recognised source of disturbance to cetaceans is noise. Cetaceans use sound to communicate and navigate underwater and acoustic disturbance from whale watching and other vessels can interfere with their communication, cause behavioural avoidance and potentially cause hearing damage or loss (Erbe, 2002; Moore & Clarke, 2002). An additional danger to whales, particularly for larger species (but not limited to them), is the threat of vessel-strike. The occurrence and threat of injuries and mortality has increased substantially in recent years as modern ships, including whale watching vessels, have become larger and faster. The majority of injurious and fatal collisions have occurred from large ships travelling at speeds greater than 14 knots (Laist, Knowlton, Mead, Collett & Podesta, 2001). Calves are particularly vulnerable to vessel strike, and for some species with small population sizes and low reproductive rates even a single calf mortality per year may be unsustainable (IWC, 2004).

While short-term disturbances to cetaceans from encounters with humans have been revealed in many studies (e.g. Beach & Weinrich, 1989; Corkeron, 1995; Orams, 2004), the longer-term effects of cumulative interactions have been shown to be more difficult to establish. Key concerns include the energetic costs associated with

responses to repeated disturbance and the impairment of life functions which can potentially affect population viability (Lusseau & Bejder, 2007).

Only recently have the cumulative effects of short-term disturbance responses to tourism interactions been shown to have significant effects on cetacean populations, however such studies have so far been limited to odondocetes (i.e. toothed whales, including dolphins). Lusseau (2004) investigated linkages between short-term behavioural disruptions and long-term impacts on bottlenose dolphins from tourism vessels in southern New Zealand and found that persistent short-term disturbance and behavioural avoidance of tourism vessels in an area was likely to lead to longer-term area avoidance. This can have negative consequences for the resident population, particularly if animals become displaced from important habitat (e.g. feeding, breeding or resting areas). A population-level impact from vessel-based tourism was established in a study of resident bottlenose dolphins in Shark Bay, Western Australia (Bejder et al., 2006). Drawing on decades of detailed behavioural observations of tourism utilised and non-utilised control areas, Bejder et al. determined a significant decline in dolphin abundance associated with vessel-based dolphin watching tourism involving only two tour operators. This discovery triggered a Ministerial intervention and led to the revocation of one of the marine mammal watching tourism permits (Higham & Bejder, 2008).

Studies of the effects of tourism on mysticetes (i.e. baleen whales, including most of the great whales, e.g. humpback, blue and minke whales) are far less common, and the impacts of human interactions on these whales at the population level are poorly known and are unlikely to be measurable in the short-term. Obstacles for this type of research include the scale of their migration and distance from shore (many species travel over several thousands of kilometres between summer feeding and winter breeding grounds), their long life span, reproduction rates, uncertain population sizes, and the limits of time and funding available for such research. Consequently, for many species, key aspects of their biological and ecological requirements are poorly understood (Mann, 1999; 2000; Bejder & Samuels, 2003).

One of the few studies of tourism impacts on mysticetes, by Watkins (1986), reported that humpback whales initially avoided whale watching vessels at the early stages of

an industry, however made more frequent voluntary approaches to vessels in subsequent years. Watkins also reported an opposite behavioural response in northern hemisphere minke whales (*Balaenoptera acutorostrata*), where early voluntary approaches to vessels were followed by avoidance of vessels in subsequent years (Watkins, 1986), however this study was based on relatively few records. Heckel, Espejel and Fischer (2003) studied the effects of vessel traffic on migrating grey whales (*Eschrichtius robustus*) in Magdalena Bay, north-western Mexico, and found that the lack of management regulations preventing overcrowding of whales and harassment by boats changed the swimming behaviour of the whales, and there are serious concerns that this might result in the long-term displacement of their migratory corridor further offshore, increasing the vulnerability of calves to predation. A similar study of behavioural responses by migrating humpback whales to whale watching vessel traffic noted short-term increases in swim-speed and temporary changes in direction of travel (Scheidat, Castro, Gonzalez & Williams, 2004). Scheidat et al. (2004) however report that different populations of humpbacks have shown varying responses to vessels in other locations and at different times of the year, suggesting that the potential for negative impacts from disturbance can vary between different life-history stages (e.g. seasonal feeding, migrating, or breeding). An understanding of these important biological phases and requirements is therefore essential to minimise potential impacts of human interactions at critical life-history stages.

1.2.2 Swim-with programs

Swimming with wild cetaceans is a rapidly growing form of whale watching tourism. In a review of swimming-with-whales tourism operations worldwide (excluding smaller cetaceans such as dolphins), Rose, Weinrich, Iniguez and Finkle (2005) found 51 commercial operations advertising dedicated swims with whales on the World Wide Web, and a smaller number promoting opportunistic swims. Comparison with their earlier review finding 29 operators (Rose, Weinrich & Finkle, 2003) shows a sharp increase in a relatively brief period. The majority of swim programs, located in the Dominican Republic, French Polynesia, the Kingdom of Tonga, New Zealand and Mayotte (Mozambique Channel, Africa), are based on humpback whales (*Megaptera*

novaeangliae), while a smaller number of operations were found to conduct swims with grey (*Eschrichtius robustus*), southern right (*Eubalaena australis*), bowhead (*Balaena mysticetus*), blue (*Balaenoptera musculus*), sei (*Balaenoptera borealis*), Bryde's (*Balaenoptera edeni*) and dwarf minke whales (*Balaenoptera acutorostrata*) (Rose et al., 2005).

There are concerns however that this type of whale watching could be 'highly invasive' for the targeted whale populations (IWC, 2000). Such concerns have led to an outright banning of swimming with cetaceans in some countries (e.g. Spain, Mexico), while in other countries (e.g. the USA) strong regulations effectively prevent the activity (IWC, 2004). The Whale and Dolphin Conservation Society (WDCS), an international non-government organisation, supports and promotes high quality whale watching as a means for promoting appreciation and conservation of cetaceans, however their policy on swim-with programs states that: "…*WDCS is unable to recommend public support for commercial swim-with wild cetacean programmes which have sprung up in various parts of the world in recent years*" (WDCS, 2006). They explain the reason for this is the difficulty of ensuring that encounters take place on the animals' terms and the potential for encounters to be intrusive or stressful for the animals involved.

While studies of swim-with-dolphins programs have documented impacts such as increased avoidance behaviour (e.g. Constantine, 1999; 2001) very few studies have investigated the impacts of swim programs on larger whales. Concerns for the impacts of swim-with programs on cetaceans include many of the risks associated with vessel-based whale watching, with additional risks of disease transmission (from humans to cetaceans and vice versa), injury (to cetaceans and humans) and in some cases where feeding occurs (for some dolphin swims), dependence on provisioning and reduced natural foraging (Constantine, 2001; Birtles, Arnold & Dunstan, 2002; Rose et al., 2005; WDCS, 2006).

In its reviews of swim-with-cetaceans programs worldwide, the International Whaling Commission (IWC) Scientific Committee has acknowledged that the effects of swim programs will vary among targeted species and populations, that further research into the impacts of swim programs is required, and that precautionary management of

swim programs should be implemented until the impacts are better understood (IWC, 2000; 2004).

1.3 Management framework for swimming-with-whales tourism in the Great Barrier Reef

All cetaceans in Australian waters are protected under the Commonwealth *Environmental Protection and Biodiversity Conservation* (EPBC) *Act, 1999*. According to the Act it is illegal to kill, take, injure or interfere with a cetacean. Interference is defined to include chasing, herding, tagging, marking, branding or harassing a cetacean. Whale watching is regulated in Australia by State, Territory and Commonwealth statutory authorities, and all recreational, commercial and incidental interactions with whales and dolphins are required to follow the Australian National Guidelines for Whale and Dolphin Watching 2005 (Commonwealth Department of the Environment and Heritage, 2005). These Guidelines set a national standard for minimising the impacts of human interactions on individuals and populations of whales and dolphins, by providing advice on the operation of vessels, aircraft, shore-based and swim-with activities involving cetaceans. The Guidelines are organised into two categories: Tier One outlines national standards, and Tier Two allows for additional management considerations to be applied on a case-by-case basis.

The national standards (Tier 1) for vessels interacting with whales include a minimum approach distance of 100m (50m for dolphins), with no more than three vessels allowed within a caution zone extending to 300m surrounding a whale (150m for dolphins), and a maximum 'no wake speed' to be maintained within this zone. Swimming and diving with whales and dolphins is prohibited without the authorisation of the relevant State, Territory or Commonwealth agency, however it is acknowledged that such encounters may happen on an incidental basis where whales and dolphins approach swimmers and divers already in the water. The national standards stipulate that swimmers and divers should not enter the water closer than 100m to a whale (50m for dolphin), and should not approach closer than 30m while in the water (Commonwealth Department of the Environment and Heritage, 2005).

The Australian National Guidelines for Whale and Dolphin Watching 2005 superseded the Australian National Guidelines for Cetacean Observation (ANZECC, 2000). A significant change brought in by the 2005 update is the increase in the minimum distance that a swimmer or diver can enter the water in the vicinity of cetaceans (Tier 1); from 30m to 100m. This increase presents a new challenge for both tourism operators and managers, particularly when whales within 100m (underwater) may not be visible to swimmers or divers entering the water, making both compliance and enforcement difficult. Tier Two provisions however allow different management protocols for specially authorised operations at a species and/or location specific level. It is under this arrangement (Tier 2) that the GBR swimming-with-whales (SWW) activity is managed by the Great Barrier Reef Marine Park Authority (GBRMPA), via SWW-endorsements on tourism operators' Marine Parks Permits and an industry Code of Practice.

1.3.1 The Code of Practice

Originally proposed by Arnold & Birtles (1999) based on field observations of dwarf minke whale interactions with divers and snorkelers, the 'Code of Practice for dwarf minke whale-diver interactions' was further evaluated and revised based on industry and tourists' feedback (Birtles, Arnold, Curnock, Valentine & Dunstan, 2001) and subsequently adopted by SWW tourism operators in 2002 before it became a permit condition for the newly SWW-endorsed operators in 2003. The Code was amended over the following years to include new protocols (e.g. vessel approaches and departures to/from whales and guidelines for encounters with calves; *NB. detailed descriptions of these amendments are provided in Chapter 5*) and was substantially revised and updated in 2008 to incorporate changes to EPBC and GBRMP Regulations that were reflected in the 2005 Australian National Guidelines (Birtles et al., 2008).

The current 'Code of Practice for dwarf minke whale interactions in the Great Barrier Reef World Heritage Area' (Birtles et al., 2008) outlines a range of protocols targeted at vessel skippers, crew (responsible for managing and preparing passengers for in-water interactions) and SWW participants. The Code aims to minimise potential

impacts of SWW activities on the whales whilst allowing people to enjoy the in-water interaction experience and it requires all interactions to be based on voluntary approaches made by the whales. Key features of the Code that guide the GBR SWW interactions include: (i) that swimmers do not approach whales when closer than 30m (*NB. maximum underwater visibility in the region is typically less than this distance*), (ii) the recommended procedure involves snorkelling whilst holding a surface rope attached to the vessel (*NB. whales often arrive at Reef sites when scuba divers are in the water and in such cases divers are advised to continue their dive as normal, to not move towards a whale and to hold onto a safety chain/bar or mooring line when available*), (iii) that swimmers move slowly when whales are nearby to avoid startling them, (iv) to not touch or attempt to make any physical contact with a whale, and (v) to not use flashes or strobes for photography to avoid startling a whale (Birtles et al., 2008). Due to the limited knowledge of dwarf minke whale biology and behaviour, many of the protocols in the Code of Practice are based on a precautionary approach, to minimise potential short-term disturbance to individual whales involved in the SWW interactions.

1.4 Assessing sustainability

1.4.1 What is 'sustainability'?

Sustainability and sustainable development are key concepts in modern environmental policy. Awareness of the need for human development of the Earth to be managed more carefully became widespread in the latter half of the 20th century as it became apparent that the scale of industrial exploitation of natural resources would outstrip those resources in the not too distant future if left unchecked.

In 1987 the United Nations' World Commission on Environment and Development (WCED) reported on large-scale threats to the Earth's ecosystems from human development and laid out a strategy for the sustainable and equitable use of these resources for the future. This report, entitled '*Our Common Future*' (also known as

the Brundtland Report, after the Commission's Chair) provided a definition for sustainable development, which has guided the widespread adoption of the concept:

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (WCED, 1987, p. 54).

In June 1992 the United Nations Conference on Environment and Development (UNCED; informally known as the Earth Summit) in Rio de Janeiro developed (among other key documents) a list of principles for the sustainable development and management of the Earth's resources for the 21st Century, and an agenda ('*Agenda 21'*) outlining specific targets and actions, including resources required to meet these targets on a global scale (UNCED, 1992a). These principles have since been incorporated into the policies of governments worldwide.

The adoption of sustainable development principles in Australian environmental policy was swift, with the development of the National Strategy on Ecologically Sustainable Development (NSESD) in December 1992, and the concept's acceptance in Australia has now become widespread (Peel, 2005). The NSESD provides terms for defining ecologically sustainable development (ESD) and establishes the broad Goal: '*Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends,*' the Core Objectives and Guiding Principles to pursue the goal of ESD (ESD Steering Committee, 1992).

A large body of literature has since developed around the concept of sustainable development, and with it, disagreement and controversies over the term's meaning, interpretations and applications. The Brundtland Report foreshadowed that in its application, particularly in meeting the goals of economic and social development, interpretations of the term sustainable development would vary, but should share certain general features and "must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it" (WCED, 1987, p.54). This prediction has proven accurate as definitions for the term have flourished and the concept has evolved in several directions to encompass the

values and concerns of people working in a broad range of disciplines (Palmer, Cooper & van der Vorst, 1997).

Confusion over the meaning of sustainable development is now widely acknowledged and it has even been argued that the term 'sustainable development' itself is an oxymoron (Pearce, 1989; Redclift, 2005). Nonetheless, various interpretations of sustainability are used liberally in scientific and policy-oriented literature, and these interpretations are applied selectively for different purposes in scientific and political settings (Van den Bergh, 1996; Pezzey, 1997; Redclift, 2005). The range of available definitions of sustainable development partially explains the term's broad appeal and wide use by many different groups with often opposing agendas. Some argue that 'sustainability' and 'sustainable development' have become buzzwords, appearing to encapsulate a discrete notion, however various 'fuzzy' interpretations have been exploited to promote consensus for the need for sustainable development, even though there is no clear agreement on what exactly this means or how it can be achieved (Palmer et al., 1997; Callicott, Crowder & Mumford, 1999).

Four broad principles of sustainable development however have been recognised as underpinning the concept (Palmer et al., 1997):

1. Futurity,
2. Environment,
3. Equity, and
4. Public participation.

Van den Bergh (1996) identified two ethical dimensions relevant to these underlying principles of sustainable development: (1) the anthropocentric dimension concerning inter- and intra-generational equity and justice, and (2) the ecocentric dimension concerning the preservation of nature. The recognition of the need to preserve nature stems not only from the realisation that humans are dependent on the natural environment for survival, but also from a human desire to preserve the intrinsic, existence values of nature, on behalf of species and habitats (Pearce & Turner, 1990).

Recognising that natural systems and human needs fluctuate and change, Hardi and Zdan (1997) offer a simple and pragmatic notion of sustainable development:

> *"Sustainable development is not a "fixed state of harmony." Rather, it is an ongoing process of evolution in which people take actions leading to development that meets their current needs without compromising the ability of future generations to meet their own needs."* (p.9)

1.4.1.1 Triple-Bottom-Line and Quadruple-Bottom-Line reporting

Environmental considerations are now a strong component of developmental policies and reporting requirements for governments and increasingly, private sector corporations. The Global Reporting Initiative (GRI) provides voluntary guidelines for sustainability reporting, which has been adopted by governments (including the Australian Government) and corporations worldwide (Commonwealth Department of the Environment and Heritage, 2003; GRI, 2006). The GRI Guidelines include the reporting of performance indicators encompassing economic, environmental and social aspects in what has become known as Triple-Bottom-Line reporting (UNEP, 2002; 2006). This concept has been expanded in the last decade to include the explicit recognition of governance or institutional requirements as the fourth pillar of 'Quadruple-Bottom-Line' assessments to wholly evaluate sustainable development (Valentin & Spangenberg, 2000; Spangenberg, 2004). However Triple-Bottom-Line reporting is still prevalent and often embeds such governance criteria within the social category (e.g. UNEP, 2006).

Historically (and still in many cases today), the economic considerations of development have outweighed those of the environmental and social aspects (Bell & Morse, 2003). Social equity considerations and community involvement are regarded as critical for sustainable development by ensuring that development decisions are acceptable to all members of society (Palmer et al., 1997; Corbiére-Nicollier, Ferrari, Jemelin & Jolliet, 2003; Franceschi & Kahn, 2003). However, conflicting opinions and the necessity of compromises in the political arena often result in the prevalence of short-term over long-term objectives (Van den Bergh, 1996). Van den Bergh

(1996) argues that in order to mitigate confusion in discussions and planning for sustainable development, there is a critical need to distinguish between economic goals (outcomes) and the ecological conditions (principles). Constraints imposed on development that are derived from either the attainment of desired economic goals or the maintenance of environmental conditions may differ, even though the objectives of both are to achieve sustainability in the long-term. Henry and Jackson (1996) argue that the emphasis on the end goal of sustainability in the literature has far outweighed the development of means by which it is sought. Approaches to sustainable development must therefore focus on viable and desirable management processes to achieve sustainability, and must ensure support from the wider community. Adherence to such processes is an explicit requirement under Quadruple-Bottom-Line reporting (Valentin & Spangenberg, 2000).

1.4.2 Uncertainty and precaution

Due to the complex nature of environmental and ecological processes, scientific uncertainty is a universal problem faced by natural resource managers and decision makers. The precautionary principle, as defined by the Report of the United Nations Conference on Environment and Development (Principle 15) states that:

> "*In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*" (UNCED, 1992b).

While the concept of precaution predates the 1992 Earth Summit (its exact origin is disputed), the precautionary principle achieved broad international recognition and endorsement as one of the underlying principles of sustainable development through this conference. It has since rapidly become a pervasive feature in environmental law as well as health regulation, with international instruments and domestic laws now guiding decision makers to apply a 'precautionary approach' in decisions on public

health and the environment (Peel, 2005). The precautionary principle is expressed as one of the Australian NSESD's seven Guiding Principles:

> "*Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*" (ESD Steering Committee, 1992).

The Australian interpretation removes consideration of 'cost-effectiveness' in precautionary decision-making. Both definitions have been criticised as being expressed in relatively 'weak' terms, as they address only what should not be done, rather than specifying positive actions that should be taken to prevent environmental damage (Gullett, Paterson & Fisher, 2001; Peel, 2005). Advocates of a 'strong' interpretation have argued for the application of stringent regulatory measures in cases where the scientific basis for predicting negative outcomes is very limited, whereas critics of this interpretation have argued that the use of precautionary measures in all cases of scientific uncertainty can be taken too far, and can stall scientific progress and economic development (Peel, 2005).

Consideration of the precautionary principle has been mandated in Australian legislation, under Section 391 of the *Environment Protection and Biodiversity Conservation Act 1999*, which directs the Commonwealth Minister for the Environment in making decisions within the process of environmental impact assessments (EIA) and approvals to take account of the precautionary principle. Bailey (1997) however criticises the EIA process, which informs decisions to proceed or not proceed with development, but does not guide ongoing management to ensure sustainability. As the long-term perspective of sustainability is clear, assessments of sustainability can therefore only be conducted over a very long period.

1.4.3 Methods for assessing sustainability

A variety of methods and frameworks for evaluating progress towards sustainability have been developed and are used for a range of industries and resources. For

management of natural resources and wildlife, some examples include the Limits of Acceptable Change framework (LAC; Stankey, Cole, Lucas, Petersen & Frissell, 1985), the Tourism Optimisation Management Model (TOMM; Manidis Roberts Consultants, 1997), Systemic Sustainability Analysis (SSA, Bell & Morse, 1999) and the Adaptive Impact Management model (AIM; Riley, Siemer, Decker, Carpenter, Organ & Berchielli, 2003; based on the Adaptive Environmental Assessment and Management (AEAM) model developed by Holling, 1978). Common characteristics of these approaches include a focus on minimising negative impacts, the encouragement of public involvement and learning, and the use of indicators to monitor the resource and identify requirements for management response (Miller & Twining-Ward, 2005).

1.4.4 Sustainability indicators

Indicators are simplified measures of components or processes of larger, more complex systems, and are used in all aspects of everyday life for guiding the decisions we make. The use of indicators offers a compromise between scientific accuracy and the need for concise information (Van den Bergh, 1996). Indicators can provide a snapshot of our performance in a particular area, or the state of a system at a point in time, and this is weighed according to the relative value we have ascribed the indicator (Strange & Bayley, 2008).

The use of indicators as tools for measuring sustainability has become widely accepted, however it is not easy to determine exactly what indicators will measure sustainability in any given case, nor how they should be measured. Some key characteristics of indicators to evaluate sustainability however have been proposed and these are now generally agreed (Holling, 1978; Harger & Meyer, 1996; Bell & Morse, 1999). Harger and Meyer (1996) suggest that sustainability indicators should:

- Be simple to understand;
- Address environmental, economic and social issues with as little overlap as possible;

- Be measurable in a quantitative sense;
- Allow trends to be determined;
- Be sensitive to change; and
- Allow changes and trends to be detected in a timely manner.

The use and appraisal of sustainability indicators in tourism is only recent and is therefore not widespread (Sirakaya, Jamal & Choi, 2001; Buckley, 2003; Miller & Twining-Ward 2005). Miller & Twining-Ward (2005) distinguish differences between conventional indicators commonly used in tourism (e.g. hotel/business performance indicators such as labour turnover and customer satisfaction) from sustainability indicators, and the difficulties in the transition from the former to the latter. They argue that most indicators utilised by the tourism industry are conventional only, with many gaps remaining for implementing sustainability indicators.

The World Tourism Organisation (WTO) recommends procedures for developing indicators for tourism destinations, outlining 12 key steps in three phases: research and organisation, indicator development, and implementation:

Research and organisation phase:

1. Definition/delineation of the destination,
2. Use of participatory processes,
3. Identification of tourism assets and risks,
4. Long-term vision for a destination.

Indicator development phase:

5. Selection of priority issues,
6. Identification of desired indicators,
7. Inventory of data sources,
8. Selection procedures.

Implementation phase:

9. Evaluation of feasibility/implementation,
10. Data collection and analysis,
11. Accountability, communication and reporting,

12. Monitoring and evaluation of indicators application (WTO, 2004, p.21)

While the WTO's indicator development procedures are intended for use at the destination level, ranging in scale from small nations, to regions and to specific resorts or sites, the process is reflective of accepted procedures for developing sustainability indicators for other cases (Miller & Twining-Ward, 2005). Miller and Twining-Ward (2005) further advise that there is no single indicator development process that is appropriate to all situations, however many of the steps that are recommended are common to a range of different applications and following these key steps provides the greatest likelihood of identifying the most suitable indicators.

In the development phase, the WTO (2004) identifies two broad approaches to identifying indicators: (1) a data-driven approach, which begins with an inventory of available data sources, which are subsequently each weighed against the objectives, and (2) a policy or issue-driven approach, which begins with establishing the broad objectives and determining what information is required to address these. Strengths of the former approach include the use of existing information and potentially quick responses from available data, however a weakness may be the exclusion of key issues in areas where data are unavailable. The policy/issue-driven approach has the benefit of focussing on the most important issues and can identify new data requirements, however some of these data requirements may not be achievable within time and resource constraints. Ideally, identification of sustainability indicators should incorporate elements of both approaches to ensure an explicit appreciation of any necessary compromises between monitoring needs and capabilities (WTO, 2004; Miller & Twining-Ward, 2005).

1.4.5 Stakeholder involvement

One of the most important principles for the development of sustainability indicators is that the stakeholders are engaged and collaborate to reach a consensus on the principles and definitions that are used to define the objectives of the monitoring program (Grimble & Wellard, 1997; Bell & Morse, 1999; 2003; Miller & Twining-

Ward, 2005). Bell and Morse (1999) however note that this scenario has rarely been put into practice and there are cases where indicators have been set without sufficient stakeholder involvement. The active participation of stakeholders in the development and subsequent learning processes is crucial, as these are the people most likely to be affected by the management policies being implemented as a result (Salafsky, Margoluis, Redford & Robinson, 2002). Integrating knowledge from multiple perspectives and disciplines, and engaging stakeholders in the management and monitoring process will increase the likelihood of identifying impacts on which to target future management actions (Riley et al., 2003).

The day-to-day users of a natural resource often have a greater knowledge of its condition than do the resource managers, and consequently often regard themselves as the stewards of the resource (Ostrom, 1990). Thus information gathered and provided by these users can account for much of the information needed for development and evaluation of sustainability indicators that can be gathered at a reasonable cost (Ostrom, 1990; Riley et al., 2003). However, the stakeholders must share a willingness to achieve the sustainability objectives, otherwise it is likely they will fail. Identifying and bringing together the appropriate stakeholders at an early stage to set and agree on the sustainability objectives is therefore a critical first step (Bell & Morse, 1999; Miller & Twining-Ward, 2005). In the process of developing, implementing and reviewing indicators, even the level of stakeholder participation itself is suggested as a sustainability indicator (Bell & Morse, 1999). But how are these stakeholders identified?

The Oxford English Dictionary defines the word ‘stakeholder’ as: “a person, company, etc., with a concern or (esp. financial) interest in ensuring the success of an organization, business, system, etc.” Ramirez (1999) suggests somewhat narrow criteria for natural resource stakeholders, simply defining them as users and managers of the resource. It is important however to recognise that a broad range of different stakeholders (or groups) will have different attributes which will include specific interests, roles and social networks, as well as relative power and influence (Grimble & Wellard, 1997; Sirakaya et al., 2001).

There is no definitive process for identifying stakeholders, as each resource or case will have its own unique individuals or groups with an interest and direct or indirect relationship with the resource (Ramirez, 1999; WTO, 2004). The likelihood of a particular stakeholder being recognised and becoming involved in management negotiations will depend on their features and attributes, including their power over other stakeholders, the legitimacy of their relationship to the resource, and the urgency of their claim for attention (Ramirez, 1999). The WTO (2004) recommend that any person or group that believes they are involved or affected by management decisions regarding a resource should be considered a stakeholder. They provide an indicative list of potential stakeholders in tourism at local destinations, within five broad categories:

1. Communities – which may include local community groups, native and cultural groups, traditional leaders, private sector employees, property owners and tenants;
2. Public sector – which may include municipal, regional, state and national authorities (including natural resource management agencies), and other ministries and agencies with an interest in the planning or development of tourism and attractions;
3. Private sector – which may include tour operators, travel agents, service providers (e.g. accommodation, transport, restaurants, attractions and their associations), tour guides, interpreters and outfitters, suppliers to the industry, as well as tourism, trade and business development organisations;
4. NGOs – which may include environmental, conservation or other interest groups; and
5. Tourists – which may include representative organisations at the point(s) of origin and international tourism bodies (WTO, 2004).

The WTO (2004) acknowledges that familiarity of the resource and the range of associated issues, including an element of local knowledge, is necessary to identify all of the stakeholders in each case. However, while many stakeholders for a particular resource may be identifiable, a particular stakeholder is only likely to become part of collaborative decision making processes and become ‘social actors’ if they are empowered with sufficient knowledge and capacity to make decisions and act on

them (Ramirez, 1999). As the interests, roles and people within stakeholder groups invariably shift over time, the framework for managing stakeholder involvement must be flexible and adaptive to accommodate new stakeholders, shifting roles and interests, and changes in the sustainability objectives (Walters & Holling, 1990; Ramirez, 1999; Miller & Twining-Ward, 2005).

1.4.6 Defining sustainability objectives

A key step in the early stages of identifying sustainability indicators is to establish a clear set of objectives that are recognised by the stakeholders as desirable, achievable and sustainable. Miller and Twining-Ward (2005) state a need to first synthesise the existing knowledge and identify the knowledge gaps. Initial analyses and scoping are likely to be performed by a researcher or project facilitator, usually based on the relevant literature. For local-level projects however, Miller and Twining-Ward (2005) suggest that the process of scoping is likely to be less reliant on secondary information and more so on stakeholder and community input, guided by broader scale concerns. The relevant information is then presented to the stakeholders in one or more facilitated workshops to analyse and prioritise the key issues (WTO, 2004; Miller & Twining-Ward, 2005).

Facilitated stakeholder workshops are generally regarded as the most effective and transparent means of elucidating and prioritising the key issues to define sustainability objectives, as well as for developing and evaluating indicators to measure progress towards these objectives (Holling, 1978; Bell & Morse, 1999; Miller & Twining-Ward, 2005). The process of defining the sustainability objectives in workshops can benefit stakeholders' understanding of what sustainable tourism means in their particular case, and this creates opportunities for a range of projects, such as the development of a tourism plan or strategy (Miller & Twining-Ward, 2005). It is important however that the stakeholders are encouraged to identify positive future outcomes and desirable conditions, rather than to just produce a list of problems (Miller & Twining-Ward, 2005).

Tourism and natural resource stakeholders may not always be willing or have the time to participate in public meetings and workshops. To maximise stakeholder involvement in the development of objectives and indicators, the use of survey techniques such as questionnaires and structured and semi-structured interviews are recommended to address any potential gaps in opportunities for stakeholder input (WTO, 2004; Miller & Twining-Ward, 2005). Face-to-face interviews are recommended as the most effective technique, enabling the interviewer to build a rapport with respondents, allowing a more in-depth probing of their responses, and for demonstrating a clear interest in their opinions and values of the respondent (Fowler, 2002).

The interview process however presents difficulties in the sharing of information with other stakeholders and there are limitations on the number of respondents that can be sampled from the population. In some cases purposeful sampling, rather than random sampling, of knowledgeable key informants may be preferable where limited time and resources are available (Fowler, 2002; Miller & Twining-Ward, 2005). The use of iterative processes (e.g. the Delphi method), where stakeholders are given the opportunity to refine their responses after group feedback in subsequent workshops, can also help to overcome the problem of information sharing and group appraisal (Linstone & Turoff, 1975; 2002; Miller & Twining-Ward, 2005). Miller (2001) conducted a two-round modified Delphi survey of tourism researchers regarded as 'experts' in topics relevant to sustainable tourism development. The use of emailed questionnaires to evaluate the strengths and weaknesses of a range of pre-selected potential sustainability indicators allowed Miller to achieve a majority consensus on the values of each indicator, despite broad disagreement regarding the concept of 'sustainability' and its borders.

The use of Internet and email technologies have been recognised for their ability to facilitate broader stakeholder involvement and allow easier dissemination and transparency of contributions and results. Consultation with large numbers of stakeholders is made possible using online technologies and the use of this approach is increasing (WTO, 2004).

1.4.7 Indicator screening

Once a clear set of sustainability objectives are developed, compiling and screening a list of potential indicators are the next key steps. The two main sources for generating a list of potential indicators are from literature relevant to the particular case, and from the input of stakeholders. As there is no existing 'master list' of tourism sustainability indicators, and because the key issues for each case are likely to be specific to particular ecosystems, species, sites and industries, many indicators may need to be developed from scratch (Miller & Twining-Ward, 2005).

The process of screening indicators is a qualitative one, and has been argued to be more of an art form than a science (Meadows, 1998; Bell & Morse, 1999; Miller & Twining-Ward, 2005). The selection of indicators however must be subject to logical scrutiny and justifiable to the end users. Indicators must also cover the spectrum of environmental, social, and economic aspects ranging from local through to internationally acceptable standards, however the number and scope of indicators chosen must be within the means and resources available to the project. A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, and evaluation against key criteria are recommended as useful methods for weighing and selecting the most appropriate and effective indicators (Bell & Morse, 1999; WTO, 2004; Miller & Twining-Ward, 2005).

Several authors have proposed lists of criteria for screening sustainability indicators, and while there are similarities in their broad characteristics, emphases on particular criteria vary (Bell & Morse, 2003). The World Tourism Organisation outline five criteria for screening indicators of sustainable development for tourism destinations and provide a worksheet to assist in selecting appropriate indicators (WTO, 2004). Their criteria are:

1. Relevance – Who will use the indicator and how will it influence decisions?
2. Feasibility – Is it practical and affordable to gather and analyse the data?
3. Credibility – Is the information scientifically valid and reliable?
4. Clarity – Is the information clear and understandable to all users?

5. Comparability – Can trends be detected over time and can useful comparisons be made with other cases?

Additional criteria proposed by Guy and Kibert (1998) provide a much broader framework for screening and selecting potential sustainability indicators, including:

- *Community development*: asks whether the stakeholders were involved in the indicators' development and if they considered the indicators acceptable.
- *Linkage*: asks if the indicators link environmental, social and economic issues.
- *Valid*: asks if the indicators measure something that is related to the state of the system (i.e. relevance).
- *Available and timely*: ask about the regularity and ease (and presumably also the cost) of data collection.
- *Stable and reliable*: asks whether the data are compiled systematically and fairly.
- *Understandable*: asks if the results are simple enough to be interpreted by lay persons.
- *Responsive*: asks whether the indicators can respond quickly and measurably to changes.
- *Policy relevance*: asks if the indicators are relevant to public or corporate policy.
- *Representative*: asks whether collectively the indicators cover the important dimensions of the focus area.
- *Flexible*: asks if new or better data might become available in future to address the indicator.
- *Proactive*: asks if the indicator can act as a warning rather than simply measuring an existing state.

In comparing these differences in recommended criteria, Bell & Morse (2003) state that the most suitable indicators in each case will necessarily emerge through a careful selective process involving development, evaluation and acceptance by the stakeholders. For example, while some proposed criteria rule out indicators that are qualitative (e.g. Harger & Meyer, 1996), under certain conditions qualitative indicators may be preferable to quantitative ones (Bell & Morse, 1999).

The number of indicators that can be monitored within the scope of available resources is an important consideration during the screening process. Having too many indicators can become incomprehensible and can impede the evaluation process, however using too few risks an over-simplistic interpretation of the system processes and can limit the ability to detect key trends (Holling, 1978; Bell & Morse, 1999; Miller & Twining-Ward, 2005). It is likely that at the beginning of the identification and screening process, a long list of potential indicators will be identified. Therefore the challenge for stakeholders is to shorten this list to a limited number that address the objectives and key issues, that are within the scope of available resources. For example, in the Samoa Sustainable Tourism Indicator Project, a list of 270 potential indicators was initially identified. Through the process of screening, 57 were chosen for further evaluation, and eventually 20 were selected for initial monitoring (WTO, 2004). While no exact number of indicators is prescribed for any particular situation, several authors recommend that in most local situations, somewhere between 10 and 25 are likely to be appropriate, however more or fewer indicators may still be viable (Harger & Meyer, 1996; WTO, 2004; Miller & Twining-Ward, 2005).

1.4.8 Trial and evaluation

Once a list of indicators has been developed via the screening process, each indicator must be evaluated to determine its effectiveness. As each indicator can become a research project in its own right, and large amounts of data can be collected over time, there must be very careful organisation and management of the monitoring program and data (Bell & Morse, 1999; WTO, 2004; Miller & Twining-Ward, 2005). Documenting the methods and techniques for data collection is also particularly important so that others can carry on indicator monitoring in the long-term. Miller and Twining-Ward (2005) recommend compiling a table of the candidate sustainability indicators to appraise the necessary range of techniques and methods, and to facilitate maximum efficiency in the collection of data where any overlaps occur.

There are several ways to interpret data from indicators, and each method has its strengths and weaknesses. The main objective for each method of tracking indicators however is to define a point at which a management response is triggered. ***Benchmarking***, the reference to a baseline or starting point for subsequent comparison of indicators is a common approach (Busch & Trexler, 2003; WTO, 2004). It is important however to be aware that the establishment of benchmarks is a subjective process, and that the starting point for a baseline comparison may not necessarily represent a desirable state for the system being monitored (Weaver & Lawton, 1999; Miller & Twining-Ward, 2005). The use of ***thresholds*** for tracking indicators is a useful approach, which defines a particular point beyond which some type of consequence reveals itself and a need for management action is identified. The limits or thresholds that ecological systems can withstand however are very difficult to determine, due to the inherent uncertainty of the natural processes (Meadows, 1998). In contrast to thresholds, analyses of indicators can focus on the achievement of ***desirable goals*** or ***targets***. However Miller and Twining-Ward (2005) warn that an excessive focus on reaching specific targets can distract those involved from using the indicator data to help move towards sustainability. Goals and targets must be recognised as a means of achieving sustainability and should not be confused as an end-goal in themselves. An alternative approach to thresholds or targets is to define an ***acceptable range*** for tracking indicators, which can be used experimentally and adjusted where necessary in light of new information. This approach sets a desirable range within which indicators can move, and management actions can be decided when indicators fall outside this range (Manidis Roberts Consultants, 1997; Miller & Twining-Ward, 2005).

The establishment of acceptable ranges is also a subjective process, and different people may interpret the results differently. However there are some advantages in the simplicity of this approach, particularly for visualising an indicator's progress over time (Manidis Roberts Consultants, 1997; Miller & Twining-Ward, 2005). Problems with setting ranges however, are that if they are too loose, they can give the false impression of an acceptable trend, and unsustainable practices may not be identified soon enough. If they are set too tightly, the targets may be unachievable (Miller & Twining-Ward, 2005).

It is likely that for some indicators the desired direction of results will be ambiguous, due to a lack of knowledge of the relationships between variables. Miller and Twining-Ward (2005, p.159) state: "*In reality, the semantics are confusing, and benchmarks, thresholds, targets and ranges are often used interchangeably to mean the point at which action should be taken*." The establishment of benchmarks, thresholds, targets and acceptable ranges must therefore hold up to the scrutiny of all stakeholders, and should be reviewed and revised in light of new information and/or pressures on the resource.

It must also be recognised that the predictive capability of indicators is extremely limited, and that the main focus of any monitoring scheme is to produce assessment information for managers and users as quickly as possible (Holling, 1978). Van den Bergh (1996) cautions that while statistical analyses of indicator data may establish correlative relationships between variables, causal relationships of real-world events are far more complex, involving multiple variables interacting over long time periods, and as such may even be impossible to establish. Ranges, targets and thresholds for indicators can provide a useful tool for stakeholders to recognise undesirable trends, however they are not a substitute for in-depth scientific investigation of cause and effect relationships. The shortcomings of indicators and the level of uncertainty must therefore be acknowledged explicitly at the onset of the indicator development process (Holling, 1978; Van den Bergh, 1996; Miller & Twining-Ward, 2005).

1.5 Management models for sustainability

Increasingly, wildlife managers are adopting management approaches that integrate human as well as biological dimensions, and are broadening stakeholder involvement in management (Riley et al., 2003). The complex and systemic nature of environmental problems requires the development of appropriate models in which to make decisions for sustainable management. Costanza and Ruth (1998) state that models are built in virtually all decision situations, by abstracting from observations and relating the relevant parts with each other. Bailey (1997) emphasises the great diversity in environmental characteristics of different sites (also including technical

aspects, legal, political and social contexts), thus highlighting that successful management policies will necessarily be different for different places and settings.

The willingness of stakeholders to become involved in and support a management process such as developing an indicator monitoring program can also vary, and maintaining their confidence and interest in the process may not be an easy task (WTO, 2004). Careful planning, management and facilitation of stakeholder involvement is therefore necessary to achieve the best outcomes, and to ensure that when management actions are taken, the reasons for them are clearly understood and are acceptable to the stakeholders. A number of frameworks outlining a process for sustainable management of natural resources have been proposed, many of which feature the engagement of stakeholders and development of sustainability objectives and indicators as a core component (Bell & Morse, 1999; WTO, 2004; Miller & Twining-Ward, 2005).

The Limits of Acceptable Change (LAC) framework, developed for the United States Forest Service, engages the local community and other stakeholders to identify the key issues affecting an area, and encourages their involvement in the development of indicators and management triggers, based on how much change to the natural resource is acceptable (Stankey et al., 1985). Stankey et al. (1985) outline a process of nine broad steps, involving:

(1) identification of key issues,
(2) identification of opportunities available to resource users,
(3) selection of natural resource and social indicators,
(4) an inventory of the resource and social conditions,
(5) specification of standards for indicators,
(6) identification of alternative opportunities for resource users,
(7) definition of available management actions,
(8) evaluation and selection of alternative management options, and
(9) implementation of monitoring program and chosen management options.

A simpler and less expensive model, derived from the LAC, is the Protected Area Visitor Impact Management (PAVIM) framework (Farrell & Marion, 2002). The

PAVIM process incorporates analyses of impacts and management strategies related to the concept of carrying capacity. The level of stakeholder and public participation however is limited to the earlier stages of issues and objectives identification, with the subsequent monitoring and problem analyses being replaced by expert panel evaluation (Farrell & Marion, 2002).

The Tourism Optimisation Management Model (TOMM), developed for sustainable tourism development on Kangaroo Island, South Australia, involves the local community in identifying optimal objectives for sustainable tourism development in a range of alternative development scenarios, and in identifying indicators and acceptable management responses (Manidis Roberts Consultants, 1997). A major emphasis of the TOMM is ensuring the viability of the tourism industry by focussing on the quality of the visitor experience and the condition of the available natural, social and cultural resources.

An additional framework, which shares common elements with each of abovementioned management models, but which explicitly acknowledges the uncertainties in complex ecological processes and purports to address these knowledge gaps, is adaptive management (Holling, 1978; Walters, 1986; Walters & Holling, 1990).

1.5.1 Adaptive management

Adaptive management is a pragmatic approach to achieving sustainable management. Differences between the traditional goals of science (discovery and learning of new knowledge and pursuing its implications) and of management (steadfast implementation of objectives) have often been a barrier to their interface (Lee, 1999). Adaptive management begins with the recognition that we simply do not have enough knowledge to manage ecosystems, and aims to implement policies as experiments, with learning incorporated as a high priority in the management objectives (Holling, 1978; Walters & Holling, 1990; Johnson, 1999).

Broader involvement of stakeholders in decision-making processes is becoming increasingly recognised as an appropriate means for explicitly addressing the uncertainties and risks in environmental management issues (O'Riordan, 2001). However, Slovic (2000) cautions that scientific and regulatory perceptions of environmental risk issues may not coincide with those of the community, and that 'risk perceptions' can often diverge due to the differing concerns of the disparate groups. To genuinely attempt to achieve sustainable management, however, it is necessary to disclose these uncertainties and ensure a transparent process when evaluating the evidence for management decisions (Peel, 2005). Adaptive management initiates social learning by all stakeholders as an ongoing objective to inform policy and collective choice (Holling, 1978).

Adaptive management uses management policies as experiments to probe the responses of a natural system as people's behaviour within them changes (Lee, 1999). As the system responses to human influence are gradually understood, better policies can then be designed and more refined experiments can be conducted to assess the system components. The overall goal of adaptive management is suggested to be not the maintenance of an optimal condition of the resource (which is often likely to exclude all human influence/interaction with it), but to develop an optimal management capacity for controlling the effects of our influence/interaction on the resource (Johnson, 1999). An important concept underlying adaptive management is that management decisions must be reversible if they are found to produce an undesired effect on the system (Holling, 1978).

Whilst adaptive management was originally developed as a tool for experimenting with management of large-scale ecosystems (Holling, 1978; Walters & Holling, 1990), exploitable wildlife populations and habitats (e.g. fisheries and forestry; Walters, 1986; 1997), there has been an increasing recognition of its applicability to regional and local-scale management of natural resources (Johnson, 1999; Allan & Curtis, 2003), and more recently tourism resources and industries (Miller & Twining-Ward, 2005) and whale watching (Koski & Osborne, 2005; Higham, Bejder & Lusseau, 2009).

The management models applied in each case vary and are necessarily adapted to suit the specific attributes of the resource, as well as the different roles and objectives of the stakeholders. The variability and selective applications of elements of the adaptive management process have led to recognition of different types of adaptive management frameworks (Walters & Holling, 1990). Walters and Holling (1990) distinguish between *active* and *passive* adaptive management, in which the former experiments with management parameters to determine an optimal management policy, while the latter draws on available data to construct a preferred model or approach, the success of which is then subject to post-hoc evaluation. Active adaptive management conducts deliberate management experiments on the resource to test its responses and resilience to impacts, for example in the north Atlantic and north-west Pacific salmon fisheries where the effects of catch quotas have been experimentally modified to investigate cause and effect relationships (Smith, Gilden, Steel & Mrakovcich, 1998; Johnson, 1999). Alternatively, passive adaptive management is typically non-experimental, relying instead on long-term monitoring of indicators, and has been applied in cases where deliberate experimentation of impacts on the resource were considered unacceptable, for example in management of endangered species (Walters & Holling, 1990; Lee, 1999).

Determining cause and effect relationships in complex environmental systems is at best extremely difficult and requires a long-term approach (Lee, 1999). It may even be impossible to distinguish the effects of management from those of concurrent changes in the natural environment (Walters & Hilborn, 1978; Walters & Holling 1990; Lee, 1999). Producing reliable answers to questions through scientific experimentation in active adaptive management can therefore be costly and time consuming, and requires careful consideration by the stakeholders when deciding on this approach. Such an experimental approach however may be the only way in some cases to establish the true processes and dispel erroneous causal relationships (Lee, 1999).

In a review and appraisal of the application of adaptive management, Lee (1999) argues that while the concept is widely accepted as a preferred method of achieving sustainability, there are still relatively few examples of its successful implementation. Particular difficulties associated with the adaptive management process include

imbalances in stakeholder involvement and decision-making, the lack of a long-term commitment to achieve desired outcomes, high costs, and the lack of perceived benefits of the process among stakeholders (Lee, 1999).

As the process of adaptive management progresses, the transparency of information necessarily increases. Lee (1999) warns that this can be perceived as threatening to some stakeholders, for example, if there is disclosure of activities conducted by a stakeholder that seems inappropriate to others. Some members involved in the process may therefore weigh the anticipated benefits against their own costs and risks, and it is possible that some members may waver or resist participating. Unbiased leadership through the process is therefore very important, and where disputes and conflict arise in the assessment and evaluation phases, these must be negotiated and resolved within the boundaries of a process that the disputing parties recognise as legitimate (Lee, 1999). In some cases however, Lee (1999) warns that there may be a temptation for the term 'adaptive management' to be used as a buzzword when the full process is not followed, for instance when there is a less than complete transparency of information and/or limited dissemination of potentially disruptive findings.

1.5.2 Applications of adaptive management in wildlife management and whale watching tourism

While adaptive management has generated a large following in the literature over the past 30 years in its application to a wide range of ecosystems, particularly in North America (Lee, 1999), it has only recently been recognised by tourism researchers and very few examples of its application in tourism exist (Miller & Twining-Ward, 2005). In the management of wildlife on a regional scale, Riley et al. (2003) applied adaptive principles to develop an Adaptive Impact Management (AIM) model for managing black bear populations in New York State. The emphasis of their model was to focus on managing impacts on society, based on the shared values and understanding of impacts on the bears, rather than the conditions of the bear population and habitat *per se*. Riley et al. (2003) argue that impacts on wildlife only become management concerns if people perceive them and interpret them as impacts, and they must be important to stakeholders to trigger a management response. Thus their model places

a strong emphasis on early and continuous stakeholder engagement, and shared learning to achieve sustainable management.

In one of the few marine wildlife tourism applications, the principles of adaptive management have been applied in the management of whale watching in the Salish Sea boundary waters between British Colombia, Canada and Washington State, USA (Koski & Osborne, 2005). Vessels in the Salish Sea began targeted whale watching tours to view resident killer whales (*Orcinus orca*) in 1984 and this has since grown into a multi-million dollar year-round industry involving 73 active commercial whale watching vessels. It is now estimated that over 500,000 people take part in whale watching activities in the area annually, including viewing from the shore, aircraft, kayaks, commercial and private vessels (Koski & Osborne, 2005). In the absence of regulations for managing vessel-based wildlife watching in Canada and the U.S., voluntary 'best practice' guidelines were developed in 1988, and were evaluated and modified using semi-annual stakeholder meetings combined with an education and monitoring program. These guidelines were formally adopted by commercial operators in 2002 and were endorsed by both federal governments (Koski & Osborne, 2005). Key components of the process adopted in this case include an annual cycle of developing, distributing, evaluating and refining guidelines for managing the vessel-whale interactions (see Figure 1.2). Stakeholders engaged in this process included commercial operators, private vessel owners, shore-based whale watchers, non-government organisations NGOs and research scientists (Koski & Osborne, 2005).

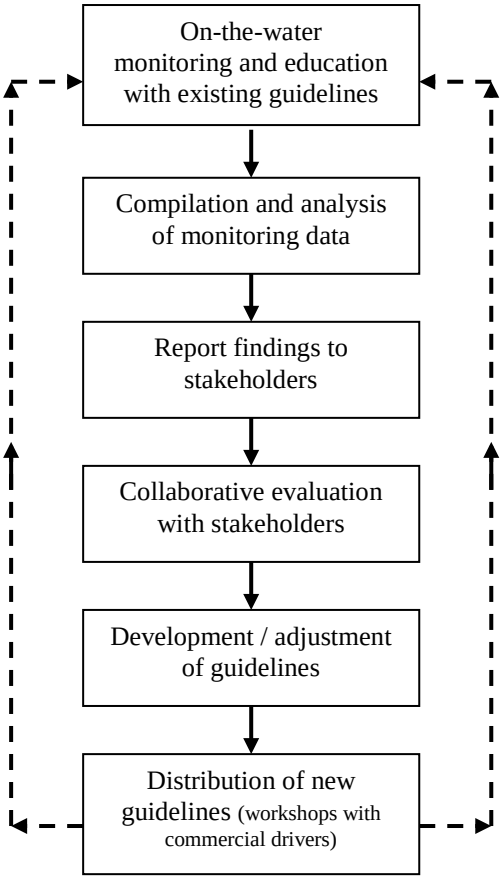


Figure 1.2: Adaptive management model for vessel-based whale watching in the Salish Sea (from Koski & Osborne, 2005, p.2)

In a recent review of the management context for whale watching at the local, regional/national and global levels by Higham et al. (2009), the authors demonstrate the inter-relatedness and influence of policy, planning and management between these levels. They highlight a need for integrated, dynamic and adaptive management frameworks at the local/site-specific level, to more effectively address issues associated with uncertainty and global ecological changes. Higham et al. (2009) advocate the application of the Limits of Acceptable Change framework as a basis for determining acceptable biological and ecological conditions for the targeted cetacean population(s) and for establishing appropriate limitations on industry (e.g. including spatial range, temporal and/or seasonal limits, numbers of operators, platform design and interaction guidelines).

The integration of social science and natural science research and monitoring is also regarded as an essential component of adaptively managed whale watching activities. Visitor data, including demographic profiles, satisfaction, perceptions of the experience as well as environmental performance and impacts can assist the implementation and fine-tuning of visitor management, and can contribute to assessments of social carrying capacity (Duffus & Dearden, 1990; Higham et al., 2009). Such visitor studies should also include evaluations of the effectiveness of interpretation and education programs, which are essential for achieving desirable visitor management outcomes (Moscardo, 1998; Higham & Carr, 2002; Higham et al., 2009).

1.5.3 Implementing adaptive management

The process of implementing an adaptive management model is very similar to that for developing and evaluating sustainability indicators with the involvement of stakeholders. This is no coincidence, as indicators and stakeholder involvement are integral components of adaptive management (Holling, 1978). Because the stakeholders' objectives for sustainability are likely to evolve with time, adaptive management provides a framework that is responsive to changes in key issues relating to the socio-ecological system, and outlines steps for the continual reviewing and updating of objectives and indicators (Holling, 1978; Miller & Twining-Ward, 2005).

Adaptive management encourages experimentation with indicators and the methods used for monitoring in order to learn from failures as well as successes to ultimately improve monitoring and management in the long-term. "Adaptive management suggests that indicators are never cast in stone: they are drafted, redrafted and improved as new information and resources become available." (Miller & Twining-Ward, 2005, p.153).

Holling (1978) outlines the following major phases of adaptive management:

1. Assessment;
2. Experimentation and monitoring; and
3. Evaluation.

A series of recommended steps are given for each of the three phases above, however Holling (1978) states that they are not intended to be prescriptive, rather the steps should be moulded to meet the specific requirements of each management case. An assessment phase, involving workshops with the relevant stakeholders, is crucial at the beginning stages of developing a suitable management model. The first workshop, involving all of the relevant stakeholders, should address:

- Identification and classification of impacts
- Identification of key information needs
- Description of the range of alternative management options
- Outlining of a framework and crude model for indicators and management responses
- Consideration and integration of the broad objectives, indicators, management actions, time horizon and spatial extent (Holling, 1978; Walters & Holling, 1990).

Workshops are regarded as one of the most important tools in implementing adaptive management. They allow managers and stakeholders to develop an understanding of the key issues and to provide input into assessment techniques and assumptions, developing commitment to the process and a sense of ownership in the outcomes (Holling, 1978; Johnson, 1999; Lee, 1999; Miller & Twining-Ward, 2005). Subsequent workshops should further define the management objectives, construct alternative policies and explore uncertainties. They should also seek to revise the management model and define new information needs, particularly as new information become available (Walters & Holling, 1990).

In the assessment phase, it is recommended that scientists, stakeholders and decision makers need to evaluate diverse sets of hypotheses and management options, not just individual ones. Maintaining the status quo, a common choice among many natural resource management agencies (Johnson, 1999), should be examined as one alternative among many, with its own costs, benefits and outcomes (Peterson et al., 1997). Peterson et al. (1997) recommend visualising alternative futures, developing

alternative policies and creating opportunities for learning. The assessment phase requires a range of qualitative and quantitative research techniques to allow:

- Generation of a range of alternative objectives;
- Design of effective policies to achieve alternative objectives;
- Identification and evaluation of indicators (social, economic, environmental and resource-specific) relevant to decision-making;
- Evaluation of each management option in terms of the behaviour of the indicators over space and time;
- Generation of useful and digestible summaries of indicator information to facilitate screening of the most appropriate management options;
- Communication and interaction between and among all stakeholders (Holling, 1978).

In the experimentation and monitoring phase, Lee (1999) warns that information gathering should not be mistaken for monitoring. An adaptive approach leads to the implementation of a monitoring program, which must emerge from a rigorous evaluation of the kinds of information that are able to be collected. Adaptive assessment differs in this respect from the rapid assessment model in conservation biology, which takes an approximate inventory of the biodiversity of a place (Lee, 1999).

The evaluation phase is not the end of the process. Rather, it feeds back into the ongoing experimentation and monitoring phase. Holling (1978, p.107) views evaluation as "the entire iterative process of combining actions into policies, using a model (or some other predictive device) to enact the policies and generate time streams of indicators, and using objectives to choose among the different time streams of indicators."

Johnson (1999) summarises the process of implementing an adaptive management framework:

1. Hold workshops for stakeholders to discuss key issues, objectives, indicators and management options, and establish conflict resolution procedures.
2. Develop models that describe stakeholders' collective understanding of the system, and evaluate policies and management options.
3. Implement an appropriate management framework and begin monitoring and evaluation.
4. Evaluate management effectiveness, reassess objectives and indicators and revise the management framework in light of findings.
5. Repeat.

Holling (1978) warns that uncertainty will always remain, and that environmental assessments are not predictions in any real sense as not everything can be measured. Thus environmental management (and adaptive management) is an ongoing process, and not a one-time prediction. Walters and Holling (1990) also emphasise the need to foster experimental studies that outlive the research careers of the scientists who initiate them, with the creation of incentive systems to encourage ongoing involvement of researchers. In monitoring complex ecological processes, a long-term view must be taken in the establishment of management objectives and monitoring regimes, as the establishment of some processes and impacts may take decades to unfold (Walters & Holling, 1990).

1.6 Assessing the sustainability of swimming-with-whales tourism in the Great Barrier Reef

1.6.1 The Minke Whale Project

Dedicated field studies of dwarf minke whales in the Great Barrier Reef and the GBR SWW activity have been ongoing since 1996. This multi-disciplinary research, carried out by scientists from James Cook University and the Museum of Tropical Queensland and other institutions in collaboration with the SWW industry (the Minke Whale Project) includes long-term studies on the biology and functional morphology

of dwarf minke whales (e.g. Arnold, Birtles, Sobtzick, Matthews & Dunstan, 2005; Arnold et al., 2005a; Dunstan, Sobtzick, Birtles & Arnold, 2008), interacting population parameters (Sobtzick, *in review*), whale behaviour (Birtles et al., 2002a; Mangott, 2010), acoustics (Gedamke, Costa & Dunstan, 2001) as well as management of the SWW activity (Arnold & Birtles, 1999; Birtles et al., 2002a) and social studies of the SWW experience (Birtles, Valentine, Curnock, Arnold & Dunstan, 2002; Valentine et al., 2004). The underlying basis for much of this research has been to evaluate potential impacts of the SWW activity and assist with its sustainable management. A strong focus of the Minke Whale Project has therefore also been the development of education and interpretation materials for the industry with the aim of improving industry and passenger compliance with the Code of Practice whilst enhancing the experience and passengers' knowledge of the whales and the marine environment.

1.6.2 Current monitoring of the swimming-with-whales activity

As part of the GBRMPA's Dwarf Minke Whale Tourism Monitoring Program (2003-2009), researchers from the Minke Whale Project have collated and analysed Whale Sighting Sheets from the SWW industry and have participated in biannual stakeholder workshops (Birtles et al., 2010). While a great deal of important information is provided by crew via Whale Sighting Sheets (for example the frequency and distribution of whale sightings, numbers of whales and interaction times), the absence of key biological and behavioural information (such as site fidelity and residence times) limits the conclusions that can be made about the impacts of the swim interactions on the whales, and hence evaluation of the sustainability of the industry (Birtles et al., 2010). Dedicated studies and long-term monitoring of these and other important biological characteristics are therefore needed if a comprehensive assessment of sustainability of the SWW activity is to be made.

1.6.3 Industry compliance

The effectiveness of the management regime must also be evaluated as part of any sustainability monitoring program (Holling, 1978; Bell & Morse, 1999). Two measures of an effective management regime for human-wildlife interactions are: (1) minimisation of impacts on the wildlife, and (2) compliance with the management protocols (Garrod & Fennell, 2004). In areas where enforcement by a regulatory management agency is costly or difficult (e.g. in remote areas), compliance depends on tourism operators' agreement and acceptance of management protocols. The tourism industry's understanding of the need for management protocols and their willingness to comply is best achieved through the use of education and interpretation programs, and this has become a widespread management technique applied by park management agencies worldwide (Vander Stoep & Gramann, 1987; Orams, 1996; Lawrence, Phillips & Hardy, 1999).

While tourism operators may be generally accepting and supportive of management protocols, breaches of guidelines can still occur in some cases, particularly where there is competition between operators and other performance pressures (i.e. delivering on the customers' expectations). In a study of compliance among vessel-based dolphin watching operators in Port Stephens (NSW), Allen (2006) reported a breach of the Code of Conduct in one out of six interactions. Allen found that breaches were most likely to occur in competitive circumstances, when one vessel after another approached the same group of dolphins, and when recreational boats became involved in interactions. Scarpaci, Dayanthi and Corkeron (2003) investigated compliance with regulations by swim-with-dolphins operations in Port Phillip Bay Victoria, finding more than 30% non-compliance with approach and manoeuvring protocols and more than 60% non-compliance with time limits for encounters among operators.

Indirect approaches to regulating and maximising compliance with management guidelines, such as the use of interpretation and education tools, rather than direct approaches such as enforcement, have been widely recognised as being more effective and less costly methods of controlling tourists and operators' behaviour and minimising impacts on wildlife (Orams, 1996; Moscardo, 1998, 1999). These

management tools can also enhance the visitor experience and foster a sense of responsibility for the resource (Vander Stoep & Gramann, 1987).

1.6.4 Platforms of opportunity

Given the difficulties involved in collecting sightings, biological and behavioural data of marine species in the wild, the involvement of commercial whale watching operators as "platforms of opportunity" can help to fill critical gaps in the collection of monitoring data (Robbins, 2000; Robbins & Mattila, 2000). Reviews of monitoring data collected by whale watching tourism operators have found that while such data is a valuable resource to scientific investigations, inherent sampling biases and the complexity and cost of managing such data can limit their usefulness (Robbins, 2000; Robbins & Mattila, 2000). Scheidat et al., (2004) noted that whale watching vessels typically do not conduct systematic searches for whales, instead stopping to observe whales whenever sightings are made. Leaper, Fairbairns, Gordon, Hiby, Lovell & Papastavrou (1997) argue that while whale watching tourism vessels can provide data collection on a limited budget, these data are unlikely to be useful in estimating the density or abundance of whales within their range.

Quantifying vessel search effort is one of the main problems in analysing opportunistic data from whale watching vessels to estimate the relative abundance of whales in an area (Leaper et al., 1997). In an attempt to evaluate minke whale abundance and distribution using a whale watching platform around the Isle of Mull, Scotland, Leaper et al. (1997) utilised a real-time computer database recording system ("Logger") linked to a Global Positioning System (GPS) receiver. The systematic collection of vessel search effort data, provided by Logger over a three-year period, enabled their first estimates of whale densities and relative abundance in the area.

Researchers from the Minke Whale Project have sought to maximise the data collected by the industry and its passengers, via Whale Sighting Sheets, passenger questionnaires, log books for recording behavioural observations, and by encouraging crew and passengers to donate underwater photos and video footage of minke whales to a photo-ID study and catalogue of identified individual whales (Birtles et al., 2010;

Sobtzick, *in review*). Nevertheless, analyses of these data are complex and require committed work by trained researchers. The reliability of crew and passengers' recordings of behavioural observations must also be carefully examined. Buckley (2003) states that while interested and experienced volunteers can make a positive contribution to monitoring programs, reliable ecological monitoring requires trained researchers.

1.7 Summary of key findings from the literature review and research questions

After reviewing the relevant literature across several disciplines it is evident that:

- Internationally, demand for whale watching and swimming-with-whales tourism is increasing (Hoyt, 2001; Rose et al., 2005; O'Connor et al., 2009).
- The impacts of this form of tourism, particularly on baleen whales, are poorly understood (Mann, 1999; Birtles et al., 2002c; Lusseau, 2004).
- Sustainability assessments require longitudinal research of key indicators, addressing relevant ecological, social, economic and management aspects (WTO, 2004; Miller & Twining-Ward, 2005).
- An effective long-term sustainability-monitoring program requires support and involvement of key stakeholders, managed within an agreed framework that is: (1) adaptable to changes in stakeholder objectives to meet socio-economic goals, and (2) responsive to new knowledge of the resource and impacts upon it (Holling, 1978; Johnson, 1999; Bell & Morse, 1999; Miller & Twining-Ward, 2005).

- Platforms of opportunity can provide a cost-effective means of data collection for some sustainability indicators, however the quality of such data must be carefully scrutinised (Robbins, 2000; Scheidat et al., 2004).
- The swimming-with-dwarf minke whales tourism industry in the Great Barrier Reef provides an opportunity to develop a local-scale species-specific sustainability monitoring program (Birtles et al., 2002c), and has the potential to contribute to the scientific theory and knowledge of: (1) whale watching

tourism management, (2) sustainability monitoring of marine wildlife tourism, and (3) management models for sustainable nature and wildlife-based tourism programs.

The key research questions of this thesis are thus:

1. What defines a 'sustainable' swimming-with-whales tourism industry?
2. What indicators are likely to be effective in measuring sustainability of the swim-with-dwarf minke whales tourism industry in the Great Barrier Reef?
3. To what extent can the industry and tourists provide reliable monitoring data?
4. What are the optimal management conditions that may assist the long-term sustainability of this swim-with-whales tourism industry?

1.8 Thesis objectives and outline of chapters

To address the above research questions, this thesis sets out the following broad objectives:

1. Describe the nature and extent of the Great Barrier Reef swimming-with-whales (SWW) tourism activity, including patterns and trends associated with the spatial and temporal occurrence of dwarf minke whale encounters and industry 'effort'. Such information will provide a basis for future monitoring of trends in minke whale encounters and potential effects of the SWW activity (e.g. avoidance of important habitat areas).

2. Evaluate the nature of the SWW experience and identify the range of tourist and stakeholder values associated with dwarf minke whales and the GBR SWW activity. The elucidation of such social values held by different stakeholder groups (including tourists, industry, managers and representatives of the wider community) will provide a basis for selecting the most appropriate indicators for future monitoring of the SWW activity and will

assist managers and stakeholders in determining limits of acceptable change (LAC; e.g. Cole & Stankey, 1997) to uphold these values.

3. Identify and evaluate key management issues associated with the SWW activity, including 'on-the-water' management of SWW participants as well as the broader framework and processes by which management protocols are implemented. Such an evaluation will highlight key issues, strengths and weaknesses of the current management approach and will assist managers and stakeholders in addressing current and emerging problems in a collaborative approach to sustainable management.

4. Evaluate a range of monitoring data that are generated by industry personnel (e.g. crew completion of Whale Sighting Sheets and vessel effort data sheets) and passengers (e.g. questionnaire responses on perceptions of management of the SWW activity) to determine their quality and efficacy for use in monitoring potential sustainability indicators.

5. Develop a comprehensive suite of Quadruple-Bottom-Line (QBL) sustainability objectives for the GBR swimming-with-dwarf minke whales tourism industry, encompassing ecological, social economic and governance/management criteria, via a collaborative process involving key stakeholders. The QBL sustainability objectives will incorporate the range of stakeholder values and aspirations for the GBR SWW activity and will provide a framework for indicator selection, screening and evaluation.

6. Drawing on available industry- and passenger-generated monitoring data, identify and evaluate a range of potential sustainability indicators to address to the above QBL sustainability objectives. The outcomes of this process will include the identification of available data and key gaps that need to be addressed to comprehensively assess the sustainability of the SWW activity.

7. Drawing on and synthesising findings of the above research objectives, develop management recommendations and an industry-specific adaptive

management model to assist with long-term monitoring and sustainable management of the GBR SWW activity.

1.8.1 Outline of four studies and chapters

To address the thesis objectives, four studies were conducted which investigated:

(1) The spatial and temporal distribution of dwarf minke whale encounters and SWW tourism operators' effort in the Great Barrier Reef,
(2) The social values of dwarf minke whales and the swimming-with-whales experience,
(3) Management of the swimming-with-whales activity, and
(4) The development and implementation of sustainability indicators for future monitoring of the swimming-with-whales activity.

The four studies are reported in Chapters 3-6. A flow diagram is provided below (Figure 1.3) outlining seven chapters, including (1) the introduction and literature review, (2) methodology and overarching theoretical framework, (3-6) specific methods, results and discussion points arising from each of the four studies, and (7) A summary discussion, which includes a proposed adaptive management model for the GBR SWW activity. The content of each chapter is summarised briefly below.

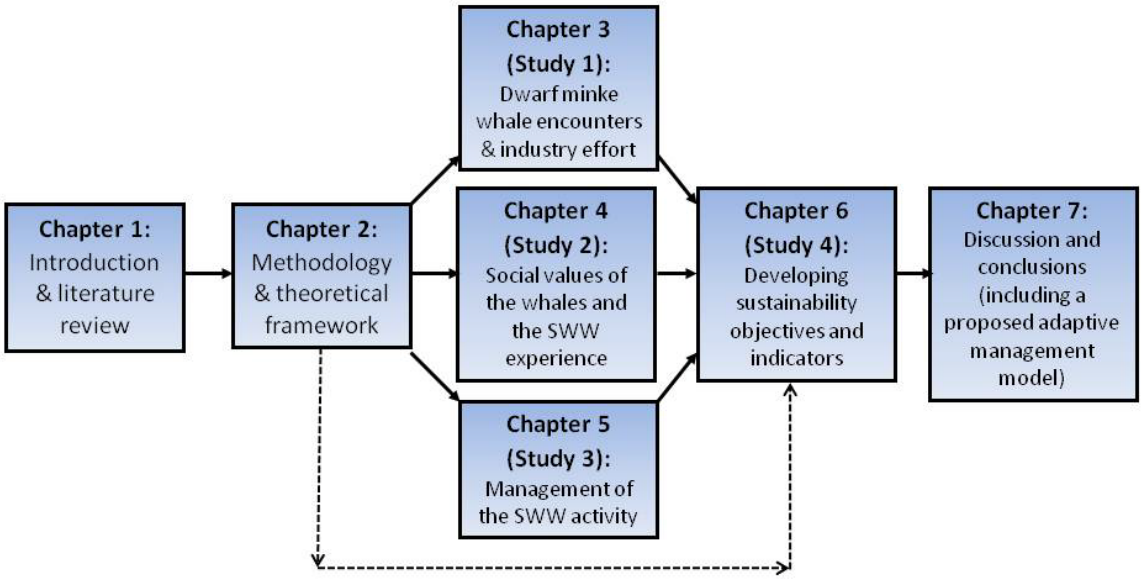


Figure 1.3: Flow diagram outline of thesis chapters

Chapter 1: Introduction and Literature Review

This chapter presents the background and context to establish key research questions and broad objectives that are addressed in this thesis. Literature from a diverse range of relevant topics and academic disciplines are reviewed (e.g. marine mammal science, tourism management, sustainable development, adaptive management and monitoring) to establish the theoretical framework within which this thesis is based and the fields to which it contributes.

Chapter 2: Methodology

The broad epistemology for this thesis (sustainability science), its multidisciplinary approach and theories underlying specific methods utilised in each of the following chapters are described in detail. Four studies (addressing the above objectives 1-6) and their methodological approaches are outlined, including sources of data and types of analyses.

Chapter 3 (Study 1): Dwarf minke whale encounters and industry effort

Documenting the first of the four studies, this chapter addresses Objective 1 above and contributes to the evaluation of industry-generated monitoring data and potential sustainability indicators (Objectives 4 and 6 above). This chapter describes typical dwarf minke whale encounters and examines trends in industry encounter statistics

over three minke whale seasons (2006-2008). This chapter presents the first evaluation of GBR SWW industry effort and contrasts this with reported minke whale sightings to generate minke whale encounter rates and proportions of total encounter time to vessel effort at Reef sites frequently used by the SWW-endorsed operators. Several minke whale encounter 'hotspots' are identified at which minke whales are encountered with the greatest reliability. The encounter rates and the proportions of total encounter time to vessel effort (similar to catch-per-unit-effort indices) for the Reef sites at which the majority of minke whale encounters occur provide a useful tool for future monitoring of spatial and temporal trends in minke whale encounters and contribute to potential sustainability indicators for the SWW activity.

Chapter 4 (Study 2): Social values of dwarf minke whales and the SWW experience

The second study, documented in Chapter 4, addresses Objective 2 above by (i) evaluating and describing the elements that contribute to the GBR SWW experience, (ii) identifying key differences in the 'minke whale experience' between tourists on live-aboard vessels and those on day-boat trips to the GBR, and (iii) identifying the range of social values of dwarf minke whales and the SWW experience, held by the SWW participants and key stakeholders of the SWW activity (including industry personnel, managers and other stakeholders). Passenger questionnaires are used for evaluation of SWW participants' experiences and values and an interview survey of stakeholder key informants was conducted to elicit stakeholders' values and benefits attributed to the SWW activity.

Chapter 5 (Study 3): Management of the swimming-with-whales activity

Study Three, reported in Chapter 5, addresses Objective 3 above and contributes to an assessment of management/compliance monitoring data for potential sustainability indicators (Objectives 4 and 6 above). This chapter draws on several data sources to: (i) evaluate processes and outcomes from stakeholder workshops held over 2006-2008, (ii) explore key management issues associated with the SWW activity via interviews with key stakeholders, (iii) evaluate the roles of vessel crew in the management of SWW interactions, exploring ways of ensuring high standards of encounter management, (iv) investigate passengers' perceptions of the management of minke whale encounters, and (v) evaluate the potential use of passenger surveys as a compliance monitoring tool.

Study Three also involved the development of industry interpretive materials (posters, handouts and a DVD) to facilitate crew and passenger compliance with the Code of Practice and help improve passengers' minke whale experience. An evaluation of the effectiveness of these interpretive tools (via passenger questionnaires and interviews with vessel crew) is also presented.

Chapter 6 (Study 4): Developing sustainability objectives and indicators

The fourth and final study, reported in this chapter, addresses Objective 5 above and contributes to the identification and evaluation of potential QBL sustainability indicators (Objective 6) and assesses the quality of industry generated monitoring data (e.g. Whale Sighting Sheets and vessel effort data) for proposed sustainability indicators (Objective 4). Principles of Participatory Action Research were employed to engage key stakeholders in a three-step iterative process of developing QBL sustainability objectives (based on ecological, social, economic and managerial categories) for the GBR SWW activity. Draft sustainability objectives, developed from the literature reviewed and with input from Minke Whale Project researchers, were evaluated and refined with feedback from stakeholder key informants. These objectives were subsequently reviewed, fine-tuned and adopted by stakeholders in a series of facilitated workshops. The resulting sustainability objectives and potential indicators to address these objectives are presented in the results and also in Appendix 1. Potential sustainability indicators that draw on existing data generated by the SWW industry (including Whale Sighting Sheets, vessel effort data and passenger questionnaires) are evaluated using screening criteria adapted from those proposed by Guy and Kibert (1998), Bell and Morse (2003), WTO (2004) and Miller and Twining-Ward (2005).

Chapter 7: Discussion and conclusions

This final chapter summarises and synthesises the key findings from the above chapters with relevant literature and discusses issues and challenges associated with the implementation of sustainability indicators for monitoring the GBR SWW activity. A species- and industry-specific adaptive management model (dubbed the '*Swimming-with-Whales Adaptive Management Model'* or *SWAMM*) is proposed to

assist managers and stakeholders working towards the achievement of a sustainable SWW industry in the GBR.

The *SWAMM* outlines a collaborative and transparent process in which key stakeholders implement and monitor a suite of sustainability indicators, review results and respond collectively to trends of concern, whilst periodically fine-tuning their indicators and objectives as new knowledge is acquired. It is hoped that insights from the collaborative process that lead to the development of the sustainability objectives and the *SWAMM* will inform and benefit the sustainable management of the GBR SWW activity, and other marine and terrestrial wildlife tourism.

Based on the findings of the four studies a series of recommendations are proposed to assist with the future management and monitoring of the GBR SWW activity.

Chapter 2: Methodology

2.1 Theoretical framework

The broad scope of the research questions and objectives of this thesis necessitate a mixed methods approach, drawing on analyses of both quantitative and qualitative data. Such approaches are recognised increasingly as an appropriate means of studying problems and issues involving multiple components of a complex social-ecological system (i.e. a system involving people interacting within and with a natural environment) (Young, Berkhout, Gallopin, Janssen, Ostrom & van der Leeuw, 2006; Ostrom, 2007). In the last decade a new field of 'sustainability science' has emerged which focuses on the dynamic interactions between society and nature, bringing together natural and social science disciplines to address problem-oriented research needs for sustainable development (Kates et al., 2001; Swart, Raskin & Robinson, 2004; Clark, 2007).

2.1.1 Sustainability science

Sustainability science encompasses problem-driven interdisciplinary research that generates knowledge to support decision making for sustainable development (Kates et al., 2001; Clark & Dickson, 2003). Clark (2007, p.1737) notes that "*sustainability science is a field defined by the problems it addresses rather than by the disciplines it employs*." Key drivers in this field are end-user relevance of generated knowledge and the practical application of research outcomes. The 'co-production' of such knowledge, in collaborative partnerships between researchers and end-users, is also strongly advocated (Clark & Dickson, 2003). Whilst there are varying definitions of sustainability science as a field, three fundamental characteristics have been recognised: (1) that it is transdisciplinary, (2) that it provides integrated analyses, and (3) that it is aimed at action (Kauffman, 2009).

The multi-disciplinary, systems-based approach advocated in sustainability science arises from the recognition that traditional approaches of studying individual

components of complex nature-society systems do not yield a sufficient understanding of the overall behaviour of the system (Clark & Dickson, 2003). Young et al. (2006) note that the evolution of modern academia has led to increasing division of knowledge and research techniques into specialised disciplines and sub-disciplines. They argue that whilst this advancement has enabled scholars to define clear fields of study and develop consistent criteria for progressing knowledge of components of social-ecological systems, no discipline alone can address the diversity of components that contribute to complex systemic problems.

In a review of research papers published in three leading sustainability science journals, Kajikawa (2008) identifies and summarises the basic components that constitute the research core and framework for the field. These components share many commonalities with adaptive environmental assessments proposed by Holling (1978) and include:

(1) *Goal setting*; i.e. the identification of key issues that drive the research context. Such issues in sustainability science are often identified via social and political processes however they must have a rational basis and be supported by science.

(2) *Indicator setting*; to evaluate progress towards sustainability goals. An emphasis is placed on the development of new, effective and efficient indicators to inform users of their progress.

(3) *Indicator measurement*; performed by a variety of methods and likely to encompass a range of spatial and temporal scales.

(4) *Causal chain analysis*; i.e. investigation of cause and effect relationships. Whilst indicator measurements provide guidance on the achievement of goals, they may not necessarily identify clear linkages of causality. Analyses to deduce (or induce) causality must account for a broad range of factors that influence observed outcomes and should not be limited by focusing on the single most important factor.

(5) *Forecasting*; i.e. the use of retrospective data and observed trends to model potential future outcomes. The identification of desirable and undesirable future scenarios and assessments of the likelihood of their occurrence provide impetus to management decisions and setting/revising sustainability goals.

(6) *Backcasting*; i.e. a vision-driven approach to the realization of a goal. This approach begins with an assessment of the current situation and identification of parameters in a desired future state, then potential pathways to achieving the desired parameters are deduced. Backcasting differs from forecasting in that the future scenarios are subjective and driven by the sustainability goals, rather than objective scenarios developed via modeling of observed trends. Analyses of mismatches between outcomes of the two approaches can assist in realigning management policies and planning.

(7) *Problem-solution chain analysis*. While causal chain analyses aim to determine the contributing factors to an observed problem, they do not offer solutions when one or more contributing factors are beyond control. Thus the emphasis on problem solving is regarded as a defining feature of sustainability science. Problem-solution chain analyses seek to understand the root of the problem, for which a variety of solutions may be evaluated. The common inclination to apply panaceas (as noted by Ostrom, Janssen & Anderies, 2007; i.e. a single solution to many problems) regardless of the circumstances must also be resisted and a vigilant assessment must be made of multi-faceted problems requiring multiple approaches to their solution (Kajikawa, 2008).

Applications of sustainability science to address large scale problems in social-ecological systems (e.g. including climate change mitigation and adaptation, alleviating poverty, disease) are well documented (e.g. Clark, 2007; Kajikawa, 2008), however there are no restrictions on the scale at which it can be applied (Kates et al., 2001). While there is currently a paucity of literature documenting applications of sustainability science within a tourism context, integrated and multidisciplinary approaches to achieving sustainable tourism are increasingly being advocated (Bell & Morse, 1999; Miller & Twining-Ward, 2005; Farrell & Twining-Ward, 2005).

The studies presented in the chapters that follow address components 1-3 outlined above, drawing on several research methods and techniques from different fields in the applied social sciences (dealing with both quantitative and qualitative data), as well as some limited geographical/spatial analyses. Specific research methods are summarised for each chapter below. Whilst it was beyond the scope of this thesis to investigate biological and ecological parameters associated with the swimming-with-

dwarf minke whales activity, this research contributes to a broader, integrated research program (the Minke Whale Project), under which a range of studies addressing key biological and behavioural information needs have been ongoing. Among these, two further PhD studies on (i) dwarf minke whale population biology, residence times and re-sighting rates using photo-identification of individuals (by Sobtzick, 2011) and (ii) the behaviour of interacting whales (by Mangott, 2010) were conducted within the same time frame as the studies presented in this thesis. Additional research on the economic contribution of the SWW-endorsed operators to the local community and the values of key marine species targeted by these tourism operators (e.g. Stoeckl, Birtles, Farr, Mangott, Curnock & Valentine, 2010a) is ongoing. These studies complement one another to contribute to an integrated, Quadruple-Bottom-Line sustainability assessment of the GBR SWW activity.

2.2 Methodology by chapter

In this section the methodological framework for each chapter is outlined. Specific details of research steps and tasks for each study are provided in separate methods sections in Chapters Three to Six.

2.2.1 Chapter 3 (Study 1): Dwarf minke whale encounters and industry effort

This chapter presents data on whale sightings and vessel 'effort', collected by vessel crew (reported via Whale Sighting Sheets and Vessel Movement Logs) and researchers (including some trained volunteer researchers) participating in trips aboard SWW-endorsed vessels during three minke seasons (during June and July, 2006 – 2008). The use of whale watching vessels as research platforms (i.e. 'platforms of opportunity'; Leaper et al., 1997) and industry-generated data for contributing to research and monitoring is also critically evaluated.

Spatial analyses and mapping of key Reef sites were conducted using ARC-GIS software, using the WGS-84 mapping coordinate system. Data imported from

automated position logging devices (including handheld GPS units and *Logger 2000* software, developed by the International Fund for Animal Welfare) were also calibrated to WGS-84.

Statistical analyses (using SPSS statistics package) of patterns and trends in minke whale encounters and industry effort included One-Way ANOVAs and non-parametric Mann Whitney U and Kruskal Wallis Tests. Normality of each variable was checked using histograms, P-P plots and Levene's Test of Homogeneity of Variance prior to selecting the most appropriate test for significance. Unless otherwise stated in the results, all statistical tests were performed with α-levels at 0.05.

2.2.2 Chapter 4 (Study 2): Social values of dwarf minke whales and the swimming-with-whales experience

Study Two drew on data from self-administered passenger questionnaires as well as recorded semi-structured interviews with stakeholder key informants. Some statistical analyses of quantitative questionnaire data are presented to characterize the SWW participants. Standardised ratings scales are employed as indicative measures of tourists' satisfaction and achievement of expectations associated with the SWW experience. To explore in detail the social values of dwarf minke whales and benefits associated with the SWW activity (held by SWW participants and key stakeholders) an interpretivist approach was adopted, via a qualitative analysis of statements provided in response to open-ended survey questions (for SWW participants) and from semi-structured interviews with key informant stakeholders.

Interpretivist research seeks to describe aspects of human experiences and is principally concerned with perceptions and interpretations of experienced phenomena (Strauss & Corbin, 1998). Interpretivism recognises that human experiences are highly subjective and complex and cannot be measured directly by an external observer. The research paradigm originates in psychology and philosophy (Husserl, 1931; cited in Moustakas, 1994) and is considered by many to be at odds with positivism (i.e. the research paradigm that considers reality to be objective, tangible

and singular; Moustakas, 1994; Strauss & Corbin, 1998; Tribe, 2001). In tourism research, interpretivism is an accepted methodological framework, employed to promote understanding of the tourist/tourism phenomena from the point of view of all of the stakeholders (or actors) in the tourism environment (Tribe, 2001).

Interpretivist approaches have been used effectively in describing tourist-wildlife experiences. For example Dobson (2007), using a phenomenological interpretivist approach, described key elements of scuba diving tourists' experiences swimming with sharks, and Curtin (2006) examined recalled experiences of swimming-with-dolphins participants. Both studies identified the occurrence of 'peak' experiences among participants based on perceptions of the animals and their behaviour and a heightened emotional response to the interaction.

Key processes in interpretivist analyses of human experiences include the application of a systematic and logical treatment of the data accompanied by critical reflection to construct a detailed description of the experience (Moustakas, 1994). In undertaking detailed analyses of human experiences pertaining to a phenomenon, Moustakas (1994, p.47) notes that "… the investigator abstains from making suppositions, focuses on a specific topic freshly and naively [*sic*], constructs a question or problem to guide the study, and derives findings that will provide the basis for further research and reflection."

During the process of coding open-ended questionnaire responses and transcribed statements from interviews, a 'grounded' approach (e.g. Strauss & Corbin, 1998; Charmaz, 2006) was adopted to allow themes and elements to emerge from the raw data, rather than responses being sorted into pre-determined categories. Complementary to phenomenological studies, the grounded research method involves generating hypotheses and concepts during the course of the research process, via discovery and verification during the coding of qualitative data (e.g. from field notes, transcribed interviews or written statements; Moustakas, 1994; Strauss & Corbin, 1998). Whilst the aim of grounded research is to construct an integrated hypothesis or theory for the subject, it does not adhere to a pre-determined series of steps. Instead, an emphasis is placed on an open and iterative process whereby the context and

underlying meaning of statements are considered carefully and core elements are allowed to emerge from the data (Moustakas, 1994).

Maintaining objectivity is a key concern for researchers adopting grounded approaches (Strauss & Corbin, 1998). The researcher must distance his/her personal feelings and experiences from the data during coding and analyses, and must 'listen' carefully to the words of the respondents to allow their independent voices to emerge. Whilst remaining objective, the coding process must also incorporate sufficient sensitivity to detect subtle nuances and meanings in responses (Strauss & Corbin, 1998).

Risks associated with interpretivist research

Whilst interpretivist, phenomenological and grounded research methods are well established and have been applied in social psychology, tourism studies and in other fields, risks associated with such qualitative approaches include a failure to adequately explain and justify the soundness of the research techniques that are applied (Decrop, 1999). Strengthening qualitative research findings can however be achieved by a process of triangulation. Two or more independent approaches should converge on a particular finding, or at least not oppose it, in order to corroborate and validate results (Decrop, 1999). A detailed account of the systematic coding process is provided in Chapter 4. The coding technique employed is similar to that used by Valentine et al. (2004), which reported high levels of satisfaction with the GBR SWW experience that was correlated with the number of whales seen and their proximity to swimmers, among other experiential aspects. The grounded approach followed in this study however was strictly adhered to, to ensure that the coding process was independent and the codes were not influenced by findings from previous studies of similar phenomena. Study Two examined elements of the GBR minke whale experience in fine detail to develop a comprehensive description of the SWW experience, associated social values and benefits, and corroborates the findings *post-hoc* with those made by Valentine et al. (2004) and similar studies involving other wildlife (e.g. Curtin, 2006; Dobson, 2007).

2.2.3 Chapter 5 (Study 3): Management of the swimming-with-whales activity

Study Three adopted a mixed methods approach to evaluate key management issues and processes associated with the SWW activity, drawing on data from (1) minutes of stakeholder workshops, (2) interviews with stakeholder key informants, (3) interviews with experienced crew from SWW-endorsed vessels and (4) SWW participant surveys (self-administered questionnaires).

Assessment of 'on-the-water' management issues

A mixed quantitative and qualitative analysis of 'on-the-water' management issues is undertaken, using closed-ended (including Likert and semantic differential rating scales) and open-ended questionnaire responses to elicit SWW participants' perceptions of (i) the management of their minke whale encounter(s), (ii) any observed impacts on the whales, and (iii) the effectiveness of interpretative materials in assisting their preparation for their SWW interaction(s). Statistical comparisons of interval data (i.e. rating scales) are made between individual SWW-endorsed vessels and collectively between live-aboard and day-trip vessels using non-parametric tests (including the Mann-Whitney U, Kruskal Wallis and Spearman's rank correlation tests; α-levels set at 0.05 unless otherwise indicated) due to highly skewed (positive) overall responses.

Development and evaluation of interpretative materials

To assist the SWW industry in achieving high levels of passenger compliance with management protocols and for the benefit of SWW participants' experiences, a range of interpretative tools were developed and distributed to SWW-endorsed operators at the beginning of each of the three minke whale seasons (late May/early June; 2006-2008). The development and distribution of such materials had been ongoing for several years prior to this study as part of an integrated Minke Whale Project (MWP) extension to assist the SWW industry in its management of encounters and facilitate operators' contribution to research and monitoring data collection. This approach was shown to be very successful in achieving a high level of industry support for the MWP which was reflected in substantial returns of data including the Whale Sighting Sheets, underwater still images and video footage for photo-identification of whales (reported in Sobtzick, 2011), whale behaviour 'diaries' (Mangott, 2010) and industry

effort data (reported in Chapter 3), as well as a substantial in-kind contributions of spaces on vessels from SWW-operators allowing researchers access to conduct field data collection.

Interpretative materials developed prior to 2006 included a fold-out colour brochure on the 'current state of knowledge' (2002) of dwarf minke whale biology, behaviour and SWW protocols from the Code of Practice (CRC Reef Research Centre, 2002), a MWP annual research newsletter (e.g. Minke Whale Project, 2008), and an interactive CD-ROM on dwarf minke whale photo-identification (developed as part of a Master of Tourism research project by Hasling, 2003). Materials developed during this study included a series of A3 colour laminated posters in both English and Japanese (in 2006; designs shown in Appendix 2) and a 15 minute video segment (in 2007) to assist crew and passengers in preparing for a SWW interaction which outlines key protocols in the Code of Practice. This video segment was combined with two others, on dwarf minke whale behaviours (produced by Mangott, 2010) and on photo-identification (produced by Sobtzick, 2011) into a three-chapter DVD entitled "Meet the Minkes: Minke Whale Project Interpretive DVD 2007 (attached as Appendix 3). Feedback on the effectiveness of the DVD and other interpretive tools was also sought via the crew interviews and passenger questionnaires.

Evaluation of management processes and outcomes

A qualitative, grounded analysis of key stakeholders' impressions and concerns about the management of the SWW activity was conducted using transcribed interviews with a stratified purposeful sample of 16 stakeholder key informants (sample described in Chapter 4). A similar analysis of management processes and outcomes of stakeholder workshops held over 2006-2008 was also conducted, based on formal minutes recorded by the author. The involvement of the author in these stakeholder workshops and his contribution to the management processes and outcomes during this study represents a Participatory Action Research (PAR) approach which is outlined in the following section.

2.2.4 Chapter 6 (Study 4): Developing sustainability objectives and indicators

Study Four engaged key stakeholders in a collaborative process to develop a suite of comprehensive Quadruple-Bottom-Line sustainability objectives for the GBR SWW activity. Participatory Action Research (PAR) was employed, whereby the researcher acted as a facilitator of the process and contributed to its outcomes.

Participatory Action Research (PAR)

PAR "is a form of action research that involves practitioners as both subjects and co-researchers" (Argyris & Schön, 1989). Action research involves a cyclical process of four key steps: planning, acting, observing and evaluating (McTaggart, 1991). The cyclic nature of this process allows for flexibility and responsiveness in the research task, to help address an unfolding problem or questions associated with complex systems (McTaggart, 1991). Greenwood, Whyte and Harkavy (1993, p.177) define PAR as "a form of action research in which professional social researchers operate as full collaborators with members of organisations in studying and transforming those organisations." Greenwood et al. (1993) outline six defining features of PAR: (i) collaboration, (ii) incorporation of local knowledge, (iii) eclecticism and diversity, (iv) case orientation, (v) emergent process, and (vi) linking scientific understanding to social action.

Arnold and Fernandez-Gimenez (2007) state that PAR does not require an elaborate methodology, instead it relies on the development and maintenance of relationships, the identification of mutually rewarding goals and the establishment of a safe and comfortable environment for constructive criticism and self-reflection among participants. McTaggart (1991) argues that under these circumstances, PAR has the ability to change both individuals and the culture of the groups, organisations and institutions to which they belong. Such changes however cannot be imposed by the researcher and instead are individually and collectively agreed by the participants.

PAR and other community-based methods are growing in popularity in natural resource management and sustainability science (Arnold & Fernandez-Gimenez, 2007; Kates et al., 2001). Kates et al. (2001) argue that in solving complex problems, for example those posed by global climate change, exploratory science and practical

implementation of policy must occur simultaneously. Thus participatory approaches involving scientists and a broad range of stakeholders and end-users are strongly advocated (Kates et al., 2001). PAR can also help create power-sharing relationships between researchers and research participants/stakeholders and can assist the development of locally appropriate planning for research and management policy (Arnold & Fernandez-Gimenez, 2007).

The extent to which participants engage in and influence the PAR process can vary greatly. Greenwood et al. (1993) state that the level of participation in PAR projects will necessarily vary between different cases, and this is influenced by social and environmental factors as well as the aims and capacities of the research group and the skills of the principal researcher.

Risks associated with PAR

Argyris & Schön (1989) warn social scientists contemplating PAR of a dilemma of rigour or relevance. Traditional scientific epistemologies have an established rigour, however may suffer from irrelevance to outsiders to the core discipline. The PAR approach, which by necessity engages its end-users in meaningful knowledge sharing, runs the risk of falling short of predominant disciplinary standards. Careful documentation of the PAR process accompanied by a systematic analysis of stakeholders' input is therefore essential to minimise such risk.

Researcher's role in developing sustainability objectives

Acting as the main facilitator and driver of the sustainability objective (SO) development process, the author provided extensive input into the SOs and this has ultimately shaped the outcomes of the process. However one of the key aims of the process was to cultivate a strong sense of ownership of the SOs by the participating stakeholders. Prior to commencement of the study, the researcher presented an outline of the proposed process to a stakeholder workshop (held in May 2006), resulting in strong stakeholder support. An iterative process of three key phases was then undertaken, including: (i) drafting of preliminary proposed SOs, based on a review of relevant literature and with input from cetacean scientists, (ii) revision of draft objectives based on feedback from interviews with stakeholder key informants, and (iii) fine-tuning and adoption of objectives in a series of facilitated stakeholder

workshops. Updates on progress during SO development were reported to stakeholders at every opportunity (at each workshop as well as via regular telephone and email contact with numerous stakeholders) to ensure transparency and maintain stakeholder support. A detailed description of each phase is provided in Chapter 6.

The author's personal involvement in collaborative research of dwarf minke whales with the GBR SWW-endorsed industry over several years prior to the commencement of this study led to the development of friendly, professional relationships with key industry personnel, resulting in mutual trust and confidence that was evidenced in the SO development process. Similarly, the prior development of professional networks with key management agency staff is very likely to have facilitated their strong support for the process and their willingness to participate. These relationships are considered to have greatly enhanced the level of stakeholder participation and input during the SO development process and consequently, the resulting SOs.

Evaluation of potential sustainability indicators

An assessment is made of a range of potential indicators to address the stakeholder-adopted SOs, based on a synthesis of results from Chapters 3-5. Due to time limitations, this study does not include a follow-up process of stakeholder screening and implementation of sustainability indicators. An outline of such a process is instead proposed in Chapter 7.

The Quadruple-Bottom-Line sustainability indicators proposed (attached as Appendix 1) are not considered to be a complete listing of all potential indicators. Rather an emphasis is placed on indicators that draw on existing data (i.e. that collected over the course of this study by the author and by other researchers studying dwarf minke whales in the GBR). Gaps requiring further research however are identified and implementation issues are discussed in Chapter 7.

2.3 Limitations of research methods

The research methods described above each have their limitations which must be acknowledged:

Study one draws upon industry generated 'effort' data in an attempt to describe spatial and temporal patterns of dwarf minke whale encounters in the GBR. It is important to recognise that the use of tourism vessels as 'platforms of opportunity' limits the ability of such data to provide insights into the distribution and abundance of the whales in the region. It instead reflects patterns of industry use of the Reef and dive sites that are favoured for various reasons including accessibility and moorings, prevailing wind and weather conditions, reef faunal communities, topography and aesthetic appeal to dive tourists (e.g. as described by Miller, 2005). Encounters with whales by these vessels therefore only occur in the limited areas that are visited. To reduce such effort bias, systematic surveys would be required from a vessel dedicated to the task, which would be unlikely to cater to the expectations of tourists. The accumulation of effort data from these tourism operators does however provide a useful basis for comparing encounter rates at heavily used dive sites and the transited regions between them, which over the longer term can be monitored for trends.

Risks associated with the interpretivist approach applied in study two are noted above (p.57), and the potential for personal bias in analyses presented in studies two, three and four must also be acknowledged. In these studies, a systematic and 'grounded' approach (Strauss & Corbin, 1998) was followed in analyses of qualitative data from passenger surveys and key informant interviews to minimise the potential influence of personal bias. Studies three and four also utilised a Participatory Action Research (PAR) process (risks associated with this process are noted above; p.61), in which the researcher was an active participant in management processes, and drove the collaborative process for developing the sustainability objectives. It must be acknowledged therefore that had these studies been conducted by another person, or if different actors/stakeholders were involved, some variation in the outcomes should be expected.

Chapter 3: Dwarf minke whale encounters and industry effort

3.1 Introduction

3.1.1 Chapter objectives

Previous studies on the distribution of encounters with dwarf minke whales in the Great Barrier Reef Marine Park (GBRMP) have reported a seasonal concentration of sightings and prolonged interactions during the austral winter months with scuba dive tourism vessels operating between Port Douglas and Lizard Island. The highest proportion of encounters occurs in the Ribbon Reefs Sector of the GBRMP (Figure 3.1), in particular at frequently used dive sites in the vicinity of Ribbon Reef #10 (Figure 3.2; Arnold, 1997; Arnold & Birtles, 1999; Birtles et al., 2002a). Key biological and ecological parameters of this population of whales remain unknown, including population size, migration, distribution and abundance. While in recent years the swimming-with-whales (SWW) tourism vessels in this area have contributed increasingly to minke whale sightings data collection, in order for these data to provide meaningful insights into the relative distribution and abundance of dwarf minke whales, the searching 'effort' by these vessels must first be quantified.

Studies elsewhere of cetacean distribution and abundance using whale watching vessels as 'platforms of opportunity' have demonstrated that the use of such platforms can provide valuable information about target species (e.g. Leaper et al., 1997; MacLeod et al., 2004; Kiszka, Macleod, Canneyt, Walker & Ridoux, 2007). However, the use of opportunistic sightings data by whalewatching vessels must address inherent sampling biases and limitations and must account for vessel searching effort (Hauser, VanBlaricom, Holmes & Osborne, 2006).

This study aims to provide the first detailed account of industry 'effort' by swimming-with-whales (SWW) endorsed tourism vessels in the GBRMP that can be used to standardise whale sightings data and provide insights into the relative abundance or frequency of encounters with dwarf minke whales within the areas of operation for

these vessels. Such data can provide a basis for monitoring potential trends in minke whale encounters by the SWW-endorsed vessels in key areas, as well as contribute to sustainability indicators for the GBR SWW activity.

Specific objectives of Study One included:

1. To describe the spatial and temporal distribution of dwarf minke whale encounters within the Cairns Planning Area of the GBR,
2. To quantify and describe SWW-endorsed vessels' 'effort' in the GBR during the 2006-2008 minke whale seasons
3. To compare industry effort with minke whale encounters to produce standardised indices (e.g. encounter rates) for Reef sites at which dwarf minke whales are encountered most frequently, and
4. To investigate trends in minke whale encounters and industry effort and develop baselines for future monitoring of the SWW activity.

3.1.2 Historical context

Beginnings of a swimming-with-whales (SWW) tourism industry

Dwarf minke whales were originally identified in the Great Barrier Reef by Arnold et al., (1987), principally from a stranded specimen in an offshore Reef lagoon (Hook Reef, 1982). Reports of seasonal dwarf minke whale sightings and in-water interactions with Reef tourists during the winter months in the northern GBR were accumulated through the 1980s and 1990s (Arnold, 1997) coinciding with a growing live-aboard scuba diving tourism industry based in Cairns and Port Douglas, focussing on key dive sites in the offshore Ribbon Reefs (e.g. the famous 'Cod Hole'). Swims with dwarf minke whales during June and July in the Ribbon Reefs were advertised by several live-aboard dive operators from the mid 1990s, attracting increasing photo-journalism stories about the SWW activity appearing in scuba diving and other magazines (Arnold & Birtles, 1999). Reports of voluntary approaches made by these 'curious' little whales towards vessels, scuba divers and snorkelers were a notable feature among such stories.

From 1996, dedicated field studies of dwarf minke whales commenced on board the adventure dive tourism and research vessel *Undersea Explorer*, leading to the development of a Code of Practice to manage the increasing swimming-with-whales interactions by live-aboard dive tourism vessels (Arnold & Birtles, 1999).

In 2003, the Great Barrier Reef Marine Park Authority capped the SWW-industry and issued swimming-with-whales (SWW) endorsements to nine Reef tour operators. These endorsements were granted to: four live-aboard dive tourism operations running regular itineraries in the Ribbon Reefs, two live-aboard charter operators (of which one did not operate any tours whilst it held the endorsement), and three day-boat operators based in Port Douglas that visited sites around the Agincourt Reefs (Figure 3.1).

Changes in the SWW industry since 2003

Valentine et al. (2004) described five live-aboard dive operators providing swimming-with-whales (SWW) experiences to tourists in the Ribbon Reefs over 1999-2000. Four of these operations received SWW-endorsements from the GBRMPA and ran continuously from that time and throughout the period of this study (2006-2008) with very few changes to their itineraries over the ten-year period, however two upgraded to larger vessels in 2005 and 2006 (both from a previous capacity of 26 passengers to capacities of 30 and 31 passengers).

In 2003, one of the SWW-endorsed day-boat operations transferred its endorsement onto a live-aboard vessel (owned by the same company) which operated in the Ribbon Reefs. This venture however appeared to be unsuccessful and the endorsement was transferred back to the original day-boat after the 2004 season. Prior to the 2006 minke whale season, two of the SWW-endorsed day-boat operators upgraded their vessels to larger capacities (from 45 and 80 passengers to 100 passengers each).

Through the period for this study, the SWW-endorsed vessels and their itineraries remained unchanged, with the exception of a new operator commencing in 2008 that had acquired the previously unused SWW-endorsement held by one of the two abovementioned charter operations. Following the completion of sampling for this study, two of the SWW-endorsed live-aboard operators (including *Undersea*

Explorer) ceased trading. At the time of writing, the SWW-endorsements for these two operations have not been transferred to any other operation.

3.1.3 Description of the swimming-with-whales operators (2006-2008)

Live-aboard operations

Itineraries for the four regularly operating SWW-endorsed live-aboard vessels varied between three and six days duration. A summary description of each operator during the 2008 minke whale season is provided below (Table 3.1) and images of the vessels are shown in Plate 1. On the day of departure, vessels typically leave Cairns/Port Douglas in the evening and steam north overnight, arriving at their first dive site in the Ribbon Reefs the following morning. Up to two scuba dives may be conducted at any one site before the vessel moves to the next, with a maximum of four or five dives being conducted in any single day. Vessels usually travel shorter distances between relatively close dive sites during the day and undertake longer distance steams overnight whilst the guests are sleeping (or trying to sleep, depending on the sea conditions).

With the exception of *Undersea Explorer*, vessels rarely conducted active searches for whales in open water between Reef sites (however opportunistic sightings in open water frequently resulted in prolonged interactions with the vessel either drifting or dropping its anchor). Instead, vessels would simply visit particular sites (e.g. "Lighthouse Bommie"; see Figure 3.2 and image shown in Plate 2) with the expectation of having minke whales approach the moored vessel.

Table 3.1: Details of nine swimming-with-whales-endorsed operators and vessels in 2008

Operator trading name	Vessel name(s)	Vessel Length	Cruising speed	Passenger capacity	Summary description of itinerary
Live-aboard operators conducting regular itineraries					
Deep Sea Divers Den	*Taka*	30m	10kn	30	3 & 4 day trips to Ribbon Reefs & Osprey Reef. Departs from Cairns.
Explorer Ventures (Australia)	*Nimrod Explorer*	21m	9kn	18	3, 4 & 6 day live-aboard trips to Ribbon Reefs and Osprey Reef. Departs from Cairns; passenger transfers via Cooktown and Lizard Island.
Mike Ball Dive Expeditions	*Spoil Sport*	28.8m	10kn	31	3 & 4 day live-aboard trips to Ribbon Reefs. Departs from Cairns; passenger transfers via Lizard Island.
Undersea Explorer	*Undersea Explorer*	25m	8kn	21	Research vessel. 6 day trips to Ribbon Reefs. Departs from Port Douglas.
Live-aboard charter operators					
Eye to Eye Marine Encounters	a. M.V. Phoenix b. M.V. Sinbad c. S.V. Vivid	a. 18m b. 38m Details for vessel C unavailable	a. 9kn b. 8 kn Details for vessel C unavailable	a. 12 b. 8 Details for vessel C unavailable	Operation commenced in 2008. No fixed itineraries. Various vessels available for charter.
Floreat Reef Charter	Floreat	15m	12kn	11	No set itineraries. Available for charter.
Day-boat operators					
Aristocat Reef Cruises	Aristocat V	31m	28kn	100	Day trips from Port Douglas to Agincourt Reefs.
Poseidon Cruises	Poseidon III	24m	25kn	90	Day trips from Port Douglas to Agincourt Reefs.
Silver Series	Silver Sonic	29m	28kn	100	Day trips from Port Douglas to Agincourt Reefs.

Day-boats

Itineraries among the SWW-endorsed day-boats (as well as for several other Reef day trip operators based in Port Douglas) are nearly identical, with little variation between departure and return times and with several of the same Reef sites and moorings shared. Vessels depart the Port Douglas marina between 8:30am and 9:15am and return to Port Douglas between 4:00pm and 5:00pm at the latest. Steaming to their first Reef site in the morning takes approximately 90 minutes and three Reef sites are visited in total each day. These vessels are much larger and faster than the live-aboards, carrying between 90 and 100 passengers when full and travelling at speeds between 25 and 30 knots (Table 3.1 above). No active searches for minke whales are conducted in open water.

3.1.4 Study area and operational range of SWW-endorsed vessels in the Great Barrier Reef Marine Park (GBRMP)

The area of focus for this study is the Cairns Planning Area of the GBRMP (see Figure 3.1 below). This Area accounts for nearly all reported dwarf minke whale encounters in the GBR (detailed in results below). The Area is divided into several Sectors (by the Great Barrier Reef Marine Park Authority) for management planning purposes (as shown below in Figure 3.1). For the SWW-endorsed day-boats, the full extent of their operations are contained within the Offshore Port Douglas Sector. For the SWW-endorsed live-aboards, the majority of their activities (and the location of their Reef dive-sites) is within the Ribbon Reefs Sector (e.g. Figure 3.2), however some sites are used in other Sectors. The live-aboard vessels regularly venture outside the GBRMP to visit Osprey Reef in the Coral Sea (located approximately 70 nautical miles north-east of the Cod Hole locality; Figure 3.1) however during the core minke whale season (June and July), two of the four SWW-endorsed live-aboards change their itineraries and remain within the GBRMP to increase their opportunities for encountering minke whales (*NB. no minke whale encounters have been reported from Osprey Reef*).

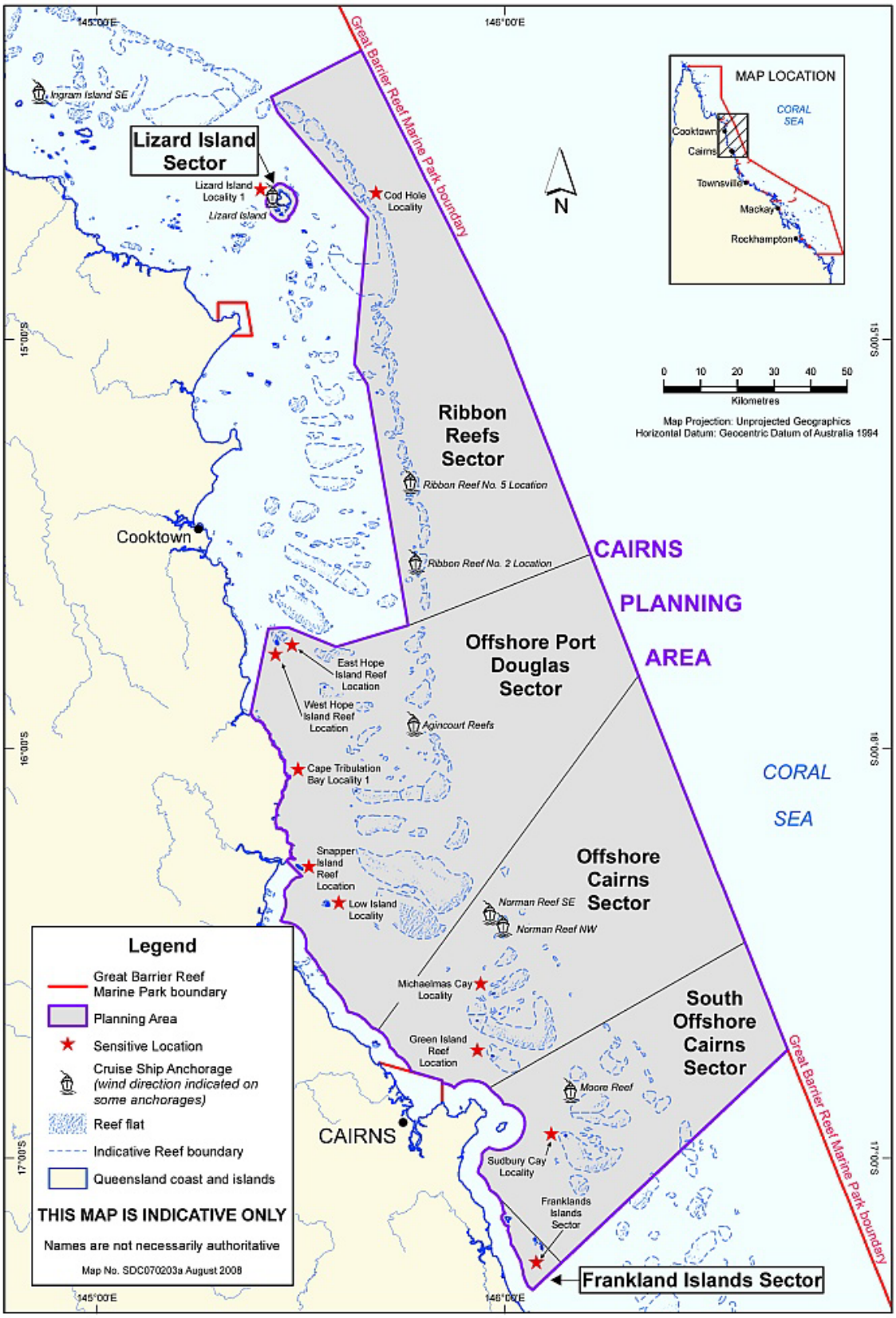


Figure 3.1 **Cairns Planning Area and management sectors, Great Barrier Reef Marine Park** (*Map courtesy of the Spatial Data Centre, Great Barrier Reef Marine Park Authority*)

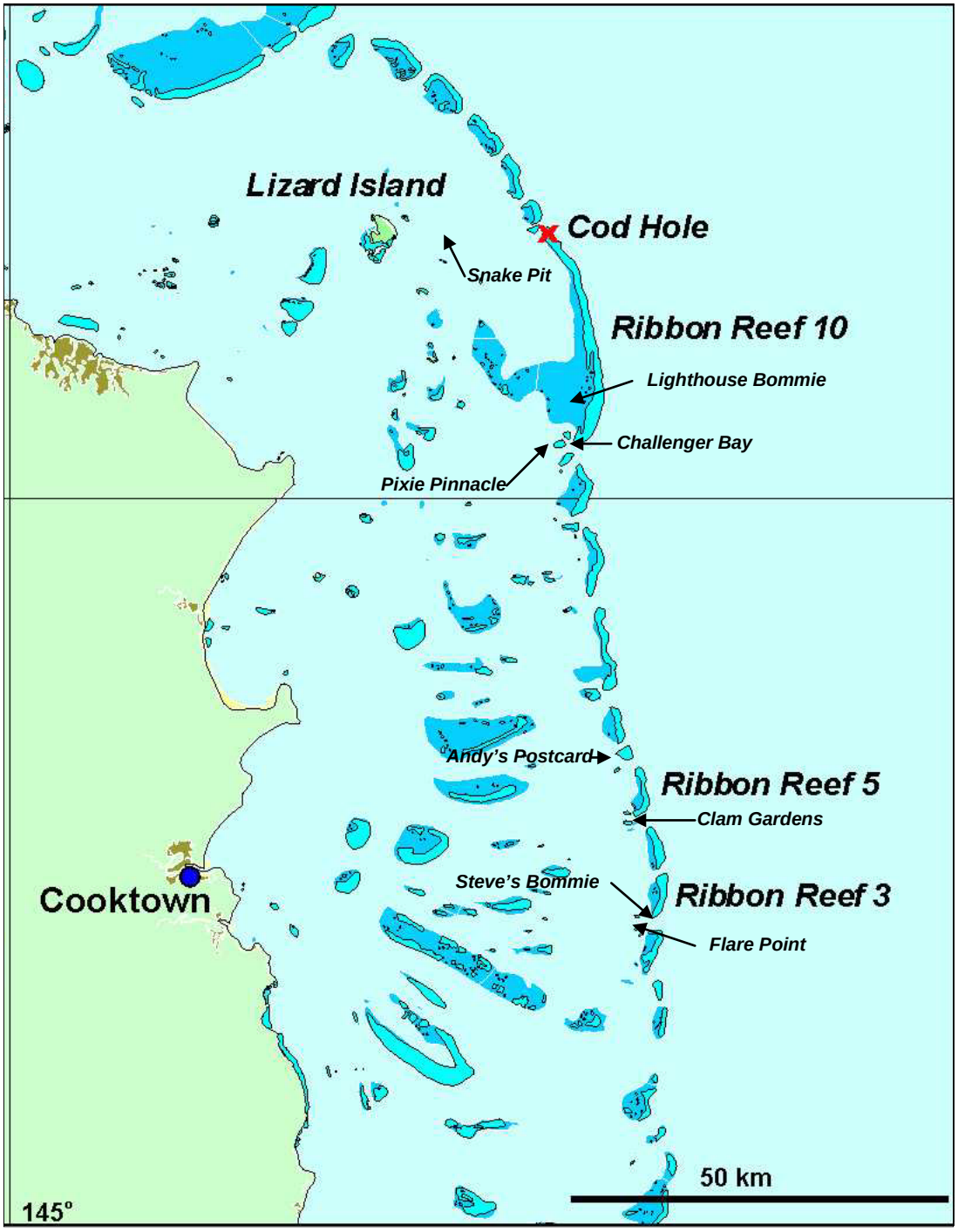


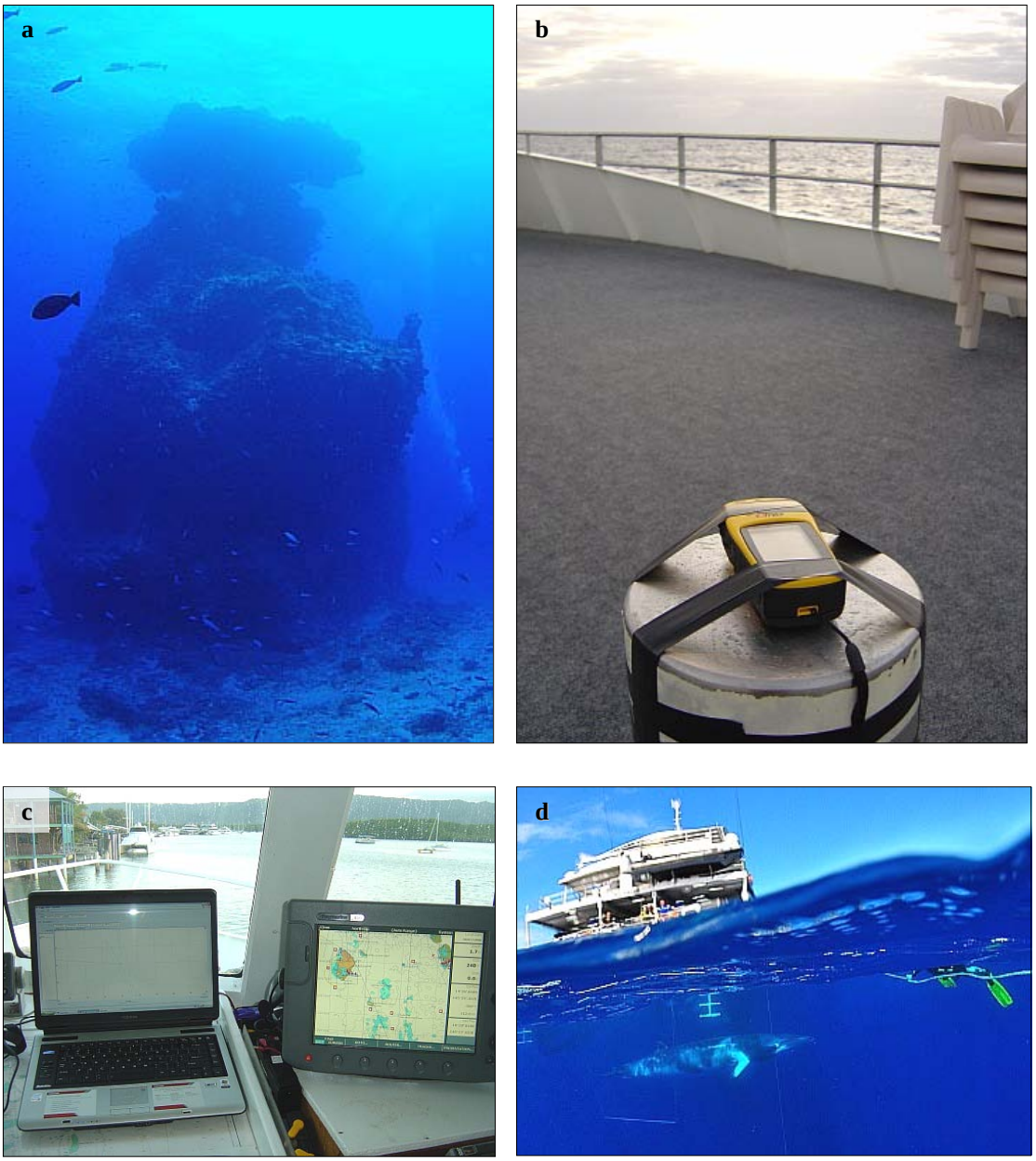
Figure 3.2 **Ribbon Reefs and approximate locations of popular dive sites visited by the swimming-with-whales-endorsed live-aboard dive vessels** (*Map courtesy of Adella Edwards, Cartography Centre, James Cook University*)

Plate 1: GBR swimming-with-whales endorsed vessels, c.2008

Live-aboard vessels: (a) *Undersea Explorer*, (b) *Spoil Sport*, (c) *Nimrod Explorer*, (d) *Taka*, (e) *Phoenix*, (f) *Floreat*.

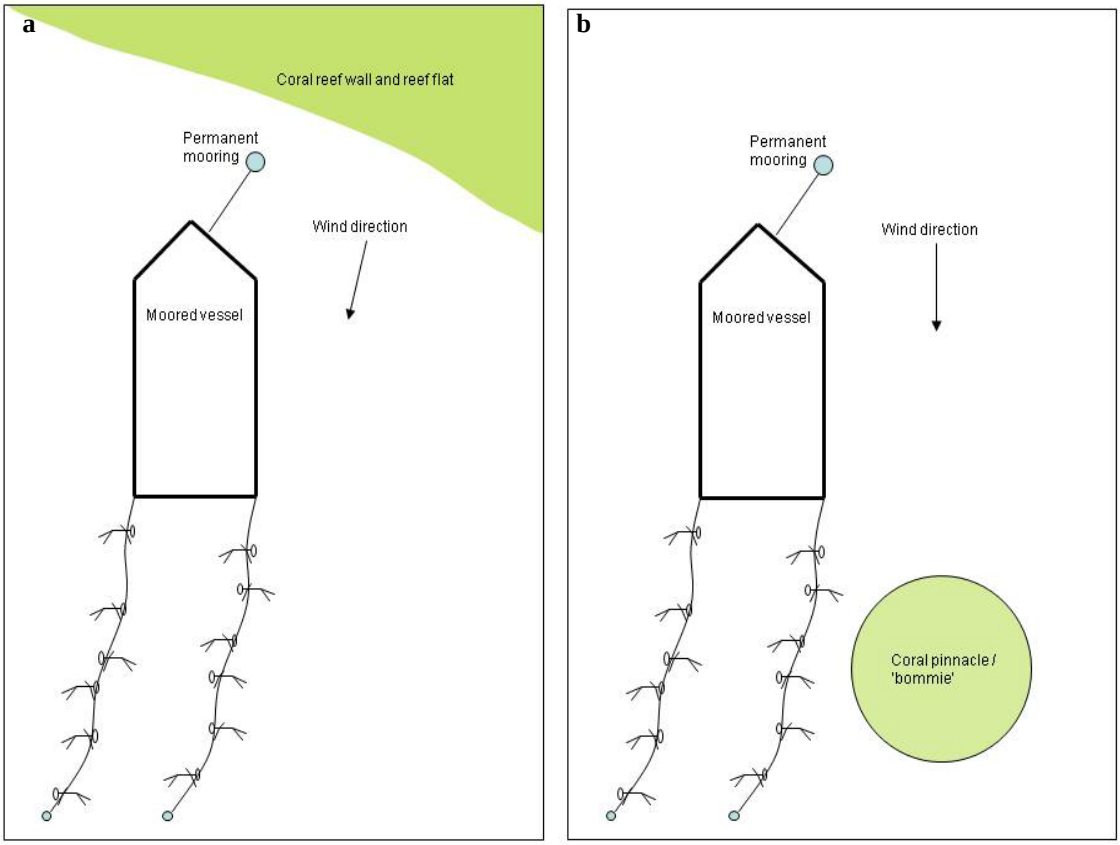
Day-boats: (g) *Silver Sonic*, (h) *Poseidon III*, (i) *Aristocat IV*.

Plate 2: Images from study area and vessels

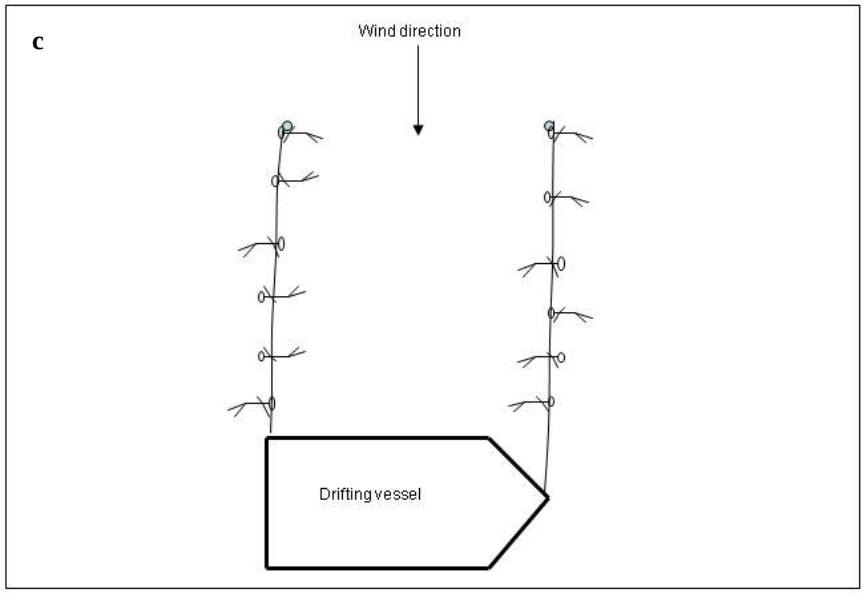


Images: (a) Lighthouse Bommie, an isolated coral pinnacle in the GBR lagoon located near Ribbon Reef No.10; (b) Garmin handheld GPS fixed to vessel on top deck, (c) Laptop in *Undersea Explorer* wheelhouse connected to ship's GPS, running *Logger* software, (d) A snorkeler's view of an in-water interaction from a moored vessel ('deco-bar' and ladder visible under vessel's stern).

Plate 3: Vessel and snorkeler position diagrams for moored and drifting in-water interactions



Approximate relative positions during an in-water interaction of a moored live-aboard vessel, ropes, snorkelers, and: (a) dive site located on a reef wall; (b) dive site located on an isolated coral pinnacle or 'bommie'. (*NB. Not all vessels adhere to the recommended maximum of six snorkelers per line*.)



(c) Approximate relative positions of a drifting live-aboard vessel, ropes and snorkelers during an in-water interaction in open water.

3.1.5 Description of typical dwarf minke whale encounters in the GBR

Terminology

Based on terminology described by Birtles et al. (2002), in the following sections an '*encounter*' with dwarf minke whales is defined as a sighting of and/or interaction with one or more whales, beginning at the time of first sighting (by any person on the vessel or in the water nearby) and ending at the time a whale is last sighted, which may occur as the vessel departs the area or when the whales leave the area. An '*in-water interaction*' occurs when one or more dwarf minke whales are observed by a person or people in the water (who are likely to be using either snorkel equipment or SCUBA). Thus all in-water interactions are encounters, however not all encounters will result in an in-water interaction.

Typical weather conditions

South-easterly "trade" winds are prevalent in the Great Barrier Reef during the austral winter months (Bureau of Meteorology, 2010), and during the core minke whale season (June-July) wind speeds in excess of 20 knots are typical. Sea surface conditions are usually rough in exposed regions of open water (Beaufort 4-6) however the leeward sides of reefs offer much calmer, sheltered conditions. Most Reef diving and snorkelling sites visited at this time of year are therefore located in such areas. The outermost reefs along the continental shelf edge in this region (Fig. 3.1) provide a very effective barrier behind which vessels can travel and visit Reef sites in relative calm during this windy season.

Moored/anchored encounters at Reef sites

Encounters with dwarf minke whales often occur at frequently visited Reef dive/snorkelling sites, where the vessel ties up to a fixed, permanent mooring or, on rare occasions, drops anchor (away from the coral). Many of these sites are visited year-round for scuba diving and/or snorkelling activities and it is often the case that divers and/or snorkelers are already in the water when minke whales approach the vessel. Passengers are briefed on the Code of Practice prior to entering the water, usually before the first dive of the trip. At the onset of an in-water interaction, one or two surface ropes, up to approx. 50m, are deployed, usually attached to the stern (sometimes also from the bow, depending on the angle of the wind to the vessel). On

entering the water, snorkelers position themselves at intervals, holding the rope and remaining relatively still, whilst the whale(s) move freely around and underneath them. Scuba divers returning to the vessel often conduct their standard safety stop at 5m directly under the stern and hold onto a submerged chain or metal 'deco-bar' and observe the whales before completing their dive. Interactions may last for several hours (dependent on the whales and the vessel's itinerary) and snorkelers may exit and re-enter the water several times. Further optional scuba dives are sometimes conducted at the site during an encounter (for those who really want to dive), however divers are instructed to stay on the dive site and avoid the open area beneath the snorkelling line(s) (see diagrams above in Plate 3).

Drifting encounters in open water

If whales are sighted whilst the vessel is steaming in open water (either moving between dive sites or conducting a search for whales) the skipper may decide to attempt an in-water interaction with the vessel drifting, or, depending on the vessel's location and weather conditions, the anchor may be dropped. During a drifting encounter, once the engines are cut, the vessel normally drifts side-on ('beam-on') to the wind and swell direction. One or two surface ropes are deployed (from the stern and bow), which trail upwind of the drifting vessel (see Plate 3). At high wind speeds, the vessel can drift (and snorkelers are dragged) at a couple of knots. On some vessels, rubber inner tubes from car or bicycle tyres are fixed to the ropes at intervals, allowing snorkelers to slip an arm or torso inside, providing some comfort and shock absorption from occasional strong tugs from the swells. Scuba diving is not conducted during drifting encounters in open water. Members of crew (or researchers) are often positioned at the end of each rope to catch any passengers that might drift off the line, before they are left behind by the moving vessel. In stronger winds (e.g. >20kts) most vessels typically opt not to conduct drifting encounters (passengers can become seasick), however *Undersea Explorer* frequently conducted drifting interactions in such conditions to maximise their whale interactions on their dedicated minke whale watching itineraries.

3.2 Methods

3.2.1 Whale sightings data

Whale Sighting Sheets (WSS)

All whale encounter data were reported via Whale Sighting Sheets (WSS2008 copy included as Appendix 4). The WSS was originally designed by the Minke Whale Project research team (of which the author was a part) prior to the commencement of this study. The completion and submission of the WSS for every minke whale encounter by SWW-endorsed operators had been a formal requirement under the operators' permit conditions since SWW-endorsements were issued by the Great Barrier Reef Marine Park Authority in 2003.

Note on intellectual property of WSS data

Data that are derived from the Whale Sighting Sheet (WSS), collected from 2006-2008, are the shared intellectual property of the Minke Whale Project (MWP; James Cook University), the Great Barrier Reef Marine Park Authority (GBRMPA; Commonwealth of Australia), the author of this thesis and two other PhD candidates (S. Sobtzick and A. Mangott) that worked within the MWP research team over the study period. The WSS were designed, collected and have been analysed by members of the MWP research team (including the author), under the GBRMPA-funded '*Dwarf Minke Whale Tourism Monitoring Program*' (GBRMPA, 2006; *NB. The contracted Chief Investigators for this task were A. Birtles and P. Valentine*). All of the abovementioned parties have consented to the shared use of these data for the purpose of reporting findings that are relevant to each of their respective studies. The results shown below using these data are the original work of the author.

Pre- and Post-Season Workshops for industry and stakeholders

Pre-Season Workshops, hosted by the MWP research team, were held in Cairns in late May, prior to the core minke whale 'season' in June and July. All SWW-endorsed operators were invited to attend and were encouraged to bring as many vessel crew along as possible. Additional pre-season information sessions were held specifically for the benefit of SWW-endorsed day-boat vessel crew in Port Douglas (as very few

of these crew were able to attend the main Workshop in Cairns) to help raise their awareness of dwarf minke whale sightings, data collection and their management of encounters via Code of Practice. At each workshop, industry data collection sheets were explained in detail and crew were encouraged to collect these data as completely and accurately as possible.

Post-Season Workshops were held after each minke whale season in November or December in Cairns. Preliminary results of the WSS were produced after data were collated from each season and were reported back to industry, managers and other key stakeholders at these Workshops (as outlined in the workshop agendas; Appendix 5). Overall, a high level of interest in the results from each season was shown by Workshop participants, and awards (e.g. certificates of appreciation and chocolates) were presented to operators and crew members for collecting the highest proportion of each data instrument (e.g. WSS, effort logs, passenger questionnaires and images for minke whale photo-identification).

Interpretive material to encourage industry data returns

A range of interpretive tools were developed (by the author and other members of the MWP research team) prior to each minke whale season and were distributed to SWW-endorsed operators at each Pre-Season Workshop. Interpretive materials were designed to encourage crew and passenger compliance with the Code of Practice and facilitate their contributions to research data collection over each minke whale season. The interpretive material included: laminated colour posters, a Minke Whale Information Package (updated annually; containing minutes of previous workshops, copies of research update PowerPoint slides, relevant papers, data sheets and summaries of key Code of Practice protocols), a Minke Whale Interpretive DVD (Appendix 3; described further in Chapter 5), colour brochures and copies of annual research newsletters produced by the MWP (two examples provided in Appendix 6).

Overall, industry data returns increased over the three-year period (as reported in the results below) and a high willingness to participate in minke whale research data collection was observed among many crew members on the SWW-endorsed vessels.

3.2.2 Researcher data collection

Researchers participated in field data collection aboard most SWW-endorsed vessels each season (as outlined in Appendix 7), with vessel berths/spaces provided in-kind to the MWP research team by each operator. This resulted in 605 researcher days at sea over the three seasons (167 in 2006, 188 in 2007 and 250 researcher days at sea in 2008). The estimated value of this in-kind contribution from the SWW-endorsed operators was >$244,000 (based on advertised trip prices).

The largest proportion of researcher days at sea were on board the vessel *Undersea Explorer* (totalling 360 researcher days at sea over the three seasons), which provided berths for a minimum of two (and occasionally up to four) researchers for seven weeks (7 trips lasting 6 days each) over each core minke whale season. *Undersea Explorer* (*UE*) served as the primary research vessel each minke whale season from 1996 to 2008. MWP research team members (including a number of trained volunteers) participated in trips aboard other SWW-endorsed vessels whenever spaces were available. For all trips on other SWW-endorsed vessels, only one researcher was able to be present per trip.

Observer searching effort

Researchers on-board *UE* conducted a standardised and continuous watch for whales from the top deck or roof of the vessel between sunrise (approximately 6:45am) and sunset (shortly before 6:00pm) for each day at sea and collected detailed data on all whale encounters, vessel movements and site usage, among other data relevant to several different and complementary studies. Whilst the vessel was moored at Reef sites, its location on the leeward side of the reef reduced the field of view in which a whale sighting was possible (i.e. in deeper water away from the shallow coral reef flat) to approximately 180^{o}. Sea conditions were typically much calmer at moored locations on the leeward sides of reefs and for much of the time at these locations only one researcher maintained an active surface watch. When steaming between sites or conducting a search in open water for whales, the 360^{o} field of view was observed by at least two researchers, positioned on the roof of the wheelhouse. Crew and

passengers would occasionally assist with searches for whales in open water and their position and watch direction were recorded.

Researchers on other vessels conducted a similar watch during daylight hours (as for *UE*) however could not be present at all times of the day (e.g. during meal breaks, etc.), and collected similarly detailed data on all whale encounters, vessel movements and site usage. When steaming between sites in open water, the researcher was only able to maintain a surface watch over a limited area (usually the stern as the skipper was usually watching ahead of the bow whilst driving).

It is considered likely that minke whales were quite often not observed even when they were in close proximity to the vessel. The dark dorsal colouration of dwarf minke whales, their small size and relatively inconspicuous surface behaviour (with the exception of occasional breaches) increases the difficulty of sightings, particularly when vessels are steaming in open water in rough and/or rainy weather conditions.

Whilst observer searching effort data (e.g. number of observers, direction and duration of watch, weather conditions) were recorded whenever researchers were on board vessels, such data were not available from trips on which researchers were not present. Due to the variation between vessels in their searching effort and the proportion of trips on which researchers were present, observer searching effort is excluded in the following calculations of vessel effort vs. whale encounters for the range of Reef sites that are visited by the vessels. Instead, the results presented below are based solely on the location of the vessels (i.e. at dive sites) and the occurrence and duration of minke whale encounters (i.e. presence/absence data) to enable standardised comparisons between these sites. Vessels on which an active surface watch was maintained were considered more likely to have had sightings of whales further away from the vessel, and whilst steaming between sites. A comparison between vessels is therefore presented in the results below.

Volunteer training

A total of 30 volunteers (over three seasons) assisted with field data collection aboard SWW-endorsed live-aboard vessel and day boats, with some providing additional assistance with data entry after each season. Pre-season volunteer training workshops

(two sessions of approximately four hours duration) were held prior to the commencement of field data collection each season. Volunteers were familiarised with all data collection instruments and were given detailed instructions on researcher field data collection protocols prior to being selected for fieldwork (see Appendix 8).

In 2006 and 2007, volunteer researchers (6 and 8 volunteers respectively) participated in trips on live-aboard vessels only. Following poor data returns from SWW-endorsed day boats for these two years (as reported in results below), in 2008 efforts were made to improve day-boat data returns and a larger number of volunteers (18) were recruited and trained, with eight participating in several day-boat trips each over the 2008 minke season. A summary of researchers' presence on vessels (seasonal coverage) and vessel effort data collected on SWW-endorsed vessels over the three seasons is provided in Appendix 7.

Completion of the Whale Sighting Sheets

When on-board vessels, researchers and volunteers assisted crew wherever possible with their completion of Whale Sighting Sheets, by providing accurate data from their observational records. Prior to 2008 researchers were advised to not complete the WSS themselves, due to the SWW-endorsed operators' obligation to complete WSS as a condition of their Marine Parks permit. In 2008 a different approach was taken and researcher protocols were amended, allowing researchers to complete WSS on behalf of the SWW-endorsed operator, to alleviate the workload of busy crew and ensure that accurate data were recorded. An incidental outcome of the new protocol in 2008 was the receipt of duplicate WSS for the same encounter (n=18 encounters; a WSS completed by both a crew member and a researcher). It is possible that in some cases the crew member responsible for completing the WSS misunderstood the researcher or was unaware that a WSS had been completed by them. Researcher and crew recordings from these duplicate WSS are compared in an analysis of data quality in Chapter 6.

3.2.3 Vessel effort data

Vessel effort data were collected via several instruments and sources over the three minke whale seasons; each is described below.

Vessel Movement Logs (VML)

Vessel Movement Logs (VML; Appendix 9) were distributed to each SWW-endorsed operator at the Pre-Season Workshops, for vessel skippers and/or crew to complete voluntarily, to document all vessel movement and site visits during the June-July minke whale season. The VML sheet was designed to be as simple as possible, quick and easy to complete for the often very busy skippers. Key data fields included site names, times of arrival and departure, latitude and longitude and the vessel status at the location (i.e. moored, anchored or drifting). Recorders were instructed to complete the VML for all vessel activities during daylight hours only.

Researcher Log Sheets (RLS)

The completion of Researcher Log Sheets (RLS; Appendix 10) was a daily requirement for all researchers when at sea. The RLS contained many similar fields to the VML, with additional details required to document search time by observers (e.g. number of observers, start and end times), watch direction, the presence of other vessels at each site and whilst moving between sites, as well as weather conditions and sea state for each site visited. VML and RLS were often completed independently (by vessel crew and researchers, respectively) on the same vessel for the same days. This deliberate overlap/redundancy enabled comparisons between researcher and crew data recordings (reported in results below). Researchers were instructed to synchronise their wristwatches with the ship's GPS (or a handheld GPS if available) to ensure time recordings were accurate.

Handheld GPS units

Several Garmin eTrex handheld GPS units were acquired on loan for each minke whale season and were distributed among researcher field kits for their use on SWW-endorsed vessels, however not enough were available for use on all vessels. The units were set to record vessel tracks at a regular interval of either one or two minutes, depending on the anticipated number of trips and time between data downloads (*NB.*

the units had a memory of only 8MB and were able to store up to approximately 1200 data points). Handheld GPS units were strapped to a fixed position on the vessel's top deck (see Plate 2) and were referred to frequently by the researcher throughout the day. Where handheld GPS units were unavailable, researchers accessed the vessel's wheelhouse to record location data from the ship's GPS.

Logger

On *Undersea Explorer* from mid-way through the 2006 minke whale season, continuous vessel location data were recorded using *Logger 2000* software (developed by the International Fund for Animal Welfare) running on a laptop computer in the vessel's wheelhouse (see Plate 2). Position data were automatically recorded to a MS Access database at ten second intervals.

Data entry

Whale sightings and vessel effort data from all hardcopy data sheets (i.e. WSS, VML and RLS) were entered into a MS Access database. Some assistance was provided by volunteers with the entry of WSS and vessel effort data into their respective databases. Volunteers who assisted with data entry were trained individually and supervised closely whilst they worked. Frequent checks of entered data were made and frequency analyses were performed on completion of data entry to assist with the identification of any input errors. Vessel location data generated by the Garmin eTrex units were downloaded into a proprietary database generated by Garmin's *Mapsource* software.

3.2.4 Standardising whale sightings data with vessel effort data

Kiszka et al. (2007) investigated the spatial distribution, encounter rate and habitat characteristics of toothed cetaceans in the Bay of Biscay (English Channel) using observation data collected aboard passenger ferries (i.e. 'platforms of opportunity'). They define the encounter rate as n/L x 100, where n represents the number of encounters and L is the total distance travelled by the vessel (i.e. survey effort).

The ‘survey effort’ by the SWW-endorsed vessels in the GBR differs considerably to that described for the ferries by Kiszka et al. (2007), such that the majority of minke whale encounters occur whilst the vessels are moored or on anchor at commonly used Reef dive sites (as reported in the results below). Simplified encounter rates can be calculated for Reef sites by dividing the number of sightings at a site by the number of visits made by vessels to the site, however such a calculation does not account for the total time vessels spend at different sites, which can vary substantially and is also likely to be influenced by the occurrence of an in-water interaction (i.e. prolonging a vessel’s stay). An alternative measure for comparing the relative ‘abundance’ of minke whale encounters at Reef sites was therefore also conducted using the total time logged at each Reef site (i.e. vessel hours) as a unit of effort and the total duration of whale encounters at each site, with the result expressed as a percentage. Such a measure (‘total encounter time divided by total effort time’) is biased by vessels’ tendency to stay longer at sites when whales are present, however it still provides a useful standardised comparison of the relative ‘encounter success’ for SWW operators at different Reef sites.

3.3 Results

Results are presented below of analyses of whale sightings and vessel effort data collected over three minke whale seasons, 2006-2008. The following sections (3.3.1 – 3.3.5) present:

1. A summary description of the whale sightings data collected via the Whale Sighting Sheets.
2. Analyses of the distribution of dwarf minke whale encounters in the Great Barrier Reef, including spatial and temporal trends.
3. A summary description of the industry effort data returns, including data collected by vessel crew, researchers and automated GPS loggers.
4. Analyses of whale ‘searching effort’ by SWW-endorsed vessels, in particular the frequency and duration of visits to sites at which dwarf minke whales are encountered and trends over the study period.

5. The calculation of encounter rates and the 'total encounter time divided by total effort time' for a range of frequently visited Reef sites and analyses of spatial and temporal trends.

3.3.1 Whale Sighting Sheet data returns

Number of minke whale encounters reported

Over the three-year sampling period (2006-2008), a total of 854 Whale Sighting Sheets (WSS) reporting encounters with dwarf minke whales were received. WSS were received from a total of 22 different vessels over the three-year period, however the vast majority (96.8%; n=827/854) were submitted by the nine SWW-endorsed vessels. The number of WSS submitted by SWW-endorsed live-aboard vessels, day-vessels and non-SWW-endorsed vessels are presented below (Table 3.2). The proportions of WSS received from SWW-endorsed vessels (live-aboards and day-boats) and those received from non-SWW-endorsed vessels per year are shown below (Figure 3.3). The number of reported encounters increased each year over the three year period (Figure 3.3).

Table 3.2: Number of Whale Sighting Sheets received from each vessel per year (2006-08; n=854)

	2006	2007	2008	Total
SWW-endorsed live-aboard vessels				
Undersea Explorer	79	90	96	265
Spoil Sport	43	65	79	187
Nimrod Explorer	45	57	42	144
Taka	18	31	34	83
Floreat	6	4	2	12
Eye to Eye (3 different vessels; 2008 only)	-	-	31	31
Sub-total SWW-endorsed live-aboards	***191***	***247***	***284***	***722***
SWW-endorsed day-boats				
Aristocat	29	1	3	33
Silver Sonic	10	6	12	28
Poseidon	7	16	19	42
Sub-total SWW-endorsed day-boats	***46***	***23***	***34***	***103***
Non-SWW-endorsed vessels (9 different vessels + 2 aircraft)	20	1	8	29
Total	**257**	**271**	**326**	**854**

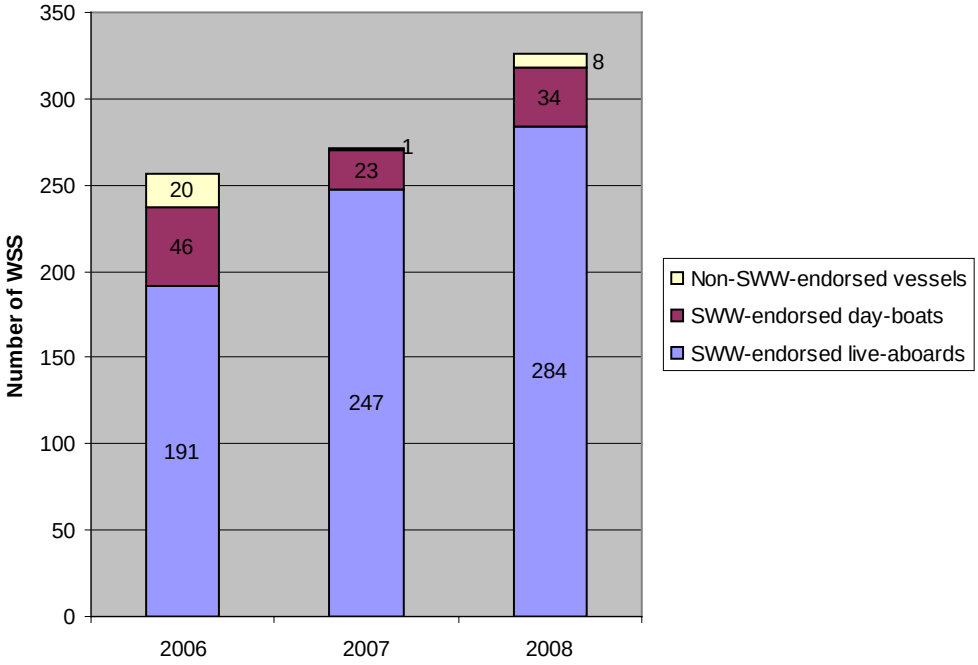


Figure 3.3: Number of dwarf minke whale sightings reported per year from SWW-endorsed live-aboards, SWW-endorsed day-boats and by non-SWW-endorsed vessels, 2006-2008 (n=854)

3.3.2 Distribution and description of dwarf minke whale encounters

Summary statistics of dwarf minke whale encounters in the GBR

The overall mean duration of encounters with dwarf minke whales in the GBR was 87.7 minutes (±SE = 4.099; range 1-665 minutes) and the mean number of whales reported in encounters was 2.97 (±SE = 0.106; range 1-25 whales; Table 3.3 below). A comparison of these statistics for encounters that resulted in an in-water interaction and those that did not (i.e. encounters in which whales were observed from the vessel only) showed that the in-water interactions were significantly longer (Mann Whitney U Test: $Z_{1,853}$ = -19.885; p = <0.001) and involved significantly more whales (Mann Whitney U Test: $Z_{1,853}$ = -14.968; p = <0.001; means presented below in Table 3.3). A similar comparison of minke whale encounters involving SWW-endorsed live-aboard vessels and day boats revealed that encounters involving the live-aboards were also significantly longer (Mann Whitney U Test: $Z_{1,825}$ = -6.661; p = <0.001) with more whales (Mann Whitney U Test: $Z_{1,825}$ = -6.018; p = <0.001; means presented in Table 3.3).

Table 3.3: Summary statistics of dwarf minke whale encounters in the GBR, including comparisons of encounter duration and number of whales

	Mean	±SE	Range
Overall (n=854)			
Encounter duration	87.7 mins	4.099	1-665 mins
Number of whales	2.97 whales	0.106	1-25 whales
In-water interactions (n=513)			
Encounter duration	135.2 mins	5.800	1-665 mins
Number of whales	3.96 whales	0.158	1-25 whales
Remaining encounters (observed from vessel only; n=341)			
Encounter duration	16.2 mins	2.060	1-437 mins
Number of whales	1.48 whales	0.061	1-14 whales
Overall, SWW-endorsed live-aboard vessels (n=723)			
Encounter duration	96.8 mins	4.659	1-665 mins
Number of whales	3.15 whales	0.121	1-25 whales
Overall, SWW-endorsed day-boats (n=103)			
Encounter duration	21.5 mins	3.257	1-220 mins
Number of whales	1.53 whales	0.137	1-14 whales

In-water interactions

Over the three-year period a total of 513 encounters (60.1% of all encounters) resulted in an in-water interaction with the whales. In-water interactions may involve snorkelers and/or scuba divers. Snorkellers were involved in 88.9% of in-water interactions (n=441/496; *NB. For 17 in-water interactions insufficient data was provided on the WSS and the distinction between snorkelers and/or scuba divers could not be made*). Scuba divers were involved in 62.3% (309/496) of in-water interactions. For 52.0% (258/496) of in-water interactions both scuba divers and snorkelers were in the water, although not necessarily at the same time. In many cases whales are first encountered during a normal scuba dive at a dive site, and after the completion of the dive, passengers will re-enter the water to continue the interaction on snorkel.

Use of ropes

Surface ropes were used (for passengers on snorkel to hold during in-water interactions, as per the Code of Practice; Birtles et al., 2008) for 92.2% (471/511) of in-water interactions. The proportion of in-water interactions for which surface ropes

were used was relatively consistent between years, however a slight increase was observed in 2008 (90.1% in 2006; 90.1% in 2007; 95.0% in 2008).

Total encounter time

The total time that vessels spent in encounters with dwarf minke whales over the three seasons was 1,248.2 hours (n=854). The total encounter time reported for each season increased over the three-year period by 16.4% (from 386.5hrs in 2006 to 449.9hrs in 2008; see Figure 3.4), however the mean encounter duration did not increase (90.2 mins in 2006, 91.2 mins in 2007 and 82.9mins in 2008) and no significant difference was found between years (Kruskal Wallis Test: $\chi^2_{1,853} = 1.430$; p = >0.05).

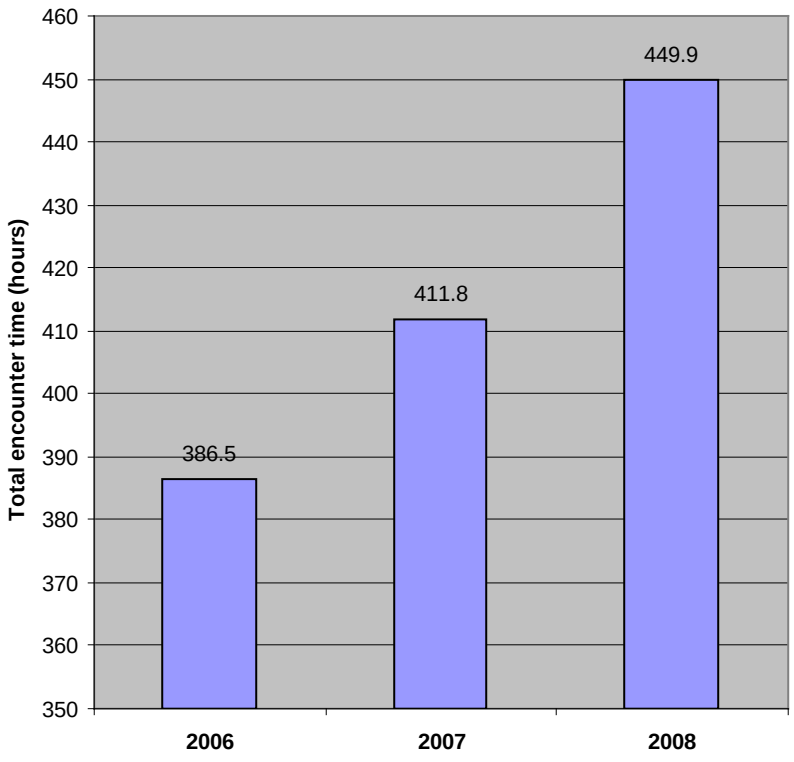


Figure 3.4: Total reported encounter time with dwarf minke whales in the GBR per year, 2006-2008 (n= 854)

Seasonality of minke whale encounters

From the total sample over the three year sampling period (2006-2008), 89.0% (760/854) of encounters occurred in June and July. A seasonal 'peak' was apparent in each of the three years, in either the final week of June or the first week of July (see Figure 3.5).

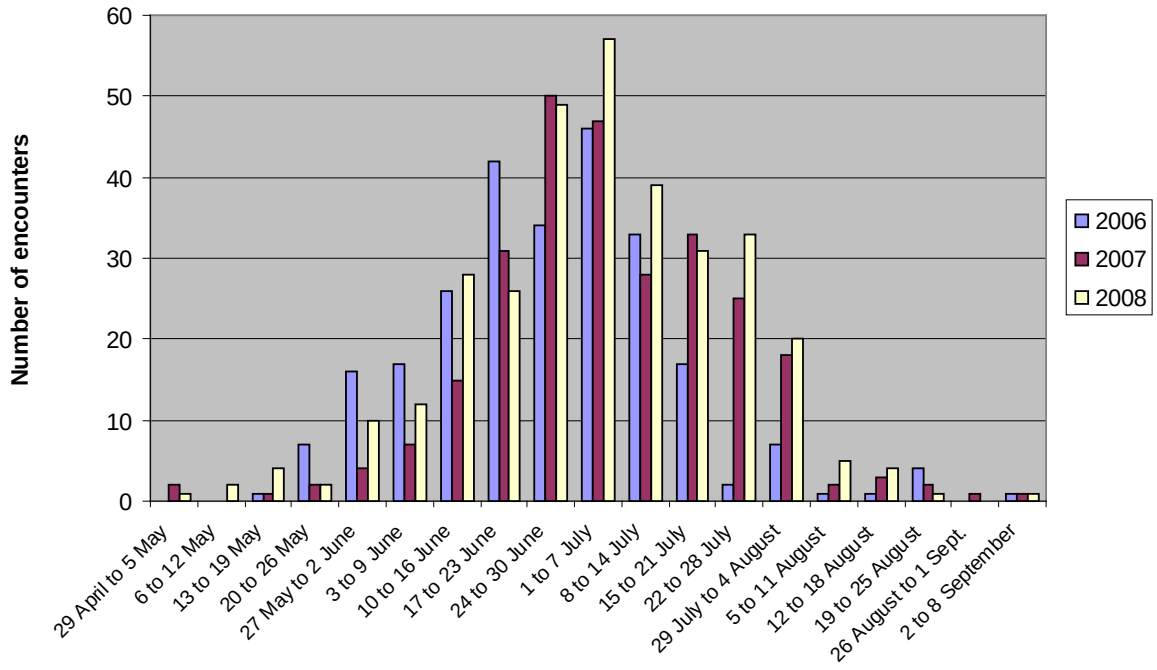


Figure 3.5: **Temporal distribution of reported dwarf minke whale encounters in the GBR from 2006 to 2008 (n=851*)** **Figure excludes three outlying encounters on 5/10/2006, 5/12/2006 and 25/11/2006.*

Vessel status at the time of first sighting

For the majority of encounters, vessels were not moving under power (76.7%; 645/841) and were either moored (62.4%; n=525), anchored (12.0%; n=101) or drifting (2.3%; n=19) at the start of minke whale encounters. The proportion of encounters that began when the vessel was under power (steaming) varied between years (24.5% in 2006; 16.7% in 2007; 27.9% in 2008) however no trend was apparent. It is possible that the slightly higher proportion of sightings that occurred whilst vessels were steaming in 2008 is attributable in some part to the increased presence of researchers (conducting a dedicated surface watch during daylight hours) on vessels for this season.

Location of encounters

All but three reported encounters with dwarf minke whales in the GBR occurred in the Cairns Planning Area of the GBR Marine Park. The location of all minke whale encounters in this area are shown below in Plate 4. Plates 5 to 7 show zoomed-in sections of the Cairns Planning Area, within which specific dive sites and the location of minke whale encounters are shown.

Plate 4: Location of 851 minke whale encounters in the Cairns Planning Area

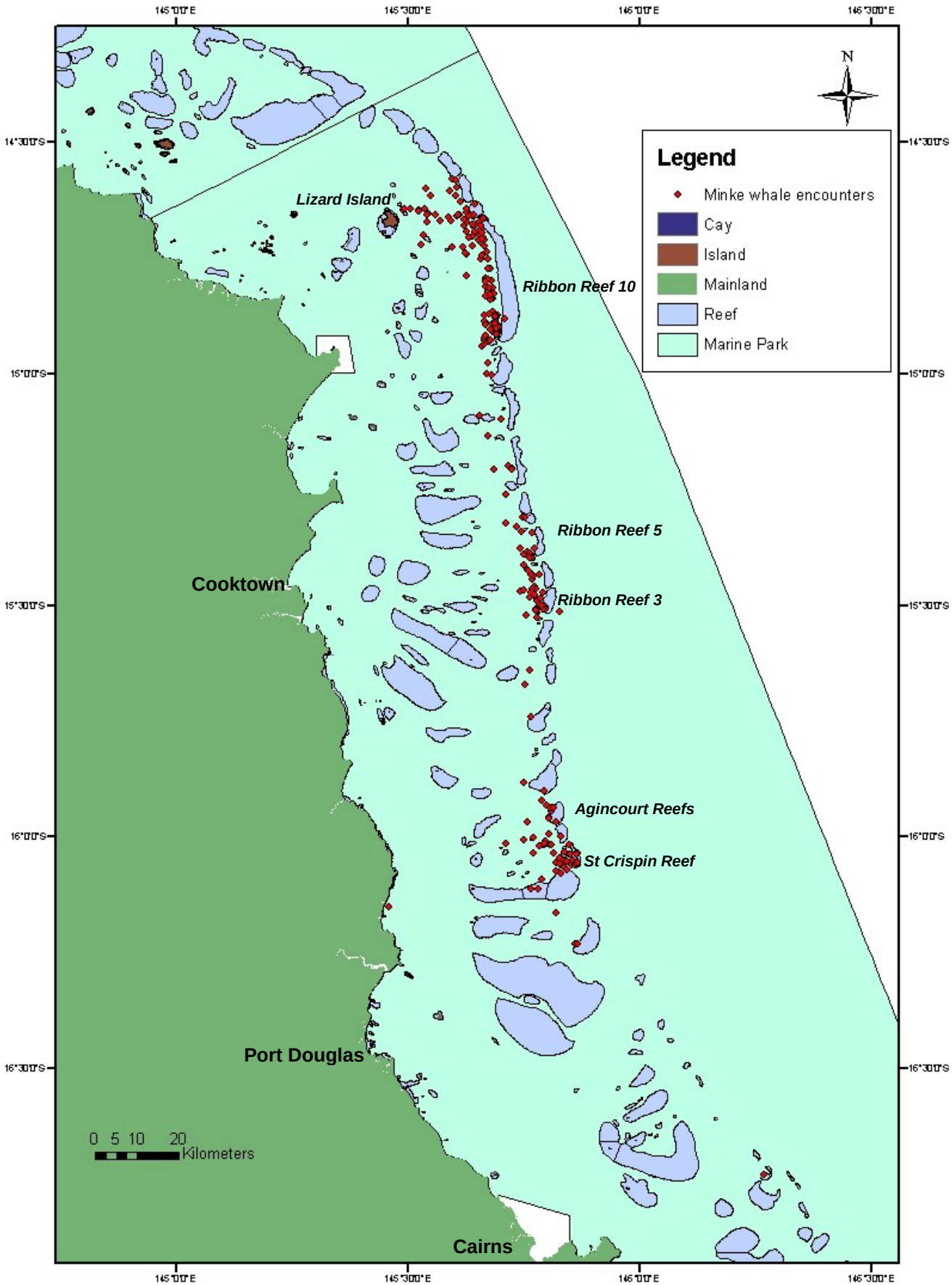


Plate 5: Location of dive sites and minke whale encounters in the vicinity of Ribbon Reef 10

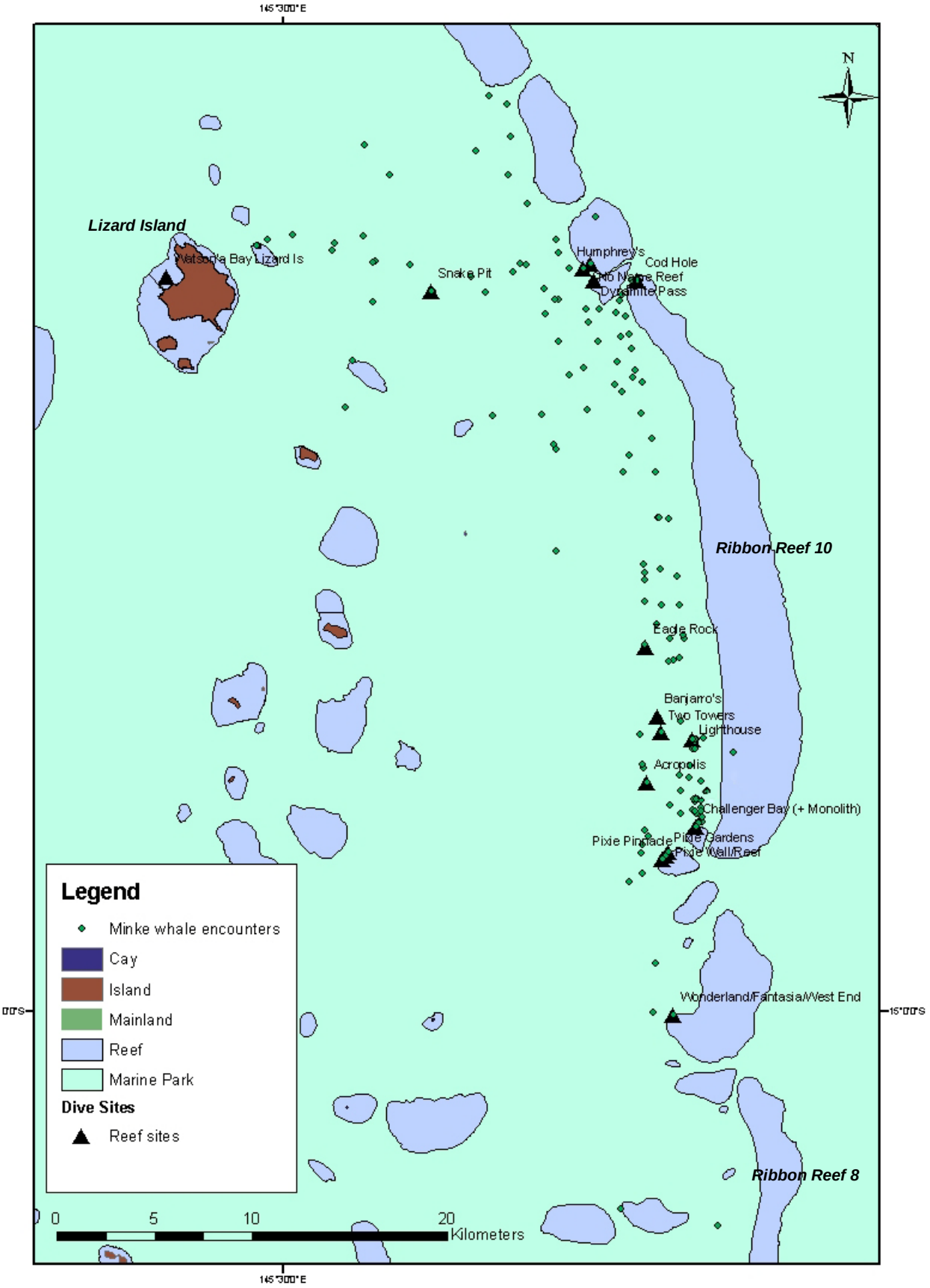


Plate 6: Location of dive sites and minke whale encounters in the vicinity of Ribbon Reef 3

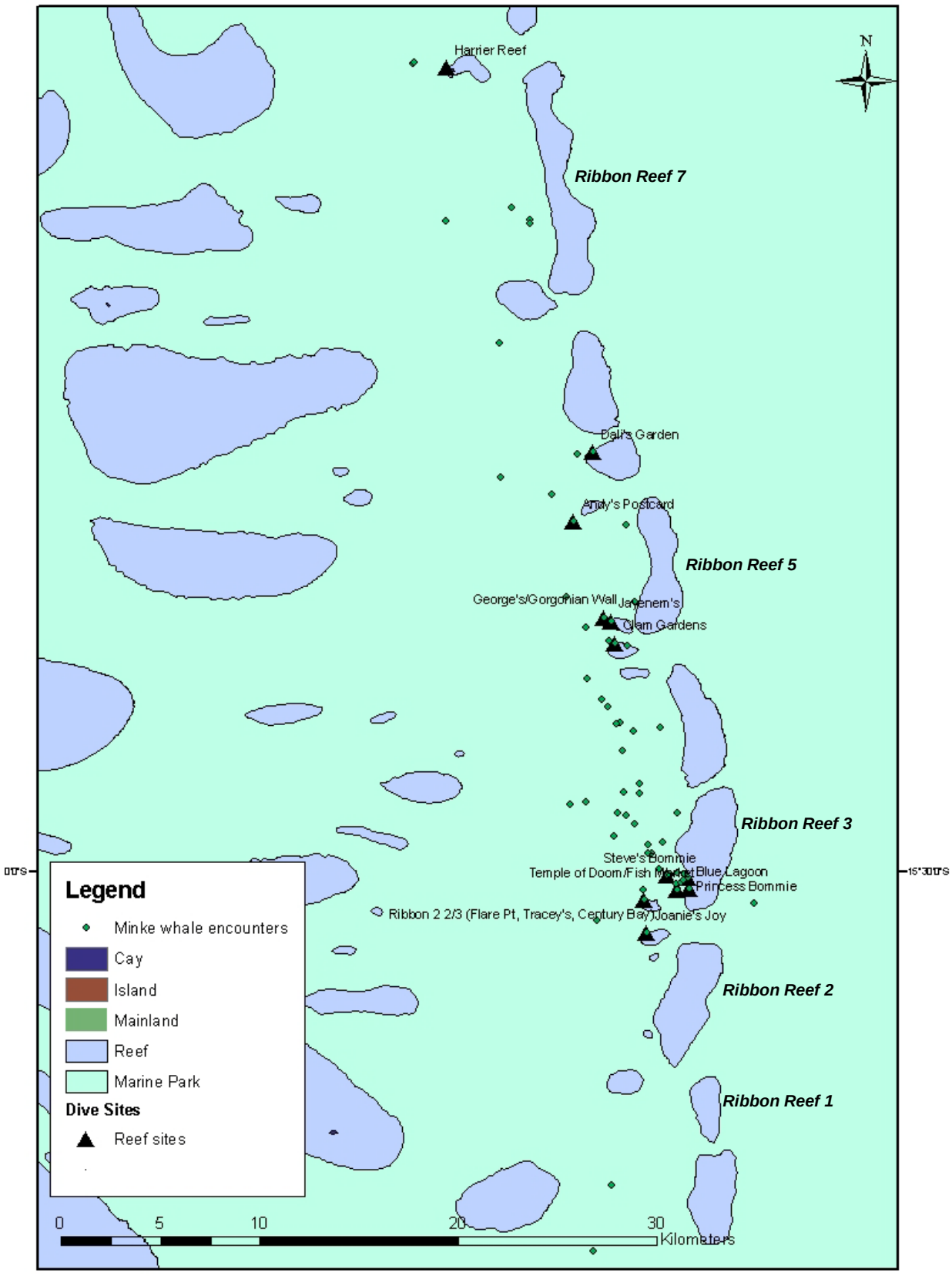
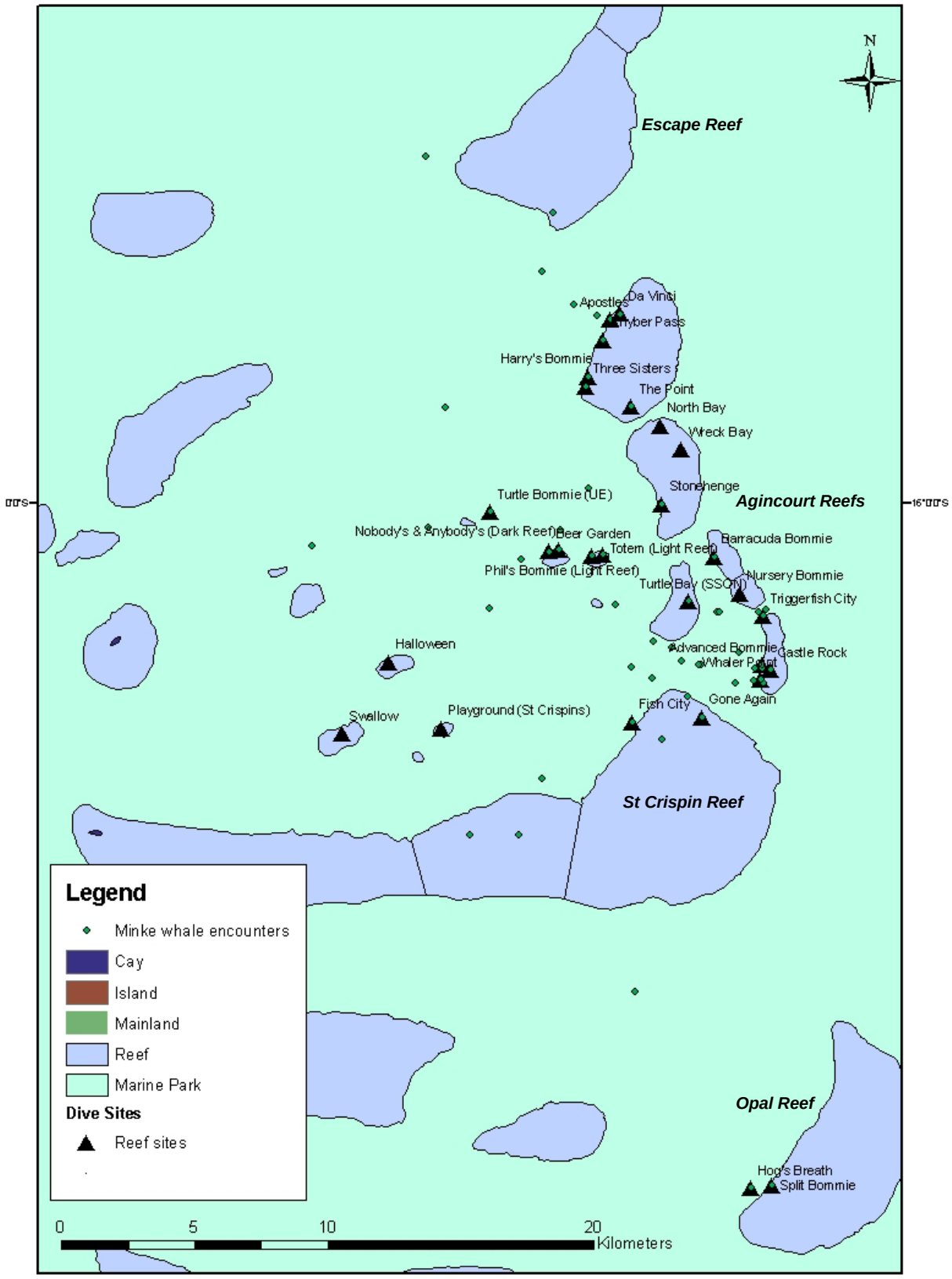


Plate 7: Location of dive sites and minke whale encounters in the vicinity of the Agincourt Reef complex



Nearly three quarters (74.4%; 626/841) of encounters occurred whilst the vessel was moored at a Reef site or at anchor in the GBR lagoon. An analysis was conducted of encounters that occurred at specific dive sites, where the vessel was either tied to a fixed mooring or was at anchor in close proximity to the site (100m or closer). A summary of encounter statistics for 40 sites at which minke whale encounters occurred most frequently is provided below (Table 3.4).

These 40 sites (Table 3.4) accounted for 70.2% (595/848) of all reported dwarf minke whale encounters in the GBR and 77.0% (960.9/1,248.2hrs) of the total encounter time reported for the three seasons (2006-2008). The site with the highest proportion of encounters was 'Lighthouse Bommie' (shown in Plate 5 and Plate 2). Encounters at this small pinnacle dive site represented 19.2% (163/848) of all reported minke whale encounters over the three year period (2006-2008) and 39.6% (494.1/1248.2 hours) of the total encounter time for the GBR. The site with the next highest proportion of minke whale encounters ('Steve's Bommie'; shown in Plate 6) had fewer than half of those reported for Lighthouse Bommie (Table 3.4).

The total number of whales encountered at Lighthouse Bommie was also the highest of all sites, representing 32.1% (812/2533 whales) of the total number of whales encountered in the GBR over the three years. The mean number of whales per encounter at Lighthouse Bommie (5.0) was exceeded by only one site: 'Two Towers' (5.1 whales per encounter), a slightly larger twin-peaked bommie located approximately 1500m (0.8nm) WNW of Lighthouse Bommie (Plate 5).

It is important to note that the number of whales reported for many encounters are estimates and that total number of whales reported for each site includes an unknown number of re-sightings of individual whales. Identifying the number of whales involved in an encounter becomes increasingly difficult when more whales are present, and in rough weather conditions. Researcher protocols for estimating the number of whales in such conditions include using a count of the most whales visible at one time as a minimum/lowest estimate for the encounter.

Table 3.4: Encounter statistics for the top 40 GBR sites at which dwarf minke whale encounters occurred most frequently, 2006-08 (n=595)

Site name (Latitude & Longitude) ***Nearest Major Reef***	**No. of encounters & proportion of total** (%)	**Total duration (hours: mins)**	**Mean encounter duration in mins** (±SE)	**Number of whales***	**Mean no. of whales per encounter** (±SE)
Lighthouse Bommie (14°52.50'S; 145°41.30'E) ***Ribbon Reef #10***	**163** (19.1%)	**494:06**	**181.9** (±13.351)	**812**	**5.0** (±0.308)
Steve's Bommie (15°30.10'S; 145°47.25'E) ***Ribbon Reef #3***	**78** (9.1%)	**152:21**	**117.2** (±13.001)	**174**	**2.2** (±0.185)
Challenger Bay (14°54.90'S; 145°41.40'E) ***Ribbon Reef #10***	**42** (4.9%)	**54:42**	**78.1** (±14.884)	**115**	**2.7** (±0.427)
Pixie Pinnacle (14°55.80'S; 145°40.50'E) ***Ribbon Reef #10***	**33** (3.9%)	**33:09**	**60.3** (±13.241)	**69**	**2.1** (±0.244)
Cod Hole (14°39.80'S; 145°39.80'E) ***Ribbon Reef #10***	**30** (3.5%)	**20:19**	**40.6** (±13.158)	**72**	**2.4** (±0.490)
Clam Gardens (15°23.80'S; 145°45.80'E) ***Ribbon Reef #5***	**24** (2.8%)	**14:21**	**35.9** (±8.793)	**39**	**1.6** (±0.198)
Tracey's Wonderland (15°30.75'S; 145°46.60'E) ***Ribbon Reef #3***	**23** (2.7%)	**20:04**	**52.4** (±16.141)	**52**	**2.3** (±0.610)
Two Towers (14°52.30'S; 145°40.45'E) ***Ribbon Reef #10***	**22** (2.6%)	**43:18**	**118.1** (±21.915)	**113**	**5.1** (±0.672)
Pixie Gardens (14°55.70'S; 145°40.60'E) ***Ribbon Reef #10***	**21** (2.5%)	**10:23**	**29.7** (±7.177)	**40**	**1.9** (±0.337)
Totem (16°01.05'S; 145°48.60'E) ***U/N Reef (Agincourt Reef Complex)***	**16** (1.9%)	**4:25**	**16.6** (±5.515)	**22**	**1.4** (±0.155)
Andy's Postcard (15°20.50'S; 145°44.70'E) ***Ribbon Reef #5***	**14** (1.6%)	**19:29**	**83.5** (±21.808)	**31**	**2.2** (±0.281)
Gone Again (16°04.35'S; 145°50.60'E) ***Agincourt Reef #1***	**11** (1.3%)	**2:21**	**12.8** (±2.621)	**16**	**1.5** (±0.157)
Phil's Bommie (1) (16°01.08'S; 145°48.60'E) ***U/N Reef (Agincourt Reef Complex)***	**8** (0.9%)	**2:41**	**20.1** (±7.148)	**12**	**1.5** (±0.267)
Fantasia (15°00.10'S; 145°40.80'E) ***Ribbon Reef #9***	**7** (0.8%)	**16:05**	**137.9** (±60.353)	**21**	**3.0** (±0.436)
Snake Pit (14°40.10'S; 145°34.10'E) ***Ribbon Reef #10***	**7** (0.8%)	**11:52**	**101.7** (±33.702)	**28**	**4.0** (±1.069)
Pixie Wall/Reef (14°55.80'S; 145°40.50'E) ***Ribbon Reef #10***	**7** (0.8%)	**5:10**	**44.3** (±16.412)	**15**	**2.1** (±0.553)
Acropolis (14°53.68'S; 145°40.05'E) ***Ribbon Reef #10***	**6** (0.7%)	**6:50**	**68.3** (±42.057)	**15**	**2.5** (±0.847)
Blue Lagoon (15°30.47'S; 145°47.83'E) ***Ribbon Reef #3***	**6** (0.7%)	**4:23**	**43.8** (±18.734)	**9**	**1.5** (±0.224)
Nobody's (16°00.95'S; 145°47.70'E) ***U/N Reef (Agincourt Reef Complex)***	**6** (0.7%)	**5:04**	**50.7** (±19.780)	**10**	**1.7** (±0.333)
Jayenem's (15°23.20'S; 145°40.45'E) ***Ribbon Reef #5***	**5** (0.6%)	**6:29**	**77.8** (±36.419)	**8**	**1.6** (±0.245)

**Includes an unknown number of re-sightings of individual whales.*

Table 3.4 (cont.): Encounter statistics for the top 40 GBR sites at which minke whale encounters occurred most frequently, 2006-08 (n=595)

Site name (Latitude & Longitude) ***Nearest Major Reef***	**No. of encounters & proportion of total (%)**	**Total duration (hours & mins)**	**Mean encounter duration in mins** (±SE)	**Number of whales***	**Mean no. of whales per encounter** (±SE)
Advanced Bommie (16°03.30'S; 145°51.82'E) ***Agincourt Reef #1***	**5** (0.6%)	**3:15**	**39.0** (±10.654)	**8**	**1.6** (±0.245)
The Point (15°58.06'S; 145°49.18'E) ***Agincourt Reef #4***	**5** (0.6%)	**2:26**	**29.2** (±14.606)	**6**	**1.2** (±0.200)
Castle Rock (16°03.40'S; 145°52.00'E) ***Agincourt Reef #1***	**5** (0.6%)	**1:53**	**22.6** (±10.727)	**7**	**1.4** (±0.245)
Split Bommie (16°13.85'S; 145°52.02'E) ***Opal Reef***	**5** (0.6%)	**1:21**	**16.2** (±5.774)	**6**	**1.2** (±0.200)
Triggerfish City (16°02.30'S; 145°51.85'E) ***Agincourt Reef #2***	**5** (0.6%)	**1:01**	**12.2** (±4.641)	**5**	**1.0** (±0.0)
Gorgonian Wall (15°23.10'S; 145°45.50'E) ***Ribbon Reef #5***	**4** (0.5%)	**3:50**	**57.5** (±17.619)	**12**	**3.0** (±1.000)
Temple of Doom (15°30.50'S; 145°47.50'E) ***Ribbon Reef #3***	**4** (0.5%)	**3:23**	**50.8** (±18.945)	**10**	**2.5** (±0.289)
Turtle Bay (16°02.01'S; 145°50.34'E) ***Agincourt Reef #5***	**4** (0.5%)	**1:47**	**26.8** (±10.866)	**4**	**1.0** (±0.0)
Three Sisters (15°57.65'S; 145°48.25'E) ***Agincourt Reef #4***	**4** (0.5%)	**0:56**	**14.0** (±7.594)	**6**	**1.5** (±0.500)
Whaler Point (16°03.60'S; 145°51.80'E) ***Agincourt Reef #1***	**4** (0.5%)	**0:44**	**11.0** (±3.317)	**4**	**1.0** (±0.0)
Barracuda Bommie (16°01.10'S; 145°50.85'E) ***Agincourt Reef #2***	**3** (0.4%)	**3:56**	**78.7** (±59.246)	**3**	**1.0** (±0.0)
Phil's Bommie (2) (16°01.00'S; 145°47.51'E) ***U/N Reef (Agincourt Reef Complex)***	**3** (0.4%)	**2:18**	**46.0** (±24.664)	**6**	**2.0** (±0.577)
Dynamite Pass (14°39.80'S; 145°38.60'E) ***No Name Reef***	**3** (0.4%)	**2:07**	**42.3** (±25.208)	**6**	**2.0** (±0.577)
Apostles (15°56.30'S; 145°48.75'E) ***Agincourt Reef #4***	**2** (0.2%)	**0:55**	**27.5** (±2.5)	**3**	**1.5** (±0.5)
Fish City (16°04.45'S; 145°49.20'E) ***St. Crispin Reef***	**2** (0.2%)	**0:17**	**8.5** (±6.5)	**2**	**1.0** (±0.0)
Dali's Garden (15°18.62'S; 145°45.22'E) ***Ribbon Reef #6***	**2** (0.2%)	**0:11**	**5.5** (±4.5)	**3**	**1.5** (±0.5)
Turtle Bommie (16°00.19'S; 145°46.31'E) ***U/N Reef (Agincourt Reef Complex)***	**2** (0.2%)	**0:10**	**5.0** (±4.0)	**2**	**1.0** (±0.0)
Harry's Bommie (15°57.45'S; 145°48.30'E) ***Agincourt Reef #4***	**2** (0.2%)	**0:02**	**1.0** (±0.0)	**3**	**1.5** (±0.5)
Joanie's Joy (15°31.69'S; 145°47.51'E) ***Ribbon Reef #2***	**1** (0.2%)	**2:06**	**126**	**3**	**3.0**
Stepping Stones/Humphrey's (14°39.35'S; 145°38.50'E) ***No Name Reef***	**1** (0.2%)	**0:45**	**45.0**	**6**	**6.0**

**Includes an unknown number of re-sightings of individual whales.*

Comparing Reef sites' encounter statistics

The mean encounter duration and mean number of whales per encounter were compared for the three sites at which encounters were most frequent (from Table 3.4; Lighthouse Bommie, n=163; Steve's Bommie, n=78; and Challenger Bay, n=42; with sufficient sample sizes for tests of statistical significance). A significant difference was found (using non-parametric tests) between these sites for both the median encounter duration (Kruskal Wallis Test: $\chi^2_{1,282} = 18.926$; p = <0.001) and the median number of whales per encounter (Kruskal Wallis Test: $\chi^2_{1,282} = 42.664$; p = <0.001).

Changes in encounter statistics between years at key Reef sites

The encounter statistics for the top three dive sites for minke whale encounters were examined for each of the three years sampled (2006-2008; Table 3.5). Over the three minke whale seasons the number of encounters, total encounter time and total number of whales reported at these three sites varied, however no significant differences were found between years at these sites for either the median encounter duration (Kruskal Wallis Tests; Lighthouse Bommie: $\chi^2_{1,162} = 0.458$; p = >0.05; Steve's Bommie: $\chi^2_{1,77} = 1.024$; p = >0.05; Challenger Bay: $\chi^2_{1,41} = 0.344$; p = >0.05), nor the median number of whales per encounter (Kruskal Wallis Tests; Lighthouse Bommie: $\chi^2_{1,162} = 0.362$; p = >0.05; Steve's Bommie: $\chi^2_{1,77} = 0.910$; p = >0.05; Challenger Bay: $\chi^2_{1,41} = 0.490$; p = >0.05). An increase in the number of encounters at Steve's Bommie and Challenger Bay however was observed over the three seasons (Table 3.5).

Table 3.5: Comparison of annual minke whale summary statistics for the three sites with the highest number of encounters, 2006-2008

		2006	2007	2008
Lighthouse Bommie	Number of encounters	47	61	55
	Total encounter time (hr:min)	138:29	185:27	170:10
	Total number of whales	251	299	262
Steve's Bommie	Number of encounters	18	27	33
	Total encounter time (hr:min)	40:02	56:51	55:28
	Total number of whales	45	64	65
Challenger Bay	Number of encounters	10	14	18
	Total encounter time (hr:min)	17:32	16:07	21:03
	Total number of whales	33	26	56

Encounters in open water

A total of 236 minke whale encounters occurred involving vessels that were either anchored, steaming or drifting in open water (i.e. not moored or anchored at a Reef site), representing 27.7% (236/852) of the total sample. The mean duration of these encounters was 69.4mins (ranging from 1 minute to 8.3 hours in duration). The locations of encounters that occurred in open water are plotted on the map in Plates 5-7. The largest proportion of encounters in open water occurred in proximity to Ribbon Reef #10, with 48.5% (113/233) occurring between latitudes 14°39.60'S and 14°56.40'S.

Comparison of encounter statistics for day-boats and live-aboard vessels

As reported above in Table 3.2, the majority of minke whale encounters were reported by the SWW-endorsed live-aboard vessels (84.5%; 722/854 encounters), with SWW-endorsed day-boats reporting 12.1% (103/854) of encounters in the GBR. Encounter statistics for SWW-endorsed day-boats and live-aboard vessels are compared below (Table 3.6). A significant difference was found between day-boats and live-aboard vessels for both their median encounter duration (Mann Whitney U Test: $Z_{1,824} = -6.661$; $p = <0.001$) and the median number of whales per encounter (Mann Whitney U Test: $Z_{1,824} = -6.081$; $p = <0.001$).

Table 3.6: Comparison of encounter statistics for swimming-with-whales-endorsed day-boats and live-aboard vessels (2006-2008; n=825)

	Day-boats (n=103)	**Live-aboards (n=722)**
Mean encounter duration in minutes (±SE; range)	**21.48** (±3.257: 1-220 mins)	**96.76** (±4.659: 1-665 mins)
Mean number of whales per encounter (±SE; range)	**1.53** (±0.137: 1-14 whales)	**3.15** (±0.121; 1-25 whales)
Proportion of encounters that were in-water interactions (n)	**41.7%** (n=43)	**62.3%** (n=450)
Mean in-water interaction duration in minutes (range)	**34.49** (±5.270: 1-195 mins)	**145.02** (±6.337: 1-665 mins)
Mean number of whales per in-water interaction (range)	**1.51** (±0.107: 1-3 whales)	**4.20** (±0.174: 1-25 whales)

3.3.3 Industry effort data returns

Over the three core minke whale seasons (June & July only, 2006-2008) effort data were recorded for a total of 601 vessel days, representing 51.3% (601/1171) of the total vessel days at sea for all SWW-endorsed vessels over the sampling period. This proportion differed between the day-boats (21.9%; 118/538 vessel days) and live-aboard vessels (75.5%; 463/613 vessel days; *NB. the vessel 'Floreat' is excluded here due to insufficient information about total operating days*). All operating SWW-endorsed vessels assisted with the collection of effort data (the samples achieved from each vessel per year are shown below in Table 3.7). A complete account of the types of data collected (i.e. VML, RLS and/or GPS logs) for each vessel over each minke season, as well as the total days each vessel spent at sea for each season are shown in a calendar format in Appendix 7.

Table 3.7: 'Vessel days at sea' for which effort data were collected on SWW-endorsed vessels; June & July only, 2006–2008

	2006		2007		2008		Total	
Vessel / operator	Days sampled	Days operating in GBR	Days sampled	Days operating in GBR	Days sampled	Days operating in GBR	Days sampled	Days operating in GBR
Live-aboards								
Undersea Explorer	42	49	42	50	46	51	130	150
Taka	32	51	49	52	38	54	119	157
Nimrod Explorer	29	52	43	50	37	48	109	150
Spoil Sport	22	44	33	45	31	47	86	136
Floreat	11	unavailable	6	unavailable	3	unavailable	20	unavailable
Eye to Eye	-	-	-	-	19	21	19	21
Sub-total	***136***	***> 207***	***173***	***> 201***	***174***	***> 224***	***483***	***> 634***
Day-boats								
Silver Sonic	1	59	0	60	55	59	56	178
Aristocat	1	59	5	60	44	60	50	179
Poseidon	1	59	5	61	6	59	12	179
Sub-total	***3***	***177***	***10***	***181***	***105***	***178***	***118***	***538***
TOTAL	**139**	**> 384**	**183**	**> 382**	**279**	**> 402**	**601**	**1171**

3.3.4 Distribution and description of industry effort

Site visiting frequency

From the combined vessel effort database, a total of 1596 vessel site visits were logged over 2006-2008, of which 1247 were by SWW-endorsed live-aboard vessels and the remaining 349 were by SWW-endorsed day-boats. Frequencies of visits to specific sites are shown below in rank order from most to least visited (Table 3.8 for SWW-endorsed live-aboard vessels; Table 3.9 for SWW-endorsed day-boats). The locations of these sites are shown on Plates 5 and 6 for sites in the Ribbon Reefs Sector visited by live-aboard vessels, and Plate 7 for sites in the Offshore Port Douglas Sector visited mostly by the day-boats (with some visits by live-aboard vessels).

An exception among the Reef sites listed (Table 3.8) is the inclusion of Watson's Bay, Lizard Island. Two of the SWW-endorsed live-aboard vessels transfer passengers via the Lizard Island airport as part of their regular itinerary and whilst moored in this shallow lagoon, dives are not conducted. Other vessels may visit Watson's Bay occasionally (e.g. for passengers' benefit, allowing time to explore the beach and historical walking trails). As no minke whales were encountered at this site during this study, it is not included in subsequent analyses of dive site effort.

Table 3.8: Visiting frequency for sites visited by SWW-endorsed live-aboard vessels each minke whale season (June-July only, 2006-08; n=1247)

	Number of logged visits			
Site name (GPS coordinates)	**2006** (%; /n=374)	**2007** (%; /n=435)	**2008** (%; /n=438)	**Total** (%; /n=1247)
Challenger Bay (14°54.90'S; 145°41.40'E)	**45** (12.0%)	**57** (13.1%)	**52** (11.9%)	**154** (12.3%)
Cod Hole (14°39.80'S; 145°39.80'E)	**42** (11.2%)	**48** (11.0%)	**48** (11.0%)	**138** (11.1%)
Lighthouse Bommie (14°52.50'S; 145°41.30'E)	**36** (9.6%)	**42** (9.7%)	**44** (10.0%)	**122** (9.8%)
Steve's Bommie (15°30.10'S; 145°47.25'E)	**33** (8.8%)	**42** (9.7%)	**41** (9.4%)	**116** (9.3%)
Pixie Pinnacle (14°55.80'S; 145°40.50'E)	**26** (7.0%)	**28** (6.4%)	**21** (4.8%)	**75** (6.0%)
Tracey's Wonderland (15°30.75'S; 145°46.60'E)	**17** (4.5%)	**15** (3.4%)	**42** (9.6%)	**74** (5.9%)
Watson's Bay (Lizard Island) (14°39.70'S; 145°26.80'E)	**14** (3.7%)	**11** (2.5%)	**22** (5.0%)	**47** (3.8%)
Pixie Gardens (14°55.70'S; 145°40.60'E)	**9** (2.4%)	**14** (3.2%)	**23** (5.3%)	**46** (3.7%)
Clam Gardens (15°23.80'S; 145°45.80'E)	**12** (3.2%)	**12** (2.8%)	**16** (3.7%)	**40** (3.2%)
Pixie Wall/Reef (14°55.80'S; 145°40.50'E)	**11** (2.9%)	**10** (2.3%)	**10** (2.3%)	**31** (2.5%)
Beer Garden (16°00.99'S; 145°47.50'E)	**4** (1.1%)	**13** (3.0%)	**10** (2.3%)	**27** (2.2%)
Split Bommie (16°13.85'S; 145°52.02'E)	**9** (2.4%)	**16** (3.7%)	**1** (0.2%)	**26** (2.1%)
Stepping Stones (14°39.35'S; 145°38.50'E)	**6**	**5** (1.1%)	**14** (3.2%)	**25** (2.0%)
Temple of Doom (15°30.50'S; 145°47.50'E)	**9** (2.4%)	**13** (3.0%)	**1** (0.2%)	**23** (1.8%)
Two Towers (14°52.30'S; 145°40.45'E)	**-**	**12** (2.8%)	**10** (2.3%)	**22** (1.8%)
Hog's Breath (16°13.90'S; 145°51.60'E)	**8** (2.1%)	**11** (2.5%)	**-**	**19** (1.5%)
Snake Pit (14°40.10'S; 145°34.10'E)	**-**	**6** (1.4%)	**9** (2.1%)	**15** (1.2%)
Jayenem's (15°23.20'S; 145°40.45'E)	**2** (0.5%)	**8** (1.8%)	**4** (0.9%)	**14** (1.1%)
Andy's Postcard (15°20.50'S; 145°44.70'E)	**5** (1.3%)	**7** (1.6%)	**2** (0.5%)	**14** (1.1%)
Dynamite Pass (14°39.80'S; 145°38.60'E)	**7** (1.9%)	**3** (0.7%)	**3** (0.7%)	**13** (1.0%)
Fantasia (15°00.10'S; 145°40.80'E)	**3** (0.8%)	**7** (1.6%)	**3** (0.7%)	**13** (1.0%)
Troppo's (16°25.00'S; 145°59.90'E)	**1** (0.3%)	**-**	**8** (1.8%)	**9** (0.7%)
Acropolis (14°53.68'S; 145°40.05'E)	**-**	**-**	**9** (2.1%)	**9** (0.7%)
Playground (Norman Reef) (16°25.70'S; 145°59.30'E)	**-**	**-**	**8** (1.8%)	**8** (0.6%)
Princess Bommie (15°30.17'S; 145°47.80'E)	**4** (1.1%)	**1** (0.2%)	**2** (0.5%)	**7** (0.6%)
Blue Lagoon (Ribbon Reef 3) (15°30.47'S; 145°47.83'E)	**-**	**6** (1.4%)	**1** (0.2%)	**7** (0.6%)
Remaining logged sites (fewer than 7 visits each; includes anchorages)	**68** (18.2%)	**46** (10.6%)	**32** (7.3%)	**146** (11.7%)
Undetermined sites (no coordinates or site name logged)	**3** (0.8%)	**2** (0.5%)	**2** (0.5%)	**7** (0.6%)
TOTAL	**374**	**435**	**438**	**1247**

Table 3.9: Visiting frequency for sites visited by SWW-endorsed day-boats each minke whale season (June-July only, 2006-08; n=349)

	Number of logged visits			
Site name (GPS coordinates)	**2006**	**2007**	**2008**	**Total** (%; /n=349)
Phil's Bommie (16°01.08'S; 145°48.38'E)	**2**	**3**	**33**	**38** (10.9%)
Swallow (16°04.69'S; 145°43.31'E)	**-**	**-**	**35**	**35** (10.0%)
Castle Rock (16°03.40'S; 145°52.00'E)	**1**	**2**	**32**	**35** (10.0%)
Nobody's (16°00.95'S; 145°47.70'E)	**-**	**3**	**29**	**32** (9.2%)
The Point (15°58.06'S; 145°49.18'E)	**-**	**2**	**22**	**24** (6.9%)
Totem (16°01.05'S; 145°48.60'E)	**1**	**5**	**17**	**23** (6.6%)
Whaler Point (16°03.60'S; 145°51.80'E)	**-**	**-**	**23**	**23** (6.6%)
Triggerfish City (16°02.30'S; 145°51.85'E)	**-**	**2**	**16**	**18** (5.2%)
Turtle Bay (16°02.01'S; 145°50.34'E)	**-**	**-**	**17**	**17** (4.9%)
Three Sisters (15°57.65'S; 145°48.25'E)	**1**	**-**	**15**	**16** (4.6%)
Gone Again (16°04.35'S; 145°50.60'E)	**1**	**3**	**11**	**15** (4.3%)
Barracuda Bommie (16°01.10'S; 145°50.85'E)	**1**	**1**	**11**	**13** (3.7%)
Halloween (16°03.24'S; 145°44.25'E)	**-**	**-**	**8**	**8** (2.3%)
North Bay (15°58.45'S; 145°49.76'E)	**-**	**3**	**5**	**8** (2.3%)
Advanced Bommie (16°03.30'S; 145°51.82'E)	**-**	**2**	**5**	**7** (2.0%)
Nursery Bommie (16°01.84'S; 145°51.37'E)	**-**	**-**	**7**	**7** (2.0%)
Playground (St Crispins Reef) (16°04.57'S; 145°45.32'E)	**-**	**-**	**6**	**6** (1.7%)
Da Vinci (15°56.17'S; 145°48.96'E)	**1**	**1**	**3**	**5** (1.4%)
Wreck Bay (15°58.93'S; 145°50.20'E)	**-**	**-**	**4**	**4** (1.1%)
Blue Lagoon (Agincourt 3) (16°00.10'S; 145°50.06'E)	**-**	**-**	**3**	**3** (0.9%)
Stonehenge (16°00.03'S; 145°49.80'E)	**-**	**-**	**3**	**3** (0.9%)
Harry's Bommie (15°57.45'S; 145°48.30'E)	**-**	**-**	**2**	**2** (0.6%)
Undetermined sites (no coordinates or site name logged)	**1**	**2**	**4**	**7** (2.0%)
TOTAL	**9**	**29**	**311**	**349**

3.3.4.1 Duration of site visits

In order to standardise analyses of potential vessel search effort for dwarf minke whales, the following analyses have focussed on vessel location and movements during daylight hours only, defined as the twelve hour period from 6:30am to 6:30pm. During the months of June and July in the Ribbon Reefs, sunrise typically occurs around 6:45am and sunset occurs shortly before 6:00pm (*personal observation*).

Sites visited by SWW-endorsed live-aboard vessels

A summary of the mean duration of visits to the 25 most frequently visited sites (during daylight hours) by SWW-endorsed live-aboard vessels over the three minke whale seasons (June-July only, 2006-2008) is shown below (Table 3.10).

The highest mean visit duration of any site was for Lighthouse Bommie (approx. 5 hours, or 301.97mins, ± 15.7mins SE). A statistical comparison was made of the mean duration of visits to the six most frequently visited sites (Challenger Bay, Cod Hole, Lighthouse Bommie, Steve's Bommie, Pixie Pinnacle and Tracey's Wonderland; from Table 3.8). A significant difference in the mean duration of visit was found between the six sites (One Way ANOVA: $F_{1,658} = 27.053$; p=<0.001). A Tukey's HSD post-hoc test revealed that visits to Lighthouse Bommie were significantly longer in duration than visits to all other sites tested (p=<0.001).

Significant differences between the other sites were also found: visits to Steve's Bommie were significantly longer than visits to Pixie Pinnacle and Challenger Bay (p=<0.05 and p=<0.001 respectively) and visits to the Cod Hole were significantly longer than visits to Pixie Pinnacle and Challenger Bay (p=<0.05 and p=<0.001 respectively; the means (±SE) for each site are shown below in Figure 3.6). It is important to note that Challenger Bay is a popular site for night diving and overnight mooring thus the shorter mean visit time shown for this location may be attributed to a higher proportion of late afternoon arrivals and/or early morning departures.

Table 3.10: Mean duration of visits to 25 specific sites by SWW-endorsed live-aboard vessels during daylight hours (between 6:30am and 6:30pm only; June-July 2006-2008)

	Mean duration of visit in minutes			
Site name (number of visits total)	**2006** (n; range in mins)	**2007** (n; range in mins)	**2008** (n; range in mins)	**Total** (n; range in mins)
Lighthouse Bommie (n = 122 visits total; 3 missing data)	**268.58** (n=33; 23 - 644m)	**306.57** (n=42; 39 - 675m)	**322.61** (n=44; 7 - 600m)	**301.97** (n=119; 7 - 675m)
Blue Lagoon (n = 7 visits total)	**-**	**264.50** (n=6; 77 - 481m)	**287** (n=1)	**267.71** (n=7; 77 - 481m)
Troppo's (n = 9 visits total)	**206** (n=1)	**-**	**243.00** (n=8; 125 - 386m)	**238.89** (n=9; 125 - 386m)
Steve's Bommie (n = 116 visits total; 3 missing data)	**215.41** (n=32; 17 -384m)	**257.78** (n=41; 15 -577m)	**220.43** (n=40; 38 -398m)	**232.56** (n=113; 15 -577m)
Cod Hole (n = 138 visits total; 2 missing data)	**211.38** (n=40; 5 - 365m)	**239.44** (n=48; 31 - 467m)	**238.02** (n=48; 45 - 665m)	**230.68** (n=136; 5 - 665m)
Two Towers (n = 22 visits total)	**-**	**206.17** (n=12; 84 - 316m)	**189.20** (n=10; 92 - 413m)	**198.45** (n=22; 84 - 413m)
Tracey's Wonderland (n = 74 visits total; 1 missing data)	**177.88** (n=17; 10 - 285m)	**198.80** (n=15; 19 - 540m)	**190.32** (n=41; 24 - 415m)	**189.16** (n=73; 10 - 540m)
Pixie Pinnacle (n = 75 visits total ; 5 missing data)	**196.00** (n=24; 50 - 365m)	**195.48** (n=27; 10 - 400m)	**140.05** (n=19; 20 - 293m)	**180.61** (n=70; 10 - 400m)
Clam Gardens (n = 40 visits total)	**141.75** (n=12; 25 - 299m)	**220.58** (n=12; 96 - 357m)	**165.75** (n=16; 66 - 344m)	**175.00** (n=40; 25 - 357m)
Andy's Postcard (n = 14 visits total)	**98.80** (n=5; 18 - 135m)	**192.00** (n=7; 90 - 310m)	**208.00** (n=2; 125 - 291m)	**161.00** (n=14; 18 - 310m)
Pixie Gardens (n = 46 visits total; 2 missing data)	**113.63** (n=8; 66 - 161m)	**175.57** (n=14; 30 - 312m)	**155.73** (n=22; 27 - 260m)	**154.39** (n=44; 27 - 312m)
Jayenem's (n = 14 visits total)	**198.5** (n=2; 130 - 267m)	**182.50** (n=8; 120 - 259m)	**63.50** (n=4; 40 - 119m)	**150.79** (n=14; 40 - 267m)
Temple of Doom (n = 23 visits total)	**141.22** (n=9; 75 - 196m)	**149.54** (n=13; 30 - 300m)	**205** (n=1)	**148.70** (n=23; 30 - 300m)
Challenger Bay (n = 154 visits total; 6 missing data)	**119.71** (n=41; 8 - 260m)	**154.82** (n=56; 5 - 341m)	**164.45** (n=51; 11-690m)	**148.41** (n=148; 5 - 690m)
Split Bommie (n = 25 visits total; 1 missing data)	**131.44** (n=9; 105 - 210m)	**159.43** (n=14; 114 -223m)	**95** (n=1)	**146.25** (n=24; 95 - 223m)
Fantasia (n = 16 visits total)	**117.50** (n=4; 82 - 148m)	**141.29** (n=7; 95 - 210m)	**173.60** (n=5; 103 - 270m)	**145.44** (n=16; 82 - 270m)
Acropolis (n = 9 visits total)	**-**	**-**	**137.78** (n=9; 97 - 255m)	**137.78** (n=9; 97 - 255m)
Princess Bommie (n = 7 visits total)	**104.50** (n=4; 70 - 135m)	**140** (n=1)	**170.00** (n=2; 40 - 300m)	**128.29** (n=7; 40 - 300m)
Pixie Wall/Reef (n = 31 visits total; 4 missing data)	**133.88** (n=8; 75 - 219m)	**104.70** (n=10; 2 - 150m)	**138.00** (n=9; 105 - 185m)	**124.44** (n=27; 2 - 219m)
Snake Pit (n = 15 visits total)	**-**	**159.33** (n=6; 58 - 230m)	**91.11** (n=9; 12 - 205m)	**118.40** (n=15; 12 - 230m)
Stepping Stones (n = 25 visits total; 1 missing data)	**142.83** (n=6; 47 - 368m)	**132.60** (n=5; 95 - 160m)	**101.15** (n=13; 9 - 192m)	**118.13** (n=24; 9 - 368m)
Playground (n = 8 visits total; 1 missing data)	**-**	**-**	**107.14** (n=7; 26 - 270m)	**107.14** (n=7; 26 - 270m)
Dynamite Pass (n = 13 visits total)	**90.71** (n=7; 5 - 179m)	**112.33** (n=3; 15 - 215m)	**110.33** (n=3; 74 - 137m)	**100.23** (n=13; 5 - 215m)
Hog's Breath (n = 19 visits total)	**82.88** (n=8; 60 - 95m)	**98.36** (n=11; 70 - 210m)	**-**	**91.84** (n=19; 60 - 210m)
Beer Garden (n = 27 visits total; 1 missing data)	**40.25** (n=4; 18 - 55m)	**72.08** (n=12; 30 - 183m)	**38.10** (n=10; 30 - 50m)	**54.12** (n=26; 18 - 183m)
OVERALL (n = 1049 visits total; 30 missing data)	**172.14** (n=294; 5 – 644 mins)	**196.17** (n=396; 2 – 675 mins)	**189.54** (n=387; 7 – 690 mins)	**187.23** (n=1019; 2 – 690 mins)

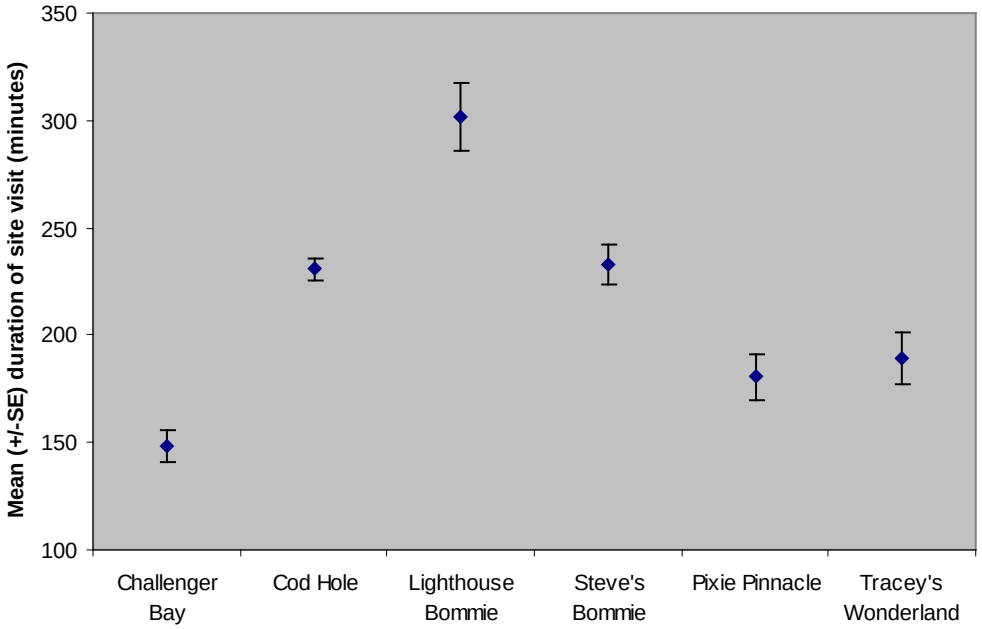


Figure 3.6: **Differences in mean (±SE) duration of visit during daylight hours between the six most frequently visited dive sites by SWW-endorsed live-aboard vessels, 2006-2008 (n=659 site visits)**

The apparent trend of increasing duration of visits to the sites Challenger Bay and Lighthouse Bommie (as shown in Table 3.10) over 2006-2008 was investigated further, however no significant differences between years were found for either site (Kruskal-Wallis tests for Challenger Bay and Lighthouse Bommie: $\chi^2_{1,147} = 5.618$; p = >0.05 and $\chi^2_{1,118} = 1.710$; p = >0.05 respectively). This finding may be attributed to insufficient sample sizes and relatively large mean standard errors (mean visit durations ±SE for Challenger Bay and Lighthouse Bommie for each of the three minke whale seasons are displayed below for comparison in Table 3.11). It is possible that analyses of this variable using longer-term data sets (i.e. more years) and/or with more complete coverage of sampling within each season (i.e. fewer missing days) may result in a significant finding.

Table 3.11: Differences in mean (±SE) duration of visit during daylight hours for Lighthouse Bommie and Challenger Bay, 2006-2008.

		2006	2007	2008
Challenger Bay	**Mean**	**119.71**	**154.82**	**164.45**
	±SE	10.454	11.965	16.031
Lighthouse Bommie	**Mean**	**268.58**	**306.57**	**322.61**
	±SE	25.021	29.298	25.864

Sites visited by SWW-endorsed day-boats

The mean site visit duration for the 22 most frequently visited sites (logged) by the three SWW-endorsed day-boat vessels are shown below (Table 3.12). Overall there was a much smaller variation in the duration of site visits by the day-boats than for the live-aboards. The overall mean site visit duration by the SWW-endorsed day-boats was 82.81 minutes, ranging from 50 to 170 minutes. Due to low sample sizes in 2006 and 2007, the overall means for the three-year period for each site are presented only (Table 3.12 below).

Table 3.12: Mean duration of visits to the 22 most frequently visited sites by SWW-endorsed day-boats over three minke whale seasons (June-July only, 2006-2008; n=378 site visits)

Site name (number of visits total)	**Mean duration of visit in minutes** (n; range)
Phil's Bommie (1) (n = 38 visits total; 9 missing data)	**88.76 mins** (n=29; 60 – 115 m)
Castle Rock (n = 35 visits total; 8 missing data)	**80.56 mins** (n=27; 60 – 112 m)
Swallow (n = 35 visits total; 1 missing data)	**69.32 mins** (n=34; 55 – 95 m)
Nobody's (n = 32 visits total; 1 missing data)	**86.19 mins** (n=31; 56 – 103 m)
The Point (n = 24 visits total; 3 missing data)	**92.05 mins** (n=21; 63 – 110 m)
Totem (n = 23 visits total; 1 missing data)	**85.86 mins** (n=22; 60 – 149 m)
Whaler Point (n = 23 visits total)	**77.96 mins** (n=23; 50 – 100 m)
Triggerfish City (n = 18 visits total; 2 missing data)	**68.50 mins** (n=16; 56 – 108 m)
Turtle Bay (n = 17 visits total; 5 missing data)	**89.00 mins** (n=12; 70 – 113 m)
Three Sisters (n = 16 visits total; 2 missing data)	**93.50 mins** (n=14; 60 – 110 m)
Gone Again (n = 15 visits total)	**77.67 mins** (n=15; 64 – 150 m)
Barracuda Bommie (n = 13 visits total; 2 missing data)	**91.09 mins** (n=11; 63 – 105 m)
North Bay (n = 8 visits total)	**82.50 mins** (n=8; 61 – 100 m)
Halloween (n = 8 visits total)	**70.00 mins** (n=8; 65 – 75 m)
Nursery Bommie (n = 7 visits total; 1 missing data)	**101.33 mins** (n=6; 66 – 170 m)
Advanced Bommie (n = 7 visits total)	**77.29 mins** (n=7; 60 – 105 m)
Playground (St Crispin Reef) (n = 6 visits total; 1 missing data)	**72.00 mins** (n=5; 65 – 80 m)
Wreck Bay (n = 4 visits total)	**109.25 mins** (n=4; 102 – 120 m)
Da Vinci (n = 4 visits total)	**88.50 mins** (n=4; 63 – 102 m)
Blue Lagoon (Agincourt 3) (n = 3 visits total)	**88.67 mins** (n=3; 83 – 93 m)
Stonehenge (n = 3 visits total)	**80.00 mins** (n=3; 65 – 100 m)
Harry's Bommie (n = 2 visits total)	**100.00 mins** (n=2; 95 – 105 m)
OVERALL (n = 342 visits total; 36 missing data)	**82.81 mins** (n=306; 50 – 170 m)

3.3.5 Comparing vessel effort with minke whale encounters

Standardisation of whale encounter and effort data

Over the three peak minke whale seasons (in June & July only), 735 encounters with dwarf minke whales were reported by SWW-endorsed vessels. Of these, 657 were from SWW-endorsed live-aboard vessels and 78 were from SWW-endorsed day-boats. Among the 657 encounters reported by the live-aboard vessels, 582 occurred on vessel days for which effort data were collected (with 75 encounters occurring on vessel days for which no effort data were available). Among the 78 encounters reported by SWW-endorsed day-boats, only 16 occurred on vessel days for which effort data were collected (with 62 encounters occurring on vessel days with no corresponding vessel effort data available).

In order to make valid comparisons of whale sightings per unit of vessel effort, minke whale encounters (reported via the WSS) that occurred on vessel days for which no corresponding effort data were available were excluded from the following analyses. Similarly, if an encounter began before 6:30am or ended after 6:30pm, the duration of the encounter was amended to be consistent with the vessel effort data (i.e. limited to the encounter time that occurred during the 12 hours of daylight). This rule was applied to 21 encounters, and a further 10 encounters that occurred outside these hours were excluded.

3.3.5.1 Whale encounters vs. vessel effort at specific sites

The total encounter time for each site (for vessel days on which effort data were recorded) was compared with the total logged effort at the site, enabling the calculation of the interaction rate, alongside encounter rates based on the frequency of encounters and visits for each site. Results for 40 sites visited by the SWW-endorsed vessels (both live-aboards and day-boats) are presented below, ranked by their proportion of total encounter time to total effort time (%) from highest to lowest (Table 3.13).

Table 3.13: Comparison of minke whale encounter time and vessel effort by SWW-endorsed operators at 40 Reef sites visited during three minke seasons (June-July, 2006-2008)

Site name (Latitude & Longitude) ***Nearest Major Reef***	(a) Total whale encounter time at site (corresponding to effort logs; hrs)	(b) Total vessel hours logged at site (site effort; hrs)	Encounter time/effort time (a/b; expressed as percentage)	(c) Site visits with whale encounters / (d) total site visits	Encounter rate (c/d; expressed as percentage)
Lighthouse Bommie* (14°52.50'S; 145°41.30'E) ***Ribbon Reef #10***	371.25	605.65	61.3%	94/122	77.0%
Two Towers* (14°52.30'S; 145°40.45'E) ***Ribbon Reef #10***	40.35	72.76	55.5%	18/22	81.8%
Apostles** (15°56.30'S; 145°48.75'E) ***Agincourt Reef #4***	0.5	1.33	37.6%	1/1	100%
Acropolis* (14°53.68'S; 145°40.05'E) ***Ribbon Reef #10***	6.80	20.67	32.9%	5/9	55.6%
Andy's Postcard* (15°20.50'S; 145°44.70'E) ***Ribbon Reef #5***	11.57	37.57	30.8%	7/14	50.0%
Snake Pit* (14°40.10'S; 145°34.10'E) ***Ribbon Reef #10***	8.36	29.60	28.2%	6/15	40.0%
Steve's Bommie* (15°30.10'S; 145°47.25'E) ***Ribbon Reef #3***	102.13	437.98	23.3%	50/116	43.1%
Fantasia* (15°00.10'S; 145°40.80'E) ***Ribbon Reef #9***	7.50	38.78	19.3%	5/16	31.3%
Blue Lagoon* (15°30.47'S; 145°47.83'E) ***Ribbon Reef #3***	4.30	31.23	13.8%	4/7	57.1%
Joanie's Joy* (15°31.66'S; 145°46.67'E) ***Ribbon Reef #2***	2.10	17.38	12.1%	1/5	20.0%
Dynamite Pass* (14°39.80'S; 145°38.60'E) ***No Name Reef***	2.12	21.72	9.8%	3/13	23.1%
Challenger Bay* (14°54.90'S; 145°41.40'E) ***Ribbon Reef #10***	34.30	366.08	9.4%	28/154	18.2%
Pixie Gardens* (14°55.70'S; 145°40.60'E) ***Ribbon Reef #10***	9.85	113.22	8.7%	15/46	32.6%
Clam Gardens* (15°23.80'S; 145°45.80'E) ***Ribbon Reef #5***	10.13	116.67	8.7%	15/40	37.5%
Temple of Doom* (15°30.50'S; 145°47.50'E) ***Ribbon Reef #3***	4.50	57.00	7.9%	5/23	21.7%
Pixie Pinnacle* (14°55.80'S; 145°40.50'E) ***Ribbon Reef #10***	16.73	210.72	7.9%	18/75	24.0%
Gorgonian Wall* (15°23.10'S; 145°45.50'E) ***Ribbon Reef #5***	1.25	16.95	7.4%	2/8	25.0%
Princess Bommie* (15°30.17'S; 145°47.80'E) ***Ribbon Reef #3***	1.00	14.97	6.7%	1/7	14.3%
The Point** (15°58.06'S; 145°49.18'E) ***Agincourt Reef #4***	1.58	32.22	4.9%	2/24	8.3%
Jayenem's* (15°23.20'S; 145°40.45'E) ***Ribbon Reef #5***	1.70	35.18	4.8%	3/14	21.4%

*Site used by SWW-endorsed live-aboard(s) only
**Site used by SWW-endorsed day-boat(s) only
***Site used by both SWW-endorsed live-aboard(s) and day boat(s).

Table 3.13 (cont.): Comparison of minke whale encounter time and vessel effort by SWW-endorsed operators at 40 Reef sites visited during three minke seasons (June-July, 2006-2008)

Site name (Latitude & Longitude) ***Nearest Major Reef***	(a) Total whale encounter time at site (corresponding to effort logs; hrs)	(b) Total vessel hours logged at site (site effort; hrs)	Encounter time/effort time (a/b; expressed as percentage)	(c) Site visits with whale encounters / (d) total site visits	Encounter rate (c/d; expressed as percentage)
Tracey's Wonderland* (15°30.75'S; 145°46.60'E) ***Ribbon Reef #3***	10.35	231.15	4.5%	14/74	18.9%
Advanced Bommie*** (16°03.30'S; 145°51.82'E) ***Agincourt Reef #1***	0.83	19.50	4.3%	2/13	15.4%
Phil's Bommie (1)** (16°01.08'S; 145°48.38'E) ***U/N Reef (Agincourt Area)***	1.75	42.90	4.1%	3/38	7.9%
Cod Hole* (14°39.80'S; 145°39.80'E) ***Ribbon Reef #10***	16.32	522.88	3.1%	15/138	10.9%
Turtle Bommie* (16°00.19'S; 145°46.31'E) ***U/N Reef (Agincourt Area)***	0.17	6.52	2.6%	2/3	66.7%
Pixie Wall/Reef* (14°55.80'S; 145°40.50'E) ***Ribbon Reef #10***	1.38	56.33	2.4%	2/31	6.5%
MacGillivray Reef* (14°39.05'S; 145°29.29'E) ***Near Lizard Island***	0.12	6.50	1.8%	1/2	50.0%
Split Bommie* (16°13'85"S; 145°52'02"E) ***Opal Reef***	0.98	58.50	1.7%	3/25	12.0%
Dali's Garden* (15°18.62'S; 145°45.22'E) ***Ribbon Reef #6***	0.18	12.92	1.4%	2/6	33.3%
Gone Again** (16°04.35'S; 145°50.60'E) ***Agincourt Reef #1***	0.25	19.42	1.3%	1/15	6.7%
Triggerfish City*** (16°02.30'S; 145°51.85'E) ***Agincourt Reef #2***	0.28	23.60	1.2%	1/19	5.3%
Stepping Stones* (14°39.35'S; 145°38.50'E) ***No Name Reef***	0.12	47.25	0.2%	1/25	4.0%
Three Sisters** (15°57.65'S; 145°48.25'E) ***Agincourt Reef #4***	0.02	21.82	0.1%	1/16	6.3%
Totem** (16°01.05'S; 145°48.60'E) ***U/N Reef (Agincourt Area)***	0.02	31.48	0.1%	1/23	4.3%
Nobody's*** (16°00'95"S; 145°47'70"E) ***U/N Reef (Agincourt Area)***	0	44.53	-	0/32	-
Whaler Point*** (16°03.60'S; 145°51.80'E) ***Agincourt Reef #1***	0	40.67	-	0/28	-
Swallow** (16°04.69'S; 145°43.31'E) ***Sylvan Reef***	0	39.28	-	0/35	-
Castle Rock** (16°03.40'S; 145°52.00'E) ***Agincourt Reef #1***	0	34.83	-	0/35	-
Hog's Breath* (16°13.90'S; 145°51.60'E) ***Opal Reef***	0	29.08	-	0/19	-
Beer Garden* (16°00.99'S; 145°47.50'E) ***U/N Reef (Agincourt Area)***	0	23.45	-	0/27	-

*Site used by SWW-endorsed live-aboard(s) only
**Site used by SWW-endorsed day-boat(s) only
***Site used by both SWW-endorsed live-aboard(s) and day boat(s).

From the results above (Table 3.13) it is clear that the encounter rates and the proportion of total encounter time to total effort time vary considerably between sites. It is important to note however that comparisons between sites with lower sample sizes (i.e. the number of site visits and the number of site visits during which minke whales were encountered; as shown in Table 3.13) should be treated with caution. Encounters with dwarf minke whales did occur at many of these sites when no effort data were logged (and thus were excluded from the above calculations), hence it is likely that the encounter rates and the proportion of total encounter time to total effort time for these sites would vary considerably with improved sampling of vessel effort, particularly among those sites used exclusively by the SWW-endorsed day-boats.

Among those sites with larger samples of logged vessel visits (for example, those with >70 site visits recorded over the three seasons), Lighthouse Bommie is clearly a 'hot spot' with the most predictable sightings of dwarf minke whales of any site known in the GBR, with minke whale encounters resulting from 77% of visits to the site during June and July.

It is interesting to note that the sites with a proportion of total encounter time to total effort time greater than 20% (excluding 'Apostles' due to its low sample size; Table 3.13) are isolated coral pinnacles (Lighthouse Bommie, Steve's Bommie, Two Towers, Andy's Postcard) or small patch reefs (Snake Pit and Acropolis) surrounded by deeper water.

Changes in Reef sites' whale encounters vs. vessel effort between seasons

Potential changes in the encounter rates and the proportion of total encounter time to total effort time at frequently visited Reef sites over the three seasons (2006-08) were investigated. Comparisons between the three minke whale seasons were made for the six sites with the highest number of visits (Challenger Bay, Cod Hole, Lighthouse Bommie, Steve's Bommie, Pixie Pinnacle and Tracey's Wonderland; Table 3.14). Some variation was apparent between years for each site however the proportion of total encounter time to total effort time (%) remained relatively consistent for each site over the period. As reported above, the smaller samples (i.e. number of logged visits) per site per year decreases the reliability for such between-year comparisons.

Table 3.14: Between-years (2006-2008) comparison of whale encounters vs. vessel effort for six Reef sites with the highest frequency of visitation (n=679 site visits total)

	2006			2007			2008		
Site	(a) whale encounter time / (b) site effort (hours)	Encounter time/effort time (a/b; expressed as %)	(c) Site visits with whale encounters / (d) total site visits (**encounter rate**; %)	(a) whale encounter time / (b) site effort (hours)	Encounter time/effort time (a/b; expressed as %)	(c) Site visits with whale encounters / (d) total site visits (**encounter rate**; %)	(a) whale encounter time / (b) site effort (hours)	Encounter time/effort time (a/b; expressed as %)	(c) Site visits with whale encounters / (d) total site visits (**encounter rate**; %)
Lighthouse Bommie	87.2 / 154.5	**56.4%**	25/36 (**69.4%**)	135.9 / 214.6	**63.3%**	36/42 (**85.7%**)	148.2 / 236.6	**62.6%**	33/44 (**75.0%**)
Steve's Bommie	27.2 / 114.9	**23.7%**	12/33 (**36.3%**)	37.9 / 176.2	**21.5%**	19/42 (**45.2%**)	34.1 / 147.0	**23.2%**	19/41 (**46.3%**)
Pixie Pinnacle	8.9 / 78.6	**11.3%**	6/27 (**22.2%**)	3.7 / 88.1	**4.2%**	8/28 (**28.6%**)	4.2 / 44.0	**9.5%**	4/20 (**20.0%**)
Challenger Bay	5.3 / 81.8	**6.5%**	5/45 (**11.1%**)	15.6 / 144.5	**10.8%**	10/57 (**17.5%**)	13.4 / 139.8	**9.6%**	13/52 (**25.0%**)
Tracey's Wonderland	1.3 / 50.4	**2.6%**	2/17 (**11.8%**)	0.02 / 49.7	**0.04%**	1/15 (**6.7%**)	9.1 / 130.0	**7.0%**	11/42 (**26.2%**)
Cod Hole	2.9 / 140.9	**2.1%**	2/42 (**4.8%**)	5.8 / 191.6	**3.0%**	5/48 (**10.4%**)	7.6 / 191.5	**4.0%**	7/48 (**14.6%**)

3.3.5.2 Proportion of total encounter time to total effort time in open water

The total time spent by SWW-endorsed vessels in open water (either steaming, drifting or at anchor away from a Reef site) during daylight hours was compared with the corresponding whale encounter time. Overall a total of 1599.2 vessel hours were logged by all SWW-endorsed vessels in open water within the Cairns Planning Area of the GBRMP and 264.6 of these vessel hours were spent interacting with minke whales (interaction rate = 16.5). *NB. Vessel time in open water when transiting directly to or from Cairns/Port Douglas is excluded from these analyses.*

A comparison of the proportion of total encounter time to total effort time was made between Sectors in the Cairns Planning Area (as delineated in Figure 3.1; these Sectors were designated by the GBRMPA for management purposes). The latitudes indicating the northern and southern boundaries of these Reef Sectors were determined from spatial data provided by the GBRMPA. Vessel effort and whale encounters that occurred between latitudes $14^{o}25.00'$ S and $15^{o}42.45'$ S were aggregated within the Ribbon Reefs Sector; vessel effort and whale encounters that

occurred between 15°42.45' S and 16°22.00' S were aggregated within the Offshore Port Douglas Sector; and vessel effort and whale encounters that occurred between 16°22.00' S and 16°40.60' S were aggregated within the Offshore Cairns Sector. No vessel effort was logged in the South Offshore Cairns Sector (or in any other areas). The proportion of total encounter time to total effort time for the three Reef Sectors above is compared below (Table 3.15).

Table 3.15: Comparison of the proportion of total encounter time to total effort time for SWW-endorsed vessels in open water for three Reef Sectors, 2006-2008

	2006		2007		2008		OVERALL	
Reef Sector	(a) whale encounter time / (b) area effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)
Ribbon Reefs Sector	106.2 / 480.8	**22.1%**	38.3 / 392.5	**9.8%**	108.9 / 536.3	**20.3%**	253.4 / 1409.5	**18.0%**
Offshore Port Douglas Sector	2.7 / 24.8	**10.9%**	7.1 / 34.6	**20.5%**	1.4 / 125.1	**1.1%**	11.2 / 184.5	**6.1%**
Offshore Cairns Sector	0 / 0.8	**0%**	*No effort data available*	**-**	0 / 4.4	**0%**	0 / 5.2	**0%**
TOTAL (all Reef Sectors)	108.9 / 506.4	**21.5%**	45.4 / 427.1	**10.6%**	110.3 / 665.8	**16.6%**	264.6 / 1599.2	**16.5%**

From the above Table (3.15) it is apparent that the proportion of total encounter time to total effort time varies considerably between the Sectors and between years, however it is important to note that the vast majority of logged vessel effort (88.1%; 1409.5/1599.2 vessel hours) was in the Ribbon Reefs Sector, limiting the ability to make meaningful comparisons between the Sectors. It is also important to note that the sizes (area in km^2) of each Sector above are unequal and these calculations were not been standardised for area.

All of the effort logged in the Ribbon Reefs Sector was by SWW-endorsed live-aboard vessels only. For the three SWW-endorsed day-boats, 100% of their time at sea was spent in the Offshore Port Douglas Sector, however their logging of effort was very low, particularly in 2006 and 2007 (as shown in Appendix 7). However, these vessels' 'search effort' in open water in this Reef Sector is likely to be consistent from day-to-day due to their standardised itineraries.

As very little effort was logged in the Offshore Cairns Sector (totalling 5.2 vessel hours; logged by one SWW-endorsed live-aboard vessel only), valid comparisons of the proportion of total encounter time to total effort time for this Sector cannot be made with the available data.

Comparing proportions of encounter time to effort time in open water between vessels

As described in the Methods (Section 3.2.2), researchers were present on the vessel *Undersea Explorer* for seven weeks each minke whale season and conducted a continuous dedicated surface watch during daylight hours for every day at sea. It is expected that the occurrence of this surface watch, combined with the increased 'dedication' of this operation's itinerary to locate and interact with minke whales would result in a higher proportion of total encounter time to total effort time for *Undersea Explorer* in open water than for other vessels. A comparison was therefore made between the logged vessel effort and whale encounter time by *Undersea Explorer* and other SWW-endorsed live-aboard vessels (combined) in open water in the Ribbon Reefs Sector (Table 3.16).

Table 3.16: Comparison of the proportion of total encounter time to total effort time between *Undersea Explorer* and other SWW-endorsed live-aboard vessels in open water in the Ribbon Reefs Sector, 2006-2008

	2006		2007		2008		OVERALL	
Vessel(s)	(a) whale encounter time / (b) area effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) whale encounter time / (b) site effort (hrs)	Encounter time/effort time (a/b; expressed as %)
Undersea Explorer	82.7 / 169.3	**48.8%**	37.5 / 133.9	**28.0%**	60.5 / 187.3	**32.3%**	180.7 / 490.5	**36.8%**
Remaining SWW-endorsed live-aboards	23.6 / 311.4	**7.6%**	0.8 / 258.5	**0.3%**	48.4 / 349.1	**13.9%**	72.7 / 919.0	**7.9%**

From the results above (Table 3.16) it is clear that the majority of minke whale encounter time in open water (in the Ribbon Reefs Sector) is attributable to *Undersea Explorer*, which accounted for 71.3% (180.7/253.4 hours) of the total whale encounter time in this area. A higher overall proportion or encounter time to effort time for *Undersea Explorer* in open water is also apparent. Whilst vessels are moored

at Reef sites it is considered unlikely that the presence of a dedicated whale observer/lookout would influence the total encounter time for the vessel at that site (however a whale might be detected sooner when it approaches the vessel) and hence the proportion (%) of total encounter time to total effort time. To test this hypothesis, a comparison of these proportions was made between *Undersea Explorer* and the remaining SWW-endorsed live-aboard vessels for six Reef sites with the highest number of site visits (Challenger Bay, Cod Hole, Lighthouse Bommie, Steve's Bommie, Pixie Pinnacle and Tracey's Wonderland; Table 3.17).

Table 3.17: Comparison of proportions of total encounter time to total effort time between *Undersea Explorer* and other SWW-endorsed live-aboard vessels for the six most frequently visited sites in the Ribbon Reefs (2006-2008; n=679 site visits)

	Undersea Explorer		**Remaining SWW-endorsed live-aboard vessels**	
	(a) Whale encounter time / (b) location effort (hrs)	Encounter time/effort time (a/b; expressed as %)	(a) Whale encounter time / (b) location effort (hrs)	Encounter time/effort time (a/b; expressed as %)
Lighthouse Bommie	130.6 / 222.4	**58.7%**	240.7 / 383.3	**62.6%**
Challenger Bay	5.9 / 80.2	**7.4%**	28.4 / 285.9	**9.9%**
Pixie Pinnacle	3.7 / 35.2	**10.5%**	13.0 / 175.6	**7.4%**
Steve's Bommie	15.2 / 85.8	**17.7%**	84.0 / 352.2	**23.8%**
Tracey's Wonderland	3.8 / 95.5	**4.0%**	6.6 / 134.7	**4.9%**
Cod Hole	10.0 / 95.5	**10.5%**	6.4 / 427.4	**1.5%**

The results above (Table 3.17) show only slight variations between the proportions for *Undersea Explorer* (*UE*) and other operators and support the above hypothesis. The greater variation between *UE* and other vessels at the Cod Hole can largely be attributed to a single encounter reported in 2008 by *UE* that lasted 6.1 hours (the longest encounter reported at this site over the three seasons).

3.3.5.3 Comparison of the probability of encountering minke whales per day on SWW-endorsed day-boats and live-aboard vessels

Minke whale encounters involving SWW-endorsed day vessels were reported on 69 separate vessel days over the three core minke whale seasons (June-July only; 31 in 2006, 16 in 2007 and 22 in 2008). As reported in Table 3.7, the three SWW-endorsed day-boats operated regular itineraries in the Offshore Port Douglas Sector for 538 vessel days over these three seasons, thus minke whales were encountered on 12.8% (69/538 vessel days) of day trips by these vessels over this period. In-water interactions with minke whales for the SWW-endorsed day-boats occurred on 30 of the abovementioned 69 days (i.e. on 5.6% of day trips; 30/538 vessel days).

For the SWW-endorsed live-aboards, minke whale encounters were reported on 352 separate vessel days over the sampling period (June-July only; 102 in 2006, 118 in 2007, and 132 in 2008), representing 57.4% (352/613; *NB. the vessel Floreat was excluded from this calculation due to insufficient data on its number of days at sea during the three minke whale seasons; as shown in Table 3.7*) of the total vessel days at sea for the SWW-endorsed live-aboard vessels over the sampling period. In-water interactions with whales for the live-aboards occurred on 290 vessel days during the sampling period, representing 47.3% (290/613) of total live-aboard vessel days at sea during this period.

For the dedicated minke whale research itineraries on *Undersea Explorer* (conducted for seven weeks over June-July each season, totalling 42 vessel days per year), minke whales were encountered on 86.5% (109/126) of the total vessel days at sea and in-water interactions occurred on 73.8% (93/126) of these days. The higher proportion of total encounter time to total effort time for these trips (with active searches for minke whales in open water) on *UE* influenced the above aggregate figures for the SWW-endorsed live-aboards. For the remaining SWW-endorsed live-aboards and for *UE* trips that were not dedicated minke whale research itineraries, minke whales were encountered on 49.9% (243/487) of their total vessel days at sea, with in-water interactions occurring on 40.5% (197/487) of vessel days at sea during the sampling period.

3.4 Discussion

This study presents a detailed analysis of dwarf minke whale sightings in the GBRMP and compares these data with industry 'effort' by SWW-endorsed vessels for the first time. Key findings of this study include:

(1) An increase in the total number of encounters (by 26.8%) and total encounter time (by 16.4%) with dwarf minke whales over the three-year period (2006-2008).
(2) The identification of key Reef sites (n=40) at which the majority (70.3%) of dwarf minke whale encounters occur.
(3) Significant differences between key Reef sites in their mean encounter duration and mean number of whales encountered.
(4) Quantification of minke whale searching 'effort' by SWW-endorsed vessels within the GBRMP during the core June-July minke whale season.
(5) Significant differences between key Reef sites for the effort (i.e. visiting duration) invested by SWW-endorsed vessels.
(6) The identification of minke whale encounter 'hotspots' (e.g. Lighthouse Bommie) at which encounters are most predictable, determined by the calculation of encounter rates and the proportion of total encounter time to total effort time at Reef sites used by the SWW-endorsed vessels.
(7) An assessment of the probability of encountering dwarf minke whales on SWW-endorsed day-boats vs. live-aboard vessels.

Some implications of these findings are explored in detail below.

3.4.1 Increasing encounters over the study period

The results above present only three years of data, however longer term analyses, drawing on Whale Sighting Sheet data reported by Birtles et al., (2010) from the previous three years (2003-2005) show a clear trend of increasing number of encounters per year and total encounter time (see below, Figure 3.7)

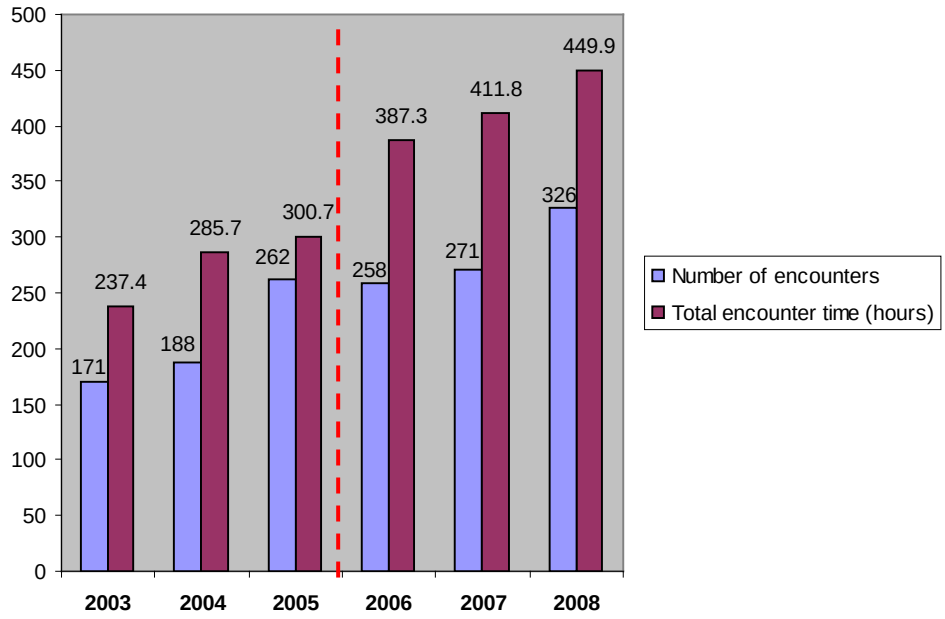


Figure 3.7 **Number of dwarf minke whale encounters and total encounter time per year, 2003-2008** (n= 1476; 2003-2005 figures sourced from Birtles et al., 2010)

As shown above (Figure 3.7) for the six-year period, the number of reported encounters with minke whales per year increased by 90.6% (from 171 encounters in 2003 to 326 in 2008) and the total annual encounter time increased by 89.5% (from 237.4 hours in 2003 to 449.9 hours in 2008).

What is the explanation for this trend? While no estimates are currently available of the population size for these dwarf minke whales, an increase of this magnitude in their population over this period seems unlikely. An increase in the number of vessels can also be excluded; with the exception of one new SWW operator in 2008, the vast majority of minke whale encounters have been reported by the same SWW-endorsed operators for the entire period, with very few WSS submitted by non-SWW-endorsed vessels (as shown in Figure 3.3). Changes in the behaviour of interacting whales (i.e. resulting in more frequent and/or longer encounters with vessels and swimmers) over this period are also considered unlikely, however findings from the PhD study by Mangott (2010) suggest that desensitisation to human interactions may be occurring in individual whales that are encountered repeatedly, resulting in closer passes to swimmers. As reported above in Section 3.3.2, there was no significant difference in

the mean encounter duration between years (2006-08), thus the increase in the total encounter time can be explained by the proportionate increase in the total number of encounters. Therefore the most likely explanations for this trend include: (a) under-reporting of encounters by SWW-endorsed operators in earlier years, and/or (b) an increase in industry 'effort' at key sites or encounter 'hot spots' (e.g. Lighthouse Bommie) where minke whales are encountered most frequently.

No evidence of under-reporting of encounters

There is no evidence available to determine the occurrence of under-reporting of minke whale encounters by the SWW-endorsed operators. With fewer researchers/dedicated observers on-board the vessels in previous years, it is possible that a higher number of whales in the vicinity of the vessel went unnoticed (particularly when steaming in open water between Reef sites). The increase in researcher presence aboard vessels in 2008 (reported in Section 3.2.2 and shown in Appendix 7) may have resulted in more observations (and records) of whales that were farther away from the vessel and/or that appeared very briefly (which corresponds to the lower mean encounter duration in 2008, however this result was not significant; Section 3.3.2). As described in the methods (Section 3.2.2) when researchers were on-board vessels, they communicated details of their observations from all whale encounters to vessel crew (and assisted with completion of the WSS) and/or completed the WSS themselves, and no unreported encounters were detected. The absence of evidence for under-reporting however does not preclude this as a possible contributor to the above 'growth' trend.

Evidence of increasing vessel effort at minke whale encounter 'hot-spots'

An increase in industry effort, involving the same few SWW-endorsed live-aboard vessels visiting known minke whale 'hot spots' more frequently and spending more time at these sites per visit appears to be the most likely explanation for the above trend. Vessels spent more time at Lighthouse Bommie and Steve's Bommie per visit than at other Reef sites (Table 3.10; Figure 3.6) and the mean visit duration for both of these sites increased over the study period (although this finding was not statistically significant, improved and/or longer-term effort sampling may reveal such significance). While industry effort data pre-dating the 2006 season were not available for this study, a comparison of encounter statistics for these two key Reef

sites (which together accounted for >28% of all encounters in the GBR over 2006-08; Table 3.4) over the six-year period 2003-2008 shows a similar trend of increasing encounters and total encounter time for both sites (Figures 3.8 and 3.9 below), which supports this explanation for the observed trend.

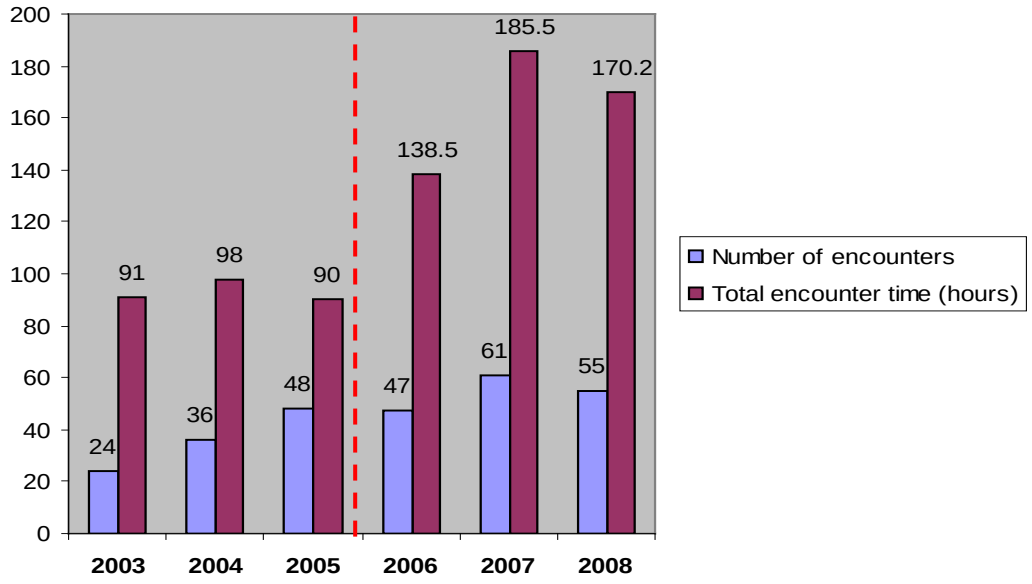


Figure 3.8: **Comparison of annual minke whale encounter summary statistics at Lighthouse Bommie, 2003-2008** (n= 271; *İncludes an unknown number of re-sightings of individual whales; 2003-2005 figures sourced from Birtles et al., 2010)

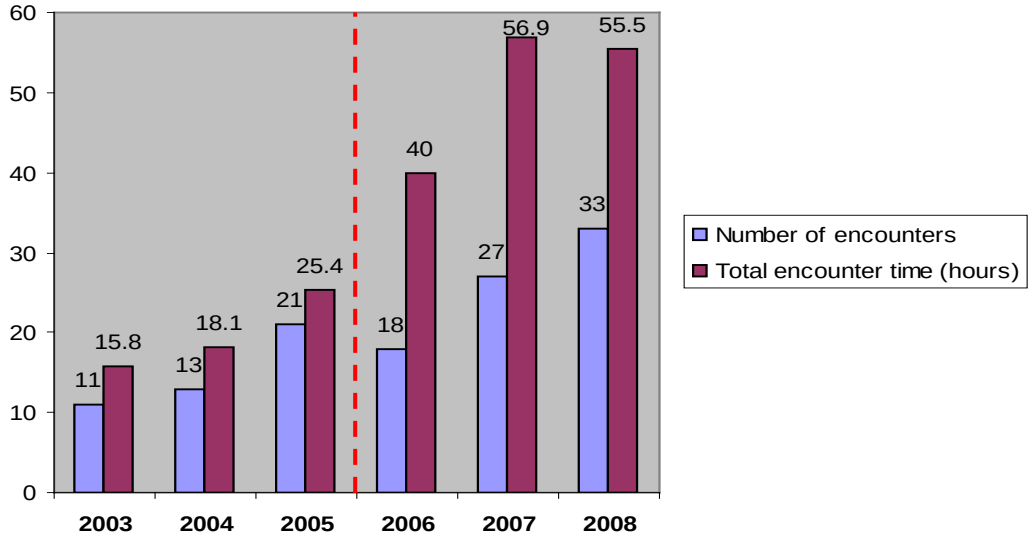


Figure 3.9: **Comparison of annual minke whale encounter summary statistics at Steve's Bommie, 2003-2008** (n= 123; *İncludes an unknown number of re-sightings of individual whales; 2003-2005 figures sourced from Birtles et al., 2010)

The mooring roster for Lighthouse Bommie (a copy of which was kindly provided by a representative of the Cod Hole and Ribbon Reefs Operators' Association's executive committee) shows that the site was booked at 100% capacity (in ½ day bookings for seven days per week) during the months of June & July continuously from 2003 through 2008 (*NB. the mooring was first installed at this site in 2002*). This roster however does not completely reflect actual use of the site as some bookings were made and then not utilised (C. Stephen, pers. comm.). It is therefore probable that the frequency of vessel visits (and the uptake of these bookings) increased over the six-year period proportionately to the encounter statistics for this site.

In 2007 and 2008 two 'new' Reef sites in close proximity to Lighthouse Bommie appeared in the vessel effort data ('Two Towers' and 'Acropolis'; as shown in Plate 4), for which no vessel visits were logged and at which no whale encounters were reported in previous years (Table 3.8). Anecdotal reports from several industry representatives suggest that these sites were very rarely visited (or were never visited by some operators) in previous years. While the number of vessel visits to these sites is relatively low when compared to other key live-aboard sites (Table 3.8), the mean visit duration to Two Towers in particular is among the highest (Table 3.10) and its proportion of total encounter time to total effort time (%) is comparable to that for Lighthouse Bommie (Table 3.13). The recent use of Two Towers and nearby Acropolis by the SWW-endorsed live-aboard operators as alternatives to Lighthouse Bommie appears to represent a growing awareness of a higher predictability of minke whale encounters in this region near Ribbon Reef #10 (Plate 4). Higher occupation of Lighthouse Bommie is also likely to have increased the use of nearby sites.

3.4.2 Latent capacity in the current SWW industry

SWW-endorsements and the Marine Parks Permits to which they are attached are fully transferable. An operator is even able to move their permit between multiple vessels within a season. From the results above it is clear that the effort by SWW-endorsed live-aboards is concentrated on 'hot-spot' Reef sites such as Lighthouse Bommie (and in recent years nearby sites such as Two Towers). With the exception

of *Undersea Explorer*, active searches for minke whales in open water by these vessels are rare. Such open-water searches by *UE* in the Ribbon Reefs Sector have been shown to be more successful for encountering whales (Table 3.16) than for effort invested by vessels at most Reef sites.

If any of the current SWW-endorsed operators change their itineraries to increase their focus on encountering minke whales, it is possible that any increased search effort in open water on their part will result in more encounters and an increased total encounter time overall. Weather conditions during the minke whale season however are typically windy (often >20 knots), and the rougher seas in open water areas (and associated seasickness experienced by many tourists in such conditions) provide a minor deterrent to such efforts (i.e. increasing the potential for seasickness among passengers). Nonetheless, *UE* conducted many drifting encounters in such conditions and other vessels could too if they (and their passengers) were sufficiently motivated.

The three SWW-endorsements held by day-boat operators represent a substantial latent capacity in the industry. While the low data returns of effort by these vessels for 2006 and 2007 limits the ability to draw conclusions about encounter rates and the proportions of total encounter time to total effort time for their Reef sites in the Offshore Port Douglas Sector, their very consistent and time-restricted itineraries (as well as a high proportion of inexperienced snorkellers; Mangott, 2004) clearly inhibit their ability to search for whales as well as their available time to interact with whales once encountered. This is evident in their low mean encounter duration when compared to the live-aboard vessels (Table 3.6). If any of these day-boat operators sold or transferred their Marine Parks Permit or SWW-endorsement to a live-aboard vessel (as one did in 2003; Section 3.1.2), it is considered likely that this would contribute to more minke whale encounters and an overall increase in the total encounter time in the GBR.

3.4.3 Implications of low encounter probabilities for SWW-endorsed day-boats

A previous study into the management of minke whale encounters by the SWW-endorsed day-boats (Mangott, 2004), identified challenges in preparing day-boat passengers for SWW interactions due to a relatively low probability of encountering whales (a 20% chance per trip), the large number of passengers, limited time available for many required briefings (e.g. on vessel safety, snorkelling, diving, marine life) and the relatively low in-water experience of passengers. The results above (Section 3.3.5.3) confirm Mangott's finding on such low encounter probabilities (with encounters occurring on 12.8% of day trips over the 2006-2008 minke seasons) and reveal an even lower chance of an in-water interaction occurring per trip (5.6%). While very few WSS were received from non-SWW-endorsed day vessels (or live-aboards) in the Offshore Port Douglas Sector over the study period, several such vessels operate in the same areas and even share some of the same sites. These vessels are under no obligation to submit a WSS for their minke whale encounters, however could reasonably be expected to encounter minke whales with the same probability as for the SWW-endorsed day-boats. The extent of minke whale encounters by non-SWW-endorsed vessels in other areas (e.g. the Offshore Cairns Sector) are undocumented, however anecdotal reports from industry personnel and occasional trip reports on operators' websites suggest they do occur each season.

3.4.4 Value and reliability of whale sightings and effort data for monitoring the SWW activity

Biases and reliability of WSS and vessel effort data

Several recent studies have established that sightings data collected opportunistically from whale watching vessels (i.e. 'platforms of opportunity') can provide very useful information on broad-scale patterns of whale distribution at a low cost, provided all potential biases are taken into account (Hauser et al., 2006; Kiszka et al., 2007). Such biases can include (but are not limited to) incorrect species identification by observers, spatial and temporal patterns of search effort, inter-observer variation (influenced by training and experience), the number of observers, sea state conditions and aspects of the platform(s) used (Evans & Hammond, 2004; Hauser et al., 2006).

Biases in the spatial distribution of effort by SWW-endorsed vessels in this study must be acknowledged. This effort within the Cairns Planning Area is limited to a number of Reef sites and the often narrow paths or routes traversed through the open water between them. These Reef sites are used by the tour operators preferentially, based on the presence of moorings or safe anchorage, shelter from the prevailing winds and sea swell, safety from strong currents, as well as the coral formations, species composition and aesthetic appeal to diving/snorkelling tourists and the site's proximity or convenience in relation to other preferred Reef sites along an established route (Miller, 2005). The recent increase in the use of minke whale encounter 'hotspots' such as Lighthouse Bommie and Two Towers appears to reflect a growing preference among these operators to increase their minke whale interaction opportunities.

Key Reef sites as fixed monitoring stations

Due to the SWW-endorsed operators' limited spatial effort and sampling biases, they cannot provide sufficient data to assess patterns of dwarf minke whale distribution and abundance within the GBR. The whale sightings data collected by the SWW-endorsed vessels however are very useful for understanding the nature and extent of the interactions between the whales and vessels/swimmers, and with quantification of vessels' effort, they can now allow comparisons of the relative distribution and abundance of dwarf minke whales between high-use Reef sites. These Reef sites represent 'fixed stations' for monitoring the presence/absence of interacting whales. While fixed stations provide only limited coverage of the immediate vicinity, the ease with which effort and sightings data can be collected (i.e. log sheets completed by vessel crew) and standardised is advantageous for sustained monitoring at a low cost (Evans & Hammond, 2004).

Standardisation of observer searching effort

While it was beyond the scope of this study to conduct a detailed analysis of the searching effort by observers on vessels, the presence of dedicated observers conducting an active search (i.e. on *Undersea Explorer*) is shown to be associated with a higher proportion of total encounter time to total effort time when the vessel is in open water (Table 3.16), but appears to have no influence on this proportion when vessels are moored or anchored at Reef sites (Table 3.17). The standardisation of

vessel effort at these Reef sites as simple presence/absence data (without quantifying observer searching effort) for use in comparisons of encounter rates and proportions of total encounter time to total effort time therefore appears to be valid and valuable for ongoing monitoring. The above finding, combined with the finding that 76.7% of all encounters were initiated when the vessel was not moving under power (Section 3.3.2), supports the hypothesis that dwarf minke whales are attracted to vessels and actively seek out these encounters themselves. The recent study by Mangott (2010) suggests that dwarf minke whales show 'exceptional exploratory' behaviour when in the GBR. The occurrence of such boat-seeking behaviour introduces another bias that will need to be addressed in future studies that explore finer scale patterns of distribution and abundance. The stimulus that potentially attracts the whales (probably the vessels' acoustic signature) and the extent or ranges to which this stimulus affects the whales' behaviour are key questions requiring further research.

Addressing gaps in effort data

It is likely that improved sampling of effort data (particularly among the SWW-endorsed day-boats) will have a large influence on the encounter rates and the proportion of total encounter time to total effort time for a number of Reef sites at which low samples (i.e. number of visits) were achieved. Encounters clearly did occur at these sites during the study period (Table 3.4) when no effort data was logged. For future monitoring of SWW industry effort, alternative data collection methods (e.g. automated loggers) should be explored with the industry, however the cost of such methods will require appraisal. To achieve a higher consistency of effort monitoring data collection using the Vessel Movement Logs (VML) or similar instrument, the busyness of vessel crew (who must attend to a multitude of tasks that take precedence; e.g. vessel and passenger safety and wellbeing) must be taken into consideration. In this study however, vessel crew showed a high willingness to assist with data collection. By directly engaging with industry personnel and by providing interpretation materials this study was successful in achieving sufficiently robust samples for the above analyses of vessel effort. The completion and submission of VML by crew was entirely voluntary (while completion of the WSS was obligatory). If obligatory vessel effort data collection were implemented as a new SWW permit condition (following consultation and agreement among industry stakeholders), a reduced focus to a limited number of key Reef sites at which such data are recorded

may be sufficient for monitoring potential trends in encounter rates and proportions of total encounter time to total effort time whilst minimising the additional burden placed on crew. Automated logging devices however represent the most reliable means of collecting such monitoring data.

Biological significance of 'hotspot' Reef sites

This study has revealed a number of key Reef sites that are used frequently by SWW-endorsed operators with varying rates of success for encountering minke whales that remained relatively consistent over the three seasons during the sampling period (Table 3.14). Interestingly, the sites with the highest proportions of total encounter time to total effort time (e.g. >20%; *NB. excluding the site 'Apostles' for which the sample size is insufficient to enable meaningful comparisons;* Table 3.13) are isolated coral pinnacles (including Lighthouse Bommie, Two Towers, Andy's Postcard and Steve's Bommie) and small patch reefs (Acropolis and Snake Pit), surrounded by deeper water (see Plates 4 & 5). This finding may be indicative of the whales' preference for wider options to escape should they need to flee the area (e.g. in the presence of predators). Reef walls are a characteristic of most other dive sites used by the operators and may present an obstacle against which a whale might be herded (e.g. by orcas). It is possible that whales may aggregate around coral pinnacles such as Lighthouse Bommie, however as the vessels themselves are considered to be responsible for attracting whales into aggregations (Mangott, 2010), further studies addressing this bias (e.g. aerial surveys) will be required to shed light on dwarf minke whales' habitat preferences (as well as their distribution and abundance) in the GBR.

Potential implications of any observed changes/trends in whale encounters vs. effort

If trends of increasing or decreasing encounter rates or proportions of total encounter time to total effort time are detected at key Reef sites, this cannot be assumed to indicate changes in the whales' relative distribution or abundance. Such trends may also indicate increasing desensitisation to vessels (e.g. if encounter rates/proportions increase) or avoidance of vessels (if encounter rates/proportions decrease). Overall however, when combined with general encounter statistics and patterns of effort, these measures are useful tools for monitoring potential changes that may be associated with the SWW activity. The increasing focus of effort by live-aboard operators on minke whale encounter 'hot-spots' is in itself a concern that may be

contributing to increasing cumulative interaction times for individual whales. The longer-term impacts of repeated encounters for individual whales are still unknown, however desensitisation in the short term over repeated encounters within a single season have now been established (Mangott, 2010).

Chapter 4: Social values of dwarf minke whales and the swimming-with-whales experience

4.1 Introduction

Developing our understanding of the social, ecological and economic values of a natural resource or social-ecological system is an important precursor to its sustainable use and development. Defining such values from the perspective of all stakeholders provides a basis for determining limits of development (e.g. in setting Limits of Acceptable Change; Cole & Stankey, 1997) to uphold these values.

In recent decades there has been a substantial growth of research dedicated to the assessment of market and non-market economic values of natural capital and ecosystem services. In their review of this expanding literature, Balmford et al. (2002) highlight that such studies are greatly enhancing our understanding of the value of ecosystems, biodiversity and individual species in economic terms and are contributing increasingly to cost-benefit appraisals affecting their management and protection. Non-economic societal values of natural capital however are more elusive and less tangible than economic values, however they should be considered no less important in a Triple-Bottom-Line (or Quadruple-Bottom-Line) sustainability assessment framework.

Humans benefit physiologically and psychologically from interactions with nature and wildlife (Walsh, Loomis & Gillman, 1984) and attribute a range of values to environs and species (Curtin, 2005). A person need not see nor interact directly with a place of wilderness or wildlife species to attribute such values; the knowledge that it is conserved (existence value), that it can be seen/utilised at some point in the future (option value) and/or will be available to future generations (bequest value) can still resonate emotionally (Walsh et al., 1984).

In wildlife tourism, conducting research to understand the tourists' perceptions and values of the wildlife and their wildlife experiences has been recognised as a critical step towards the sustainable management of human-wildlife interactions (Orams,

1996; Birtles et al., 2001; Wilson & Tisdell, 2001). In a review of wildlife tourism experience studies, Curtin (2005) found that until recently most of this research has focussed upon motivational aspects associated with the experience, based on the expectations/goals of the participants and their post-experience assessment/judgement of the experience. Problems associated with this approach include first-time users often having vague or non-existent expectations of the experience, and that unexpected experiences are often the most satisfying and memorable (Curtin, 2005; Patterson, Watson, Williams & Roggenbuck, 1998). Curtin (2005) argues that such motivational approaches to researching wildlife tourism experiences fail to explore the ways in which people perceive wildlife and their emotional responses to the experience.

Several recent wildlife tourism studies have adopted an interpretivist approach to characterising the nature of the human-wildlife interaction. For example, Dobson (2007) adopted a phenomenological, interpretivist approach to investigate key experiential aspects of shark diving tourism and described the participants' perceptions and values of sharks that emerged through the experience. Similarly, Curtin (2006) provided an in-depth analysis and comparison of tourists' experiences swimming with wild and captive dolphins. The interpretivist approach is an established methodology in studies of tourist experiences. Interpretivist research explores the constituent elements and possible meanings of experienced phenomena and deals explicitly with human subjectivity in determining these meanings (Moustakas, 1994; Strauss & Corbin, 1998; Tribe, 2001).

Previous research into aspects of the swimming-with-dwarf minke whales experience (e.g. by Birtles et al., 2002b; Valentine et al., 2004), has been largely quantitative and has not yet explored the full range of values attributed to dwarf minke whales and the swimming-with-whales (SWW) activity. Valentine et al. (2004) reported high levels of satisfaction among SWW participants on live-aboard vessels and identified important aspects of the experience that are correlated with visitor satisfaction (e.g. the number of whales seen, their proximity to swimmers and total time spent interacting). As reported in Chapter 3, in recent years there has been substantial growth in the effort by SWW-endorsed live-aboard operators that have increasingly focussed their itineraries on conducting in-water interactions with dwarf minke

whales. This growth, and the inclusion of three day-boats as SWW-endorsed operators within this industry raises new questions about the evolving nature of the industry and the SWW experience for tourists. A study of the management of minke whale encounters by the SWW-endorsed day-boats by Mangott (2004) revealed a much lower probability of minke whale encounters aboard one of these Reef day trips and several management challenges (e.g. substantially higher passenger numbers, a larger proportion of non-divers and inexperienced snorkelers, limited time available for briefings).

Key questions that were investigated in Study Two therefore included:

(a) Who are the swimming-with-whales (SWW) participants?
(b) What are the SWW participants experiencing?
(c) What are the constituent elements that characterise the GBR swimming-with-dwarf minke whales experience?
(d) What are the similarities and differences in the SWW experience between live-aboard and day-boat SWW participants?

The range of social values of dwarf minke whales and the values and benefits associated with the SWW activity were also investigated, among (a) the tourists and (b) key stakeholders of the GBR SWW activity, including tourism operators, Reef managers and representatives of wildlife conservation NGOs.

4.1.1 Study Two objectives

The objectives of this study were:

1. To evaluate and describe the elements that contribute to the GBR swimming-with-dwarf minke whales experience.
2. To identify similarities and differences in the 'minke whale experience' between tourists on live-aboard Reef trips and those on day trips to the GBR.
3. To identify the range of social values of dwarf minke whales and the SWW experience, among the SWW participants and key stakeholders of the industry.

A combined quantitative and qualitative, interpretivist approach is used to address these objectives and answer the above key questions.

4.2 Methods

To address the research objectives of the study, two data collection instruments were used: (1) self-administered questionnaires for swimming-with-whales participants (tourists) to complete at or near the end of their Reef trip, and (2) a semi-structured interview of Key Informant Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry, administered by the principal researcher.

4.2.1 Passenger questionnaires

Sample overview

Sampling of self-administered passenger questionnaires was conducted over three minke whale seasons (between May and August, 2006-2008) in the Great Barrier Reef, on board five live-aboard dive vessels and three Reef day-trip vessels (hereafter referred to as 'live-aboard vessels' and 'day-boats') that held GBRMPA tourism permits with an endorsement to conduct swimming-with-dwarf minke whales activities. The remaining single SWW-endorsed operator (of the nine total such endorsements that were issued by the GBRMPA) did not operate during the period of this study. Four of the five participating live-aboard vessels were based in Cairns, with one participating live-aboard based in Port Douglas, and all three participating day-boats were based in Port Douglas (see Chapter 3 for detailed descriptions of these operations).

Confidentiality agreement and data retention

In accordance with James Cook University Human Ethics Policy, respondents' participation in this survey was entirely voluntary and their anonymity assured. A confidentiality statement outlining these terms was provided inside the cover page of each questionnaire, as well as the estimated time required to complete the survey (Appendix 11).

An additional confidentiality agreement was made with the tourism operators participating in the study, outlining that all results of the survey would be de-identified and that no named operator or vessel would be associated with any specific

findings. This agreement was also printed on the inside cover page of each questionnaire. In the results that follow, several comparisons are made between live-aboard vessels and day-boats. The results presented that compare these distinct groups (n=5 and n=3 respectively) are consistent with the confidentiality agreement. Where specific comparisons are made between individual vessels (e.g. for sample size and response rate comparisons), the vessel names are removed and replaced with lettering (vessel A, B, C, etc.) to hide each operator's identity.

All original questionnaires have been stored in accordance with University Policy for data retention (i.e. archived in secure filing cabinets for a minimum period of three years after completion of the study). Original electronic databases are stored and backed up on the PhD researcher's password-protected computer and on physically secured hard drives, accessible only to the PhD researcher and his two supervisors.

Questionnaire design

The questionnaire was based on a previous survey instrument developed by Birtles et al. (2002) administered to swimming-with-dwarf minke whales participants from 1999-2001 (6pp in length; with key findings reported in Valentine et al., 2004). In 2002, the survey was modified and reduced to two pages (21 questions total), retaining key questions that were deemed to be important to the ongoing monitoring of the management of SWW interactions. This survey was collected from passengers on live-aboard vessels each minke whale season from 2002-2005, and for the latter two seasons a slightly modified version was collected on the three SWW-endorsed day-boats (day-boat results reported in Mangott, 2004 and Mangott, 2005).

In 2006 (at the commencement of sampling for this study) the questionnaire was modified to address the new research objectives, with several new questions added (resulting in 32 questions in total over two pages) and a number of questions retained from the previous version that remained relevant to the study. Content of the questionnaire included: (Q.1-9) demographic details including previous visitation to the GBR and scuba diving qualifications and experience; (Q.10) details about where respondents had first heard about dwarf minke whales in the GBR; (Q.11-12) previous SWW and whale watching experience; (Q.13-15) reasons for visiting the Far North Queensland region, for taking their trip to the GBR and for their choice of

vessel; (Q.16-21) specific details about their encounters with dwarf minke whales on their trip and their contributions to research data collection (e.g. by donating copies of underwater photos to the photo-ID study); (Q.22-23) expectations of and satisfaction with their minke whale experience; (Q.24-27) perceptions of the management of their minke whale encounter(s), their preparedness, any negative impacts on their minke whale experience and concerns for the sustainability of this kind of whale watching; (Q.28-31) details and impressions of interpretive material received; and (Q. 32) general comments about the survey (Appendix 11).

There were a few minor differences in the day-boat version of the questionnaire to better suit the itinerary and activities available on these trips, including their lower likelihood of an in-water interaction with dwarf minke whales. Day-boat passengers were asked some different questions, for example about (Q. 8) their in-water activities on their day-trip and (Q.9) a self-assessment of their snorkelling skills, instead of providing details about previous SWW experiences (Appendix 12).

In 2007 and 2008 minor adjustments were made to some of the survey questions in response to preliminary findings and to accommodate potential new sustainability indicators that were derived from Study Four (reported in Chapter 6). In addition, a further two pages of questions were added to the survey instrument (see Appendices 13 & 14) to address the research objectives of a separate but complementary study (Stoeckl et al., 2010a; 2010b). As reported below in the results, the increased questionnaire length in 2007 and 2008 were found not to have had any adverse effects on the response rate for this survey.

Japanese translation

Previous studies of scuba divers participating in live-aboard dive trips from Cairns showed a relatively high proportion of Japanese respondents, ranging between 8% and 16% (Valentine et al., 2004; Birtles et al., 2002b; Curnock, 1998). In order to ensure that Japanese SWW participants were represented accurately in the sample and that they were able to understand and respond to the survey questions appropriately, a Japanese translated version of the questionnaire was developed and made available on the vessels.

The questionnaire was translated with the assistance of a two fluent bi-lingual assistants, following translation and back-translation guidelines recommended by Baldauf and Jernudd (1986). A Japanese translated version of the 2006 live-aboard questionnaire is provided in Appendix 15. As shown in the results below, the proportion of Japanese respondents for this survey was substantially lower than achieved in previous studies. In 2008, prior to the commencement of the minke whale season and final season of data collection, the primary researcher made enquiries with each SWW-endorsed operator and was advised that Japanese advance bookings were very low, reflecting the continuing decline in the Japanese scuba diver market in Cairns over recent years. A Japanese translated version of the questionnaire was therefore not provided for the 2008 season. Assistance with the translation of Japanese responses to open-ended questions in the survey was obtained from just one bi-lingual assistant; responses to such questions were typically very brief and their meaning sufficiently clear that a second translator was deemed unnecessary.

Sampling protocol

Questionnaires were distributed to passengers towards the end of their trip (either on the last evening of the trip or on their return journey to the marina/harbour) by vessel crew, or by a researcher or research volunteer when present on the vessel. Questionnaires were only distributed to passengers on trips on which dwarf minke whales had been encountered, including those on which passengers had experienced an in-water interaction, as well as trips on which passengers had only seen dwarf minke whales from the vessel. Due to the participating live-aboard tourism operators' previous experience with collecting surveys (e.g. for Valentine et al., 2004) the crew of these vessels were accustomed to distributing questionnaires to all passengers at the end of each trip, resulting in excellent response rates.

Questionnaire collection by crew on participating day-boats was less successful, despite the researcher visiting each operator early in each season to meet crew and improve awareness of the research. This was attributed to the generally busier itineraries of these vessels and limited time available for crew to distribute questionnaires to passengers on the return trip from the Reef to Port Douglas. To address this problem and improve the sample sizes for the day-boats, in 2008 a group of volunteers were recruited and participated in day-trips (provided free-of-charge as

an in-kind contribution from the operators) to distribute and collect questionnaires. This resulted in 19 trips (over the three SWW-endorsed day-boats) having a volunteer on-board to distribute and collect passenger questionnaires (6 trips on two of these vessels and 7 trips on the third). Questionnaires were collected on all of these trips, whether or not dwarf minke whales had been encountered, due to the sampling requirements of the complementary study (i.e. Stoeckl et al., 2010a; 2010b). Day-boat questionnaires from trips on which minke whales were not encountered have been included in some analyses below to compare the experience between these two groups.

Data entry

Completed questionnaires were grouped by vessel and in chronological order for each trip before being numbered sequentially, prior to data entry. Each questionnaire was inspected during this stage for completeness. Questionnaires that were not completed satisfactorily, with key demographic variables left blank and/or fewer than half of the questions answered, were removed from the dataset. All questionnaire data were entered manually, with the assistance of volunteers (trained and supervised directly by the principal researcher), into an SPSS Statistics Package (Version 17.0) database. Open-ended responses were typed into cells (as 'string' variables) along with all other closed-ended (i.e. numeric) variables in the SPSS database. The open-ended responses were subsequently exported into a Microsoft Excel spreadsheet for coding and analyses. Several reliability checks of numeric and text data were performed prior to any analyses. These included running frequency summaries of each variable to detect anomalous entries (e.g. for a 1-5 rating scale, the occurrence of any numbers outside this range), visual scanning of selected complete columns (variables; using the 'show value labels' function in SPSS) and complete rows (cases) during the data entry process, and comparing original hard copy questionnaires with their entered data.

Statistical analyses

Statistical tests for significant differences using numerical data included non-parametric Mann Whitney U tests and Spearman's Rank Correlations. Normality of each variable was checked using histograms, P-P plots and Levene's Test of Homogeneity of Variance. The tested variables presented in the results below were found to be highly skewed (e.g. respondents' satisfaction ratings) and did not fit the

assumptions of parametric mean comparison tests, even after logarithmic and square root transformations. Thus the abovementioned non-parametric tests were selected as the most appropriate for these analyses.

Coding and analyses of open-ended responses

Responses to open-ended questions in the passenger questionnaire were typically one or two brief sentences. As outlined in Chapter 2 (Section 2.2.2), a 'grounded' approach (Charmaz, 2003; Strauss & Corbin, 1998) to the coding of the responses was adopted to allow themes and elements to emerge from the raw data, rather than responses being sorted into pre-determined categories. The context of each question however provided important boundaries in the interpretation of any ambiguous responses. This resulted in a high diversity of themes and elements emerging through the coding of each question, however a number of common themes and elements became apparent among the responses to each question, and appeared frequently in the responses. Many coded elements were also 'nested' within a common broader theme. The following example response illustrates how responses were coded (coded elements of the statement are underlined), in relation to Question 20: "*How would you rate your overall satisfaction with your minke whale experience(s)? …Please explain why*":

- "*Saw a lot of whales, were very close, stayed with the boat a long time.*"

In the above response three elements of the minke whale experience were coded: (1) seeing lots of whales, (2) being very close to whales, and (3) the long duration of the encounter.

4.2.2 Stakeholder key informant survey

Semi-structured interviews were conducted in Cairns, Port Douglas and Townsville over mid-2007 with 16 highly experienced stakeholder key informants, including owners and/or managers of swim-with-minke whales tourism operations (nine people, representing seven of the nine SWW-endorsed operators), Commonwealth and State Government management agency staff that had direct involvement with the management of the SWW industry (two from the Great Barrier Reef Marine Park

Authority and one from the Queensland Environmental Protection Agency), a leading cetacean scientist from the Australian Marine Mammal Centre and senior representatives from international wildlife conservation NGOs (two from the Whale and Dolphin Conservation Society and one from the International Fund for Animal Welfare).

Questions asked of the key informant survey (KIS) respondents were designed to elicit the stakeholders' values of dwarf minke whales and the SWW experience, from a number of different perspectives. These included personal values, values and benefits to the business (among industry representatives), values and benefits associated with management of the SWW activity (in particular among Reef managers), values and benefits for research and for marine/species conservation (among managers, the cetacean scientist and the NGO representatives). A copy of the interview template is provided in Appendix 16.

In accordance with University Human Ethics Policy, respondents were advised at the beginning of each interview that all results of the study would be de-identified, preventing association of any statements with individual participants. A single-page flyer was distributed to each respondent, outlining the purpose of the interview, its estimated duration and confidentiality provisions prior to their interview (Appendix 17). Interviews were recorded onto a digital voice recorder for subsequent transcription and content analysis. Face-to-face interviews were conducted with 13 of the 16 participants, with the remaining three respondents interviewed over the telephone. Two people declined to participate, both indicating that they were not sufficiently comfortable to express their views which may have differed from other perspectives within their organisation. The duration of interviews varied considerably and was dependent upon respondents' available time, their enthusiasm for the topic and the level of detail they provided in answers to questions. The mean interview duration was 65 minutes (range 23-127 mins). Due to time limitations, some participants were not able to answer all questions. Details on the number of respondents that answered each question are stated in the results that follow.

Plate 8: Images of in-water interactions with dwarf minke whales in the Great Barrier Reef

Images: (a) Multiple whales in an in-water interaction at Lighthouse Bommie, (b) a very close approach made by a whale to a snorkeler on the rope, (c) A 'headrise' by a whale in close proximity to snorkelers, (d) in-water interaction involving snorkelers and scuba divers at the dive site 'Two Towers'.

4.3 Passenger questionnaire results

4.3.1 Sample size

Over three minke whale seasons (2006-2008) a total of 2,171 passenger questionnaires were collected from eight SWW-endorsed vessels. Of these, 1,592 (73%) were from live-aboard vessels conducting the majority of their operations in the Ribbon Reefs Sector of the GBRMP, and the remaining 579 (27%) were from day boats working solely in the Offshore Port Douglas Sector. Sample sizes from each vessel per year are shown below in Table 4.1.

Table 4.1 Passenger questionnaire sample sizes for eight SWW-endorsed vessels over 2006-2008 (n=2,171)

Vessel*	2006 (n)	2007 (n)	2008 (n)	Total (n)	% of total sample
SWW-endorsed live-aboard vessels					
A	203	230	103	536	24.7
B	107	153	143	403	18.6
C	126	135	114	375	17.3
D	107	57	70	234	10.8
E	18	15	11	44	2.0
Sub-total	***561***	***590***	***441***	***1592***	***73.3***
SWW-endorsed day-trip vessels					
F	4	7	192	203	9.4
G	0	41	148	189	8.7
H	53	7	127	187	8.6
Sub-total	***57***	***55***	***467***	***579***	***26.7***
Total	**618 (28%)**	**645 (30%)**	**908 (42%)**	**2,171**	**100**

** Results are de-identified in accordance with a confidentiality agreement with participating operators.*

4.3.2 Response rate

The overall response rate for the passenger questionnaire over the three year period (2006-2008) was 44.9% (n=2171/N=4832). The number of passengers on each sampled trip for live-aboard vessels A-D was provided by the respective operators for each year (2006-2008), allowing an exact response rate to be calculated for these four vessels (Table 4.2; *NB. the sampling protocol stipulated that all passengers on these*

trips were asked to complete a questionnaire towards the end their trip). Total passenger numbers could not be obtained for vessel E for all years, nor for the day-trip vessels F, G and H for 2006 and 2007, and thus a *minimum* response rate for trips by these vessels was calculated using the vessel's passenger capacity as the maximum number of passengers that could have participated in the sampled trips. The response rate varies considerably between vessels, in particular between the live-aboards (combined response rate = 64%) and day vessels (combined response rate = 25%). The higher numbers of passengers that are carried on the day trip vessels and the limited time available in their daily itineraries (in comparison to live-aboard vessels) are regarded as the greatest contributing factors to the lower survey responses achieved for these vessels.

A greater effort was made in 2008 to increase the sample size from day trip vessels. Five volunteers assisted the principal researcher with the distribution and collection of passenger questionnaires over a total of 19 trips aboard SWW-endorsed day vessels in 2008. On each trip that was sampled in 2008 the total number of passengers was also recorded to calculate an accurate response rate.

Table 4.2 Passenger questionnaire response rates for SWW-endorsed vessels, 2006-2008 (n=2,171)

Vessel		2006	2007	2008	Total trips and passengers per vessel (N)	Response rate per vessel (n/N)
SWW-endorsed live-aboard vessels						
A	*Number of trips sampled*	11	12	11	***34***	**60%** (536/887)
	Total passengers carried (N)	269	318	300	***887***	
B	*Number of trips sampled*	14	14	11	***39***	**49%** (403/815)
	Total passengers carried (N)	289	273	253	***815***	
C	*Number of trips sampled*	8	9	8	***25***	**90%** (375/415)
	Total passengers carried (N)	138	149	128	***415***	
D	*Number of trips sampled*	13	6	6	***25***	**71%** (234/330)
	Total passengers carried (N)	151	84	95	***330***	
E	*Number of trips sampled*	2	2	1	***5***	**80%** (44/55)
	Total passengers carried (N)	22*	22*	11	***55****	
SWW-endorsed day-trip vessels						
F	*Number of trips sampled*	2	1	6	***9***	**27%** (203/739)
	Total passengers carried (N)	184*	92*	463	***739****	
G	*Number of trips sampled*	0	3	7	***10***	**25%** (189/763)
	Total passengers carried (N)	0	270*	493	***763****	
H	*Number of trips sampled*	4	1	6	***11***	**23%** (187/828)
	Total passengers carried (N)	400*	100*	328	***828****	
Response rate per year (n/N)		**43%** (618/1453)	**49%** (645/1308)	**44%** (908/2071)	**158 trips** **N = 4832***	**Overall 44.9%** (2171/4832)

**Indicates maximum possible passengers carried, based on vessel capacity where actual numbers of passengers on these trips is unknown. Response rates based on these figures are thus minimum estimates.*

4.3.3 Sample description

For the total sample (n=2,171) the mean age of respondents was 35 (range 8 to 85). Fifty percent of the sample was female. Respondents came from 50 different countries, with the largest proportions originating from Australia (36.3%), the USA (23.4%), the UK (8.4%), Japan (4.7%) and Germany (4.3%). Respondents from other European countries made up a further 10.6% of the sample (see Figure 4.1).

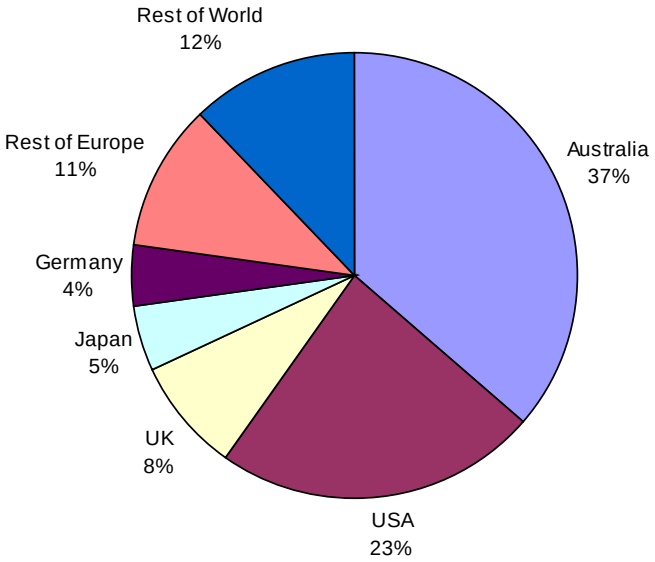


Figure 4.1: Country/region of origin of respondents (n=2,171)

Similarities and differences in demographic variables between live-aboard and day-boat respondents are shown below (Table 4.3).

Table 4.3: Demographic differences and similarities between the live-aboard and day-boat samples

	Live-aboard sample (n=1592)	Day boat sample (n=579)
Mean age	34.7	35.0
Age range	9 - 85	8 - 72
Proportion male	50.3%	49.1%
First visit to GBR	56.9%	61.4%
Respondent place of origin		
Australia	30.2%	53.0%
USA	27.1%	13.0%
UK	8.6%	7.8%
Japan	6.3%	0.3%
Germany	4.8%	2.6%
Rest of Europe	6.3%	0.3%
Rest of World	6.3%	12.5%

Experience of certified scuba divers

Respondents that were certified scuba divers were asked to provide details of their previous scuba diving experience including: (a) certification level, the year they began scuba diving and (c) the total number of dives they had performed in their lifetime. Responses revealed that most passengers on the live-aboards were certified scuba divers with an overall high level of previous diving experience. Most passengers on the day-boats however were not certified scuba divers (Table 4.4).

Table 4.4: Live-aboard and day-boat respondents' scuba diving experience

	Live-aboard sample n=1,592	**Day boat sample n=579**
Proportion of sample with scuba certification	91.2%	22.2%
• Open-water certification level (or equivalent)	29.8%	13.3%
• Advanced certification (or equivalent)	35.5%	6.0%
• Rescue diver certification (or equivalent)	10.0%	0.9%
• Dive Master certification (or equivalent)	6.5%	1.4%
• Instructor level certification	6.1%	0.3%
• Other scuba certification	3.3%	0.3%
Median total diving experience	5 years (range: <1 to 51 yrs)	3 years (range: <1 to 41 yrs)
Median total dives done in lifetime	54 (range: 1 – 24,000)	12 (range: 1 - 1000)

4.3.4 Travel motivations and the importance of seeing minke whales

The importance of 'seeing and/or swimming with dwarf minke whales' as an element of live-aboard respondents' motives for travelling was evaluated using three questions. The first asked respondents about the primary reason for their visit to Far North Queensland (*NB. the wording and style of this question was changed after 2006, from the closed-ended: "Was your visit to Far North Queensland primarily to see minke whales (Y/N)", to the open-ended format: "What was your primary reason for visiting the Cairns/Port Douglas region?" (for 2007 and 2008)*; see Appendix 11 and 13). Open-ended responses from 2007 and 2008 were coded categorically and included in an analysis of the three-year data set. The total proportion of respondents that indicated seeing minke whales as the primary reason for their visit to the region was 23.5% (374/1592). For respondents originating overseas, this proportion was

17.5% (186/1062) and for Australian respondents (excluding Queensland residents) the proportion was 41.8% (122/292). The total proportion varied between years (30.8% (173/561) in 2006; 16.8% (99/590) in 2007; 23.1% (102/441) in 2008) however no trend was evident.

Secondly, respondents were asked to indicate their 'primary reason for taking this dive trip to the Great Barrier Reef'. The style of this question also changed (multiple choice options were given in 2006) to an open-ended format in 2007 and 2008 (see Appendix 11 and 13). Open-ended responses were coded categorically and included in an analysis of the three-year data set. The total proportion of respondents that indicated seeing and/or swimming with minke whales as the primary reason for taking their dive trip was 36.6% (562/1537). Comparing this proportion between years showed an increase in 2008 (from 32.3% (170/527) in 2006 and 32.9% (193/586) in 2007, to 46.9% (199/424) in 2008). This result however may have been produced by a change in the relative sample sizes for different vessels in this year (i.e. possibly an artefact of the smaller sample from Vessel A in 2008; see Table 4.1 above).

The third question in this series was asked in both the live-aboard and day boat questionnaires in the same format for the three-year period (2006-2008; n=2171): "*What are the most important reasons you chose this particular vessel for your dive trip?*" Space was provided for respondents to list their reasons in an open-ended format. The total proportion of respondents that indicated the opportunity to see/swim with minke whales on their vessel was 15.1% (296/1961) and this was the second most frequently mentioned reason overall (mentioned more frequently than even the cost of the trip). This proportion differed between the day boat and live-aboard samples (7.5% and 18% respectively; see Table 4.5 below for a summary of all responses).

Table 4.5: Summary of respondents' reasons for their choice of vessel for their Reef trip (ranked in descending order for the total sample; n=1961; *question left blank in 210 cases*)

Reason for choosing this particular vessel	Day boat total (n=535) and proportion of respondents (%)	Live-aboard total (n=1426) & proportion of respondents (%)	Overall total (n=1961) and proportion of respondents (%)
Recommendation/reputation of vessel	**183** (34.2%)	**434** (30.4%)	**617** (31.5%)
Opportunity to see/swim with minke whales	**40** (7.5%)	**256** (18.0%)	**296** (15.1%)
Cost/price of trip	**48** (9.0%)	**123** (8.6%)	**171** (8.7%)
Group booking/travel with family/friends	**13** (2.4%)	**128** (9.0%)	**141** (7.2%)
Vessel size/smaller number of people	**80** (15.0%)	**40** (2.8%)	**120** (6.1%)
Modern vessel/new facilities/comfort/luxury	**41** (7.7%)	**75** (5.3%)	**116** (5.9%)
Previous trip/experience with this vessel	**11** (2.1%)	**79** (5.5%)	**90** (4.6%)
Convenient/compatible itinerary	**2** (0.4%)	**59** (4.1%)	**61** (3.1%)
Particular locations visited by the vessel	**10** (1.9%)	**44** (3.1%)	**54** (2.8%)
Education/learning/interpretation aspects	**9** (1.7%)	**30** (2.1%)	**39** (1.9%)
Availability (e.g. late booking)	**9** (1.7%)	**27** (1.9%)	**36** (1.8%)
Eco-certification/eco-friendly practices	**12** (2.2%)	**7** (0.5%)	**19** (1.0%)
High speed vessel	**14** (2.6%)	**1** (0.1%)	**15** (0.8%)
Personal contact/affiliation with operator	**5** (0.9%)	**9** (0.6%)	**14** (0.7%)
Research involvement of vessel/operator (live-aboard vessels only)	-	**108** (7.6%)	**-**
Visiting 3 different locations (day boats only)	**25** (4.7%)	-	**-**
Other reasons (various) combined	**74** (13.8%)	**210** (14.7%)	**284** (14.5%)

Respondents on day boats were asked: "Did you expect to see any minke whales on this trip today" and were provided with a yes/no tick box option. The proportion of respondents that answered 'yes' to this question was 27.4% (152/555). Of these 152 day-boat respondents, 42 actually saw minke whales on their trip and only 18 experienced an in-water interaction.

4.3.5 The swimming-with-whales experience

Passengers that saw minke whales

From the total sample, 81% (1756/2171) indicated that they had seen minke whales on their Reef trip. This proportion differed between the live-aboard and day-boat samples, with 99% (1580/1592) and 19% (92/476; *2008 sample only*) (respectively) indicating that they had seen minke whales whilst on their trip. From the total day-boat sample (2006-2008), 30% (176/579) indicated that they had seen minke whales.

Passengers that had an in-water interaction with minke whales

From the live-aboard sample, 96% of respondents (1536/1592) indicated that they had experienced an in-water interaction with minke whales, either using SCUBA and/or snorkelling equipment. In contrast, only 4.0% of the 2008 day-boat sample (19/476) indicated that they had experienced an in-water interaction with minke whales on their trip. From the total day-boat sample (2006-2008), 17% (100/597) indicated that they had experienced an in-water interaction (noting that for 2006 and 2007, questionnaires were only distributed on day-boat trips that had experienced a minke whale encounter).

Satisfaction with the minke whale experience

Respondents that had seen dwarf minke whales on their trip were asked: "How would you rate your overall satisfaction with your minke whale experience on this trip?" A ten-point semantic differential rating scale was provided, ranging from 1 = "very poor" to 10 = "excellent". The mean rating for the total sample was very high (8.92/10; Table 4.6), but there was a significant difference between the live-aboard and day-boat samples (Mann Whitney U Test: $Z_{1,1741}$ = -4.771; p=<0.001; means of 9.02 and 8.02 respectively; Table 4.6).

Respondents were also asked "Overall, how well did your minke whale experience meet your expectations?" A five-point rating scale was provided, ranging from 1 = "well below my expectations" to 3 = "met my expectations" to 5 = "well above my expectations". The mean rating score for the total sample was again very high (4.17/5; Table 4.7) and while the mean rating for the live-aboard sample was higher than for the day-boat sample (means of 4.16 and 3.99 respectively; Table 4.7), this

difference was not statistically significant (Mann Whitney U Test: $Z_{1,1714}$ = -1.928; p=>0.05).

Table 4.6: Mean rating of satisfaction

	Mean rating (1-10 scale)	Std. Error	Median
Live-aboard sample (n=1,573)	9.02	.035	10
Day-boat sample (n=169)	8.02	.181	9
Total sample (n=1,742*)	8.92	.037	10

**14 respondents did not provide a rating score for this question.*

Table 4.7: Mean rating of expectations

	Mean rating (1-5 scale)	Std. Error	Median
Live-aboard sample (n=1,553)	4.19	.025	5
Day-boat sample (n=162)	3.99	.087	4
Total sample (n=1,715*)	4.17	.024	4

**41 respondents did not provide a rating score for this question*

4.3.6 The importance of 'in-water' interactions with dwarf minke whales

A comparison of the satisfaction and expectation ratings of day-boat passengers that (a) had seen minke whales on their Reef trip but had not swum with them (n=76), and (b) those that had swum with minke whales on their Reef trip (n=100) was conducted. Significantly higher ratings of (i) satisfaction and (ii) expectations being met or exceeded were found for the group that had swum with minke whales (Mann Whitney U Tests: $Z_{1,175}$ = -5.299; p=<0.001 and $Z_{1,175}$ = -4.918; p=<0.001 respectively). The mean, standard errors and median rating scores for the two groups are shown below (Table 4.8).

Due to the small proportion of the live-aboard sample that saw but did not experience an in-water interaction with minke whales (1.5%; n=23), statistical comparisons between this group and those that did experience an in-water interaction could not be made.

Table 4.8: Mean, standard error and median rating scores for day-boat passengers that had (a) seen minke whales on their Reef trip but had not swum with them (n=76) and (b) those that had swum with minke whales (n=100)

	Satisfaction rating (1-10)			Rating of expectations (1-5)		
	Mean	Std. Error	Median	Mean	Std. Error	Median
Saw but didn't swim with minkes (n=76)	6.93	.304	7	3.49	.140	3
Swam with minke whales (n=100)	8.8	.19	10	4.36	.097	5

4.3.7 Numbers of whales

Respondents were asked how many whales they had seen on their Reef trip. The median number of whales reportedly seen was 5 (range 1 to 90 whales; n=1756; see Figure 4.2 below).

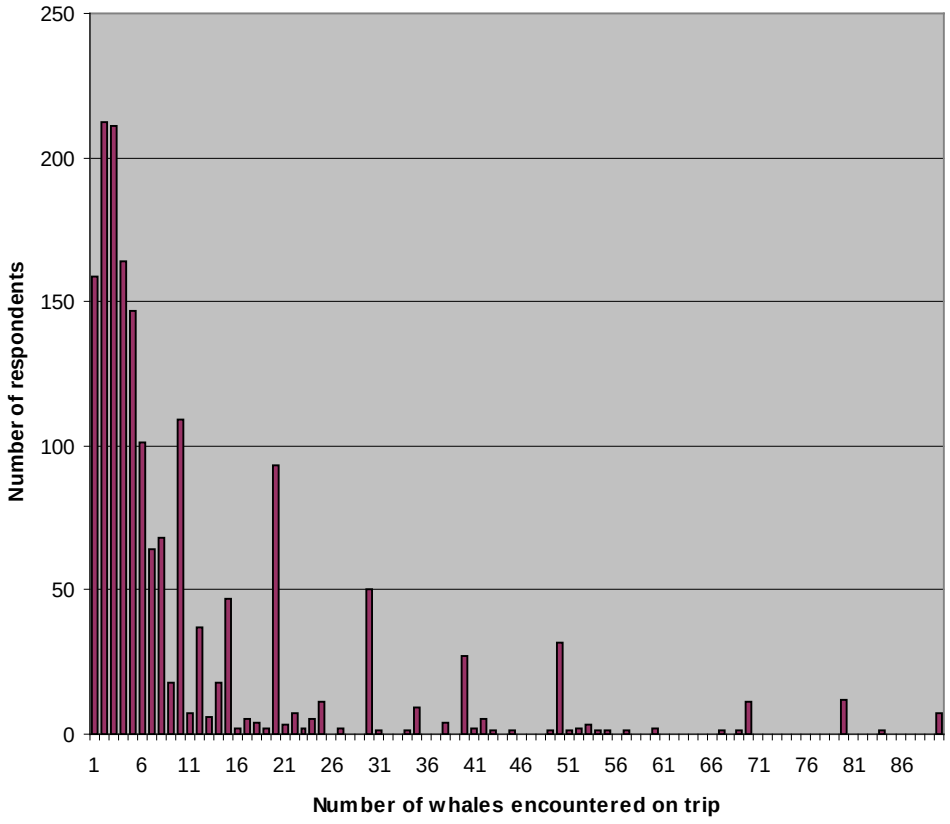


Figure 4.2: Total number of whales reported to have been encountered by respondents on their Reef trip (n=1756)

The mean and median numbers of whales reported to have been encountered by the live-aboard and day boat samples differed substantially (see Table 4.9 below), with the live-aboard respondents reporting that they had seen significantly more whales on their trip (Mann Whitney U Test: $Z_{1,1681}$ = -17.429; p=<0.001). This result is not surprising considering the longer duration of live-aboard itineraries and the opportunity for multiple encounters over several days at the Reef.

Table 4.9: Mean, standard error and median number of whales reportedly encountered by (a) day-boat and (b) live-aboard respondents

	Mean	Std. Error	Median
Day-boat sample (n=164; *missing data in 12 cases*)	1.99	.085	2
Live-aboard sample (n=1518; *missing data in 62 cases*)	11.73	.387	6

4.3.8 Proximity to whales

For the sub-sample of respondents that had experienced an in-water interaction (n=1637), the median closest distance to which respondents said they were approached by a whale (estimated by respondents) was 3m (range 0m to 50m; *NB. the single respondent that reported an approach by a whale to 0m noted that the whale had "touched foot"*). More than a fifth of respondents indicated that they had been approached to a distance of 1m or less, and nearly two-thirds of the sample indicated they had been approached to 3m or less (Table 4.10; Figure 4.3).

Table 4.10: SWW respondents' estimated distance to which they were approached by a whale (n=1527; *missing data in 110 cases*)

Estimated approach distance	n	Proportion of sample (%)	Cumulative percent (%)
1m or closer	327	21.4	21.4
>1m to 2m	355	23.2	44.7
>2m to 3m	271	17.7	62.4
>3m to 4m	101	6.6	69.0
>4m to 5m	176	11.5	80.6
>5m to 6m	39	2.3	83.1
>6m to 10m	168	11.0	94.1
>10m	90	5.9	**100%**
TOTAL	**1527**	**100%**	

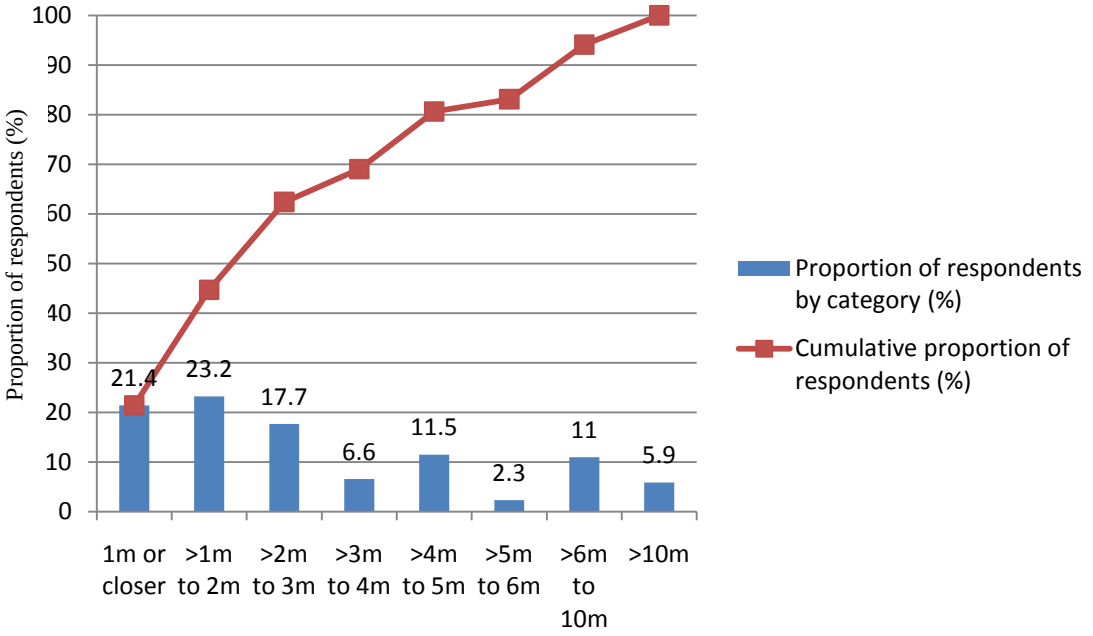


Figure 4.3: **Swimming-with-whales participants' estimated closest distance to which they were approached by a whale (proportions in distance categories and cumulative proportions)**

The mean and median closest approach distance (estimated by respondents) also differed between the live-aboard and day boat samples (see Table 4.11 below), with the live-aboard reporting that they had been approached by a whale significantly closer than the day-boat respondents (Mann Whitney U Test: $Z_{1,1526}$ = -7.328; p=<0.001).

Table 4.11: **Mean, standard error and median closest distance to which (a) day-boat and (b) live-aboard SWW participants were approached by a whale (n=1527;** *NB. Distance estimated by respondents*)

	Mean (metres)	**Std. Error**	**Median** (metres)
Day-boat sample (n=88; *data missing in 12 cases*)	8.27	1.0197	5
Live-aboard sample (n=1439; *data missing in 98 cases*)	4.14	0.1250	3

Spearman's Rank correlations were performed, investigating potential relationships between SWW respondents' satisfaction rating and (a) the number of whales they had reportedly seen on their trip, and (b) the closest distance to which respondents indicated they had been approached by a whale. Significant correlations were found

between the satisfaction rating and (i) the number of whales reported to have been seen (r = .234; p=<0.001), and (ii) the closest approach distance by a whale (r = -.359; p=<0.001). Thus a higher satisfaction rating was given by respondents who had seen more whales, and who had been approached more closely by whales. This result is consistent with the earlier study by Valentine et al. (2004) which found that closeness to the whales was associated with higher levels of visitor satisfaction.

4.3.9 Qualitative aspects of the minke whale experience

Spaces were provided on the questionnaire under each of the above questions and respondents were asked to provide a brief explanation for their ratings. Reponses typically consisted of one or two sentences about the experience. A content analysis of the open-ended responses was conducted, whereby each statement was dissected into component themes/elements. Similar themes/common elements were then aggregated and summarised.

4.3.9.1 Elements contributing to respondents' satisfaction with the minke whale experience

A total of 1,261 respondents (71.8% of respondents that had seen minke whales on their trip) provided an explanation for their satisfaction rating. From these responses, a total of 2,362 'elements' were coded (with up to six different elements emerging from some responses), with 123 distinct codes. A summary of the most frequently occurring codes for both live-aboard (n=1,209) and day-boat respondents (n=52) is presented below (Table 4.12 below). The diversity of responses to this question highlights a broad range of elements contributing to respondents' minke whale experiences.

Table 4.12: Summary of elements that contributed to respondents' satisfaction with their minke whale experience (n=1,261; *live-aboard subsample n=1,209; day-boat subsample n=52*)

Code description (*i.e. element of the minke whale experience*)	**Live-aboard sample (n)**	**Day-boat sample (n)**	**Proportion of total respondents (valid %)**
Specific positive aspects of the minke whale interaction(s)			
Being close to the whale(s)	343	21	28.9
Seeing many whales	81	2	6.6
Long duration of interaction(s)/time spent with whale(s)	61	1	4.9
Being in the water with whale(s)	57	4	4.8
Interactions were on whales' terms/whale(s) came to us	40	2	3.3
Having numerous encounters with whales	33		2.6
Whale(s) 'interacted' with humans	32		2.5
Being with whales in the wild/in their natural environment	27		2.1
Being in the water with whale(s) on SCUBA	25		2.0
Watching whales from on-board the vessel	21	1	1.7
Seeing the whale(s) clearly / getting a good look	21	1	1.7
Apparent low impact on whales / whales not disturbed/stressed	12	1	1.0
Relaxed/comfortable/calm/not stressful nature of encounter	13		1.0
Seeing the eye of the whale(s)	11		0.9
Identified individual whale(s) / named individual: 'Pavlova'	3		0.2
General positive descriptions about the minke whale experience			
Experience was amazing/incredible/great/fantastic, etc.	190	4	15.4
Adventure/fun/excitement	49	2	4.0
Uniqueness/rareness of the experience	29		2.3
Other specific positive elements (combined)	133	1	10.6
Whale behaviours			
Curious / inquisitive behaviour	82		6.5
Playful / friendly behaviour	54		4.3
Whales circling/passing repeatedly	20		1.6
Other specific behaviours (combined)	18	1	1.5
Whales' behaviour in general	17		1.3
Personal / emotional responses to the experience			
First time / new experience	63	8	5.6
'Once in a lifetime'	14	2	1.3
'Unforgettable' / will never forget / memorable	13		1.0
Felt privileged / lucky to have experienced	10		0.8
'Dream come true' / 'beyond wildest dreams'	6		0.5
Unbelievable / unreal / surreal	6		0.5
Other specific emotional/personal responses (combined)	33		2.6
Non-specific personal/emotional responses	21		1.7
Encounter management & other aspects of the trip (positive)			
Interaction(s) managed well	50	1	4.0
Educational/interpretive component	33	1	2.7
Professional/friendly crew/staff	27		2.1
Presence of researchers on board	23		1.8
Good preparation/explanation/briefings prior to interaction	22		1.7
Did not expect to see/swim with minke whales		4	0.3
Descriptive terms about the whales			
Beautiful	47	2	3.9
Reference to size of whale(s) (*e.g. big, huge, massive, enormous*)	28	1	2.3
Amazing	20		1.6
Graceful	10		0.8
Peaceful / calm / gentle / placid	5	1	0.5
Intelligent / smart	1		0.1
Other adjectives describing attractiveness of whale(s) (combined)	38		3.0
Other elements / general statements (combined)	114		9.0

Table 4.12 (continued): Summary of elements that contributed to respondents' satisfaction with their minke whale experience (n=1,261; *live-aboard subsample n=1,209; day-boat subsample n=52*)

Code description (*i.e. element of the minke whale experience*)	**Live-aboard sample (n)**	**Day-boat sample (n)**	**Proportion of total respondents (valid %)**
Wanted more from the experience			
Wanted to have more encounters/whales/time with whales	97	4	8.2
Wanted to get closer to whale(s)	58	3	4.8
Wanted more/improved opportunities to photograph whale(s)	14		1.1
Wanted to use SCUBA during interaction	10		0.8
Wanted to swim with whale(s) (among those that didn't)	6		0.5
Wanted to see more whale behaviours	5		0.4
Other specific 'wants'	13		1.0
Negative / detracting elements			
Bad weather / rough sea	55		4.4
Poor visibility	12	1	1.0
Water temperature (cold)	9	1	0.8
Too many people / too crowded	4	1	0.4
Other specific negative elements (combined)	52		4.1
TOTAL CODED ELEMENTS	**2,291**	**71**	

The most frequently mentioned element of the minke whale experience for both live-aboard as well as day-boat respondents was the closeness of the interaction(s), i.e. the distance to which the respondent was approached by a whale. More than a quarter of all respondents (343/1209 of live-aboard respondents and 21/52 day-boat respondents) mentioned their proximity to the whale(s) when providing an explanation for their satisfaction rating with the minke whale experience. In some cases eye contact was reported, and such responses were associated with very high satisfaction ratings. Examples of such responses include:

- "It was amazing to see such a magnificent animal up close. They were so graceful and peaceful." (Rating = 10/10)
- "The curiosity of the whales brought them very close to us on the line, so close I could make eye contact which was very long." (Rating = 10/10)
- "Words can not explain how wonderful this trip was! I was closer to these amazing creatures than I can imagine. The whales were magnificent." (Rating = 10/10).
- "I have never been in such close contact with such a large animal, it was especially good because it was due to the curiosity of the whales." (Rating = 10/10)

The number of whales encountered, as well as the duration of the interactions were also mentioned with high frequency, predominantly by the live-aboard respondents. Example responses (from live-aboard respondents) include:

- "Saw a lot of whales, were very close, stayed with the boat a long time." (Rating = 10/10)
- "So many whales so close - exhilarating, magnificent, stunning creatures, breathtaking experience." (Rating = 10/10)
- "8.5 hr interaction was superb. I spent 5.5 hrs in the water with them." (Rating = 10/10)
- "Whales approached us and played around us as long as we wanted. …. Normally when you spot a shark or some other large fish you see them only a few seconds." (Rating = 10/10)

Other important aspects of the interactions that were mentioned frequently by both live-aboard and day-boat respondents included the 'in-water' element (i.e. being in the whale's domain/environment) and interactions being 'on the whales terms' (i.e. approaches instigated by the whales and whales 'choosing' to interact with humans). Similar to this theme, the whales' apparent curiosity of humans (by instigating approaches) featured prominently. Examples of such responses include:

Being 'in the water' with the whale(s):

- "Just being in the water with these huge animals was amazing." (Rating = 8/10)
- "It was such a bonus to be able to see them below the water, they are gorgeous creatures." (Rating = 10/10)

Interactions were on the whales' terms:

- "We did not bother the animals and let them come up to us. It was really natural." (Rating = 9/10)
- The whales approached us, they could have left any time but stuck around and seemed curious." (Rating = 10/10)

Whales' curiosity/apparent interest in humans:

- "It was an incredible experience to be in the water with such large gentle animals that appear as interested in us as we are with them." (Rating = 10/10)
- "Whales were very curious - did not seem stressed or bothered by our presence so did not feel intrusive or disruptive." (Rating = 10/10)

Other elements which featured prominently in responses were descriptions of the whales' physical appearance (most often referring to their aesthetic appeal; beauty in most cases), their size, behaviour, and in a few cases some anthropomorphic interpretations of their nature (e.g. peaceful, smart). A small proportion of (mostly live-aboard) respondents described their personal and/or emotional reactions to their encounter, some of which indicated the achievement of a lifetime goal and/or 'peak experience'. Three live-aboard respondents also reported their experience with a named, identified whale ('Pavlova') which was encountered several times by different vessels over the 2006 and 2007 seasons and performed numerous exuberant behaviours (e.g. 'pirouetting') in close proximity to people (Minke Whale Project, 2008; Mangott, 2010) Example responses include:

Aesthetic appeal:

- "They are beautiful animals and I loved watching them in and out of water." (Rating = 10/10)
- "They are a magnificent, awesome mammal. And so cute." (Rating = 10/10)

Size of the whale(s):

- "Biggest animal I've ever seen in the ocean, beautiful creatures, relaxing to watch, it's great that they approach people." (Rating = 10/10)
- "It was nuts to see so large an animal this close in its natural environment" (Rating = 10/10)

Anthropomorphic responses:

- "Very grateful to have swum and dived amongst very peaceful minke whales" (Rating = 9/10)
- "They were so curious, gentle and smart." (Rating = 10/10)

Personal reactions/emotional responses:

- "Much better than the diving … the minke whale experience was one of the best things that I've done IN MY LIFE" (sic). (Rating = 10/10)
- "An overall life changing experience, to be able to contribute, observe and learn about these animals and learn about aspects of the reef's ecology in the process - many many thanks." (Rating = 10/10)

Identified/named whale ('Pavlova'):

- "Our experiences are what legends and fables are made of. But it did happen and we documented it. Should Pavlova stop dancing in the future, then we can say we met her at her top star quality time of her life." (Rating = 10/10)

A small proportion of (mostly live-aboard) respondents wrote positive comments about the management of their minke whale interaction(s), the interpretive materials/information provided about minke whales on their trip, and in some cases, the presence of researchers on their trip contributing to their satisfaction (e.g. providing an opportunity to learn more about the whales, seeing research being conducted first hand and/or contributing to research data collection). Example responses include:

Management of the interaction(s):

- "It was professionally managed, the whales weren't harassed by anyone so they came to us, to check us out and stayed a long time." (Rating = 10/10)
- "Excellent organisation, fantastic wildlife experience, just weather could have been better (calmer)." (Rating = 9/10)

Education / interpretation & research component:

- "I learned a lot more about the whales, found the passion and enthusiasm of the crew for the whales infectious and sincerely enjoyed the overall experience." (Rating = 10/10)
- "Presence of a researcher on board meant we were well informed on the whales." (Rating = 10/10).

Notably, four day-boat respondents indicated that they had not expected to see and/or swim with minke whales on their day trip to the Reef:

- "Did not expect to see minke whales." (Rating = 5/10)
- "Never thought I would swim with whale." (Rating = 10/10)

Whilst the majority of responses to this question were of a positive nature, a proportion of respondents (including both live-aboard and day-boat respondents) indicated that they wanted more from their minke whale experience (e.g. wanted to see more whales, get closer to whales; summarised in Table 4.12 above). A smaller proportion of negative/detracting elements were also reported, the majority of which were weather-related. Such responses were not necessarily accompanied by a low satisfaction rating (although several were), and negative comments were often written in combination with a positive aspect of the experience.

4.3.9.2 Passengers' expectations of the minke whale experience

Respondents were asked (Question 22, Appendix 11): "Overall, how well did your minke whale experience(s) meet your expectations? (Please tick one box and give a brief explanation of why you feel this way)". A semantic differential scale was provided for respondents to tick one option, ranging from 1 = "well below my expectations" to 3 = "met my expectations" to 5 = "well above my expectations", with space provided below for their comments. While 97.7% (1715/1756) of the sub-sample that saw whales on their trip responded to the closed-ended part of this question (results reported in Table 4.7 above), only 649 respondents (601 from live-aboards and 48 from day-boats) provided an explanation for their response. Analysis of these responses resulted in 1139 total coded elements. A summary of these coded elements is provided below (Table 4.13).

Table 4.13: Summary of elements that contributed to the meeting of respondents' expectations about the minke whale experience
(n=649; *live-aboard subsample n=601; day-boat subsample n=48*)

Code description (*i.e. elements contributing to the meeting of respondents' expectations*)	**Live-aboard sample (n)**	**Day-boat sample (n)**	**Proportion of total respondents (valid %)**
Unexpected positive occurrences			
Didn't expect to get so close to whale(s)	159	7	25.6
Didn't expect to see as many whales / have as many encounters	75		11.6
Didn't expect to see whale(s)	54	14	10.5
Didn't expect such curious/friendly behaviour of the whale(s)	32	2	5.2
Didn't expect feelings/emotional reaction to experience	25		3.9
Didn't expect such 'interactivity' from the whale(s)	23	1	3.4
Didn't expect to see humpback whales also	24		3.4
Didn't expect encounter to last as long	11	2	2.0
Didn't expect to swim with whale(s)	7	3	1.5
Didn't expect size of whale(s)	4	4	1.2
Didn't expect elements of whales' behaviour	7		1.1
Other unexpected positive occurrences (combined)	13		2.0
Positive occurrences (not necessarily unexpected)			
Whale(s) came close	36		5.5
Whale behaviour(s) observed	16	1	2.6
Number of whales seen / numerous encounters	11		1.7
Good management of interaction(s)	9	2	1.7
Duration of interaction(s)	7		1.1
Large size of whale(s)	7		1.1
Eye contact	3	1	0.6
Individual whale – 'Pavlova'	4		0.6
General positive comments			
Descriptive terms about minke whale experience (combined)	118	5	18.9
Descriptive terms about the whales (combined)	26	2	4.3
Happy / pleased with minke whale experience	24	2	4.0
Once in a lifetime experience	13		2.0
First time/new experience	10	2	1.8
Interaction on whales' terms	9		1.4
Other positive comments (combined)	56		8.6
Expectations not met			
Expected more whales / more encounters	11		1.7
Expected whales to come closer	9		1.4
Not as good as previous minke whale experience	9		1.4
Other expectations (combined)	26		4.0
Unfulfilled desires (not necessarily expectations)			
Wanted to get closer to whale(s)	20	4	3.4
Wanted more time with whale(s)	7	7	2.2
Wanted to see more whales / have more encounters	5	5	1.5
Wanted to swim with whale(s) (but didn't)	7	1	1.2
Wanted to get a better look at the whale(s)	7	1	1.2
Wanted to touch the whale(s)	3		0.5
Other unfulfilled desires (combined)	2		0.3
General comments about expectations			
Had no expectations / didn't know what to expect	58	6	9.9
Expectations exceeded	40	1	6.3
Expectations met / knew what to expect	26		4.0
Expectations were high	12		1.8
Better than previous minke whale experience	8		1.2
Expectations were low	6		0.9
Other negative comments (combined)	19	1	3.1
Other comments (combined)	7		1.1
TOTAL CODED ELEMENTS	**1065**	**74**	

The above summary (Table 4.13) reveals a substantial proportion of respondents were not expecting a range of positive occurrences associated with their minke whale encounters (e.g. the number of whales encountered, the close distances to which they were approached by whales, the duration of interactions). One respondent indicated that they had encountered more than 80 different whales on their trip (in this case the trip was for six days and their approximate figure is consistent with Whale Sighting Sheet data reported in Chapter 3). Examples of such responses include:

Unexpected length of interaction(s), number of whales, closeness to whales:

- "I expected to see a whale from the boat, but not to be able to swim so close to one and for such a long period of time." (Rating = 5/5)
- "I didn't really expect to see so many whales. Seeing over 80 whales was way beyond my expectations." (Rating = 5/5)
- "I didn't expect that I would see so many and so close!" (Rating = 5/5)

A relatively high proportion of both live-aboard and day-boat respondents indicated that they did not expect to see whales. In the case of the live-aboard respondents, it is likely that these respondents took part in trips outside the peak of the minke whale season when operators were not conducting dedicated minke whale itineraries or promoting a high likelihood of minke whale encounters to their clients. Other positive 'unexpected' comments included swimming with the whales and respondents' own personal/emotional reactions to the encounters. Example responses included:

Didn't expect to see/swim with whales:

- "Didn't expect to see any, let alone be up close frequently." (Rating = 5/5)
- "I really never expected to see a baleen whale in the water - in my life! To have an interaction was well above my expectations." (Rating = 5/5)

Personal feelings/emotional reactions:

- "I didn't know that it was such a moving experience. It is something I will never forget." (Rating = 5/5)
- "An absolutely breathtaking experience. A feeling I have never felt before. Who's looking at who??" (Rating = 5/5)

While relatively few negative comments were made, several respondents indicated that they had expected more from their minke whale encounters. Bad weather and poor underwater visibility also featured in some responses. In some cases, respondents indicated that they had swum with minke whales prior to this trip and had compared their recent encounter(s) on this trip with their previous – some of these comparisons were favourable and others not. Three respondents (two from the live-aboard sample and one from the day-boat sample) indicated that they were dissatisfied with the manner by which their encounters were managed. Example responses include:

- "Encounter not well managed. Twice when I got in the water to snorkelled we were only allowed 5-8 min before we were called to boat. Too chaotic with divers and snorkellers, divers floating on surface with full dive gear etc." (Rating = 2/5)
- "Too many people on deck so couldn't see well." (Rating = 3/5)

4.3.9.3 Effects of the SWW experience on participants

Respondents were asked (Question 36, Appendix 13; 2008 live-aboard sample only): "Do you feel that your minke whale experience on this trip has changed you in any way?" This question attempted to elicit any potential strong personal or emotional reactions to the experience that affected the perceptions and/or attitudes of the respondents. The phrasing and open-ended format of the question were designed to allow for a broad variety of responses. From the 2008 live-aboard sample, 357/441 (81.0%) responded to this question. Analysis of these responses resulted in 413 total coded elements. A summary of these coded elements is provided below (Table 4.14).

Table 4.14: Summary of responses: whether or not SWW participants were 'changed in any way' (n=357)

Code description	n	Proportion of respondents (valid %)
Yes – affected by experience		
General – happy/satisfied by minke whale experience	57	16.0
Want to return to experience again	6	1.7
Life changed by experience (unspecified how)	3	0.8
Want to volunteer for whale research	1	0.3
Want to donate money to whale research	1	0.3
Yes – changes in awareness		
More informed / increased awareness about whales / whale conservation	52	14.6
More informed / increased interest about marine wildlife / GBR	36	10.1
More informed / increased awareness / interest in minke whales	36	10.1
Increased awareness / appreciation for conservation issues	16	4.5
Increased awareness / appreciation for whale research	8	2.2
Increased awareness of tourism impacts on environment/wildlife	7	2.0
More informed / increased awareness of human impacts on environment	5	1.4
Increased awareness (non-specific)	5	1.4
Increased awareness / feelings about whaling issue	3	0.8
More experienced in the water/less fearful	2	0.6
No		
No (no explanation provided)	116	32.5
No, but it was a fun / great / enjoyable experience	14	3.9
No, unchanged respect for nature/wildlife	3	0.8
No, already aware of environmental/conservation issues	3	0.8
No, but reinforced awareness/importance of conservation	3	0.8
Other / non-specific	36	10.1
TOTAL CODED RESPONSES	**413**	

Nearly a third of respondents replied with a simple 'No', with a small proportion providing additional comments about their enjoyment of the experience, and/or their ongoing awareness or respect for the natural environment. For example:

- "No I still have the same love and respect for wildlife that I had before."
- "Not really but the whales are amazing - maybe even greater appreciation for nature."

The next largest proportion of responses, accompanied by an affirmative 'Yes', indicated an increased awareness, knowledge and/or appreciation for whales, marine wildlife, research and conservation issues, including whaling. Several respondents indicated that the experience had made them feel more 'in touch' or connected with nature. Example responses included:

- "Made me feel much more informed and knowledgeable and passionate about whales and marine life."
- "It has made me a more in touch with nature person and has made me aware of my actions and how it affects these whales."

A small proportion of respondents indicated that their minke whale experience had made a powerful impression upon them, however the specific nature of any change in their lives was not communicated. Such responses included the fulfilment of a lifetime ambition/dream, and (in one case) having a 'spiritual' experience. Three respondents also made comments about their increased awareness of/concern for whaling. Example responses included:

- "Absolutely. Extremely special and powerful experience. Much appreciated and a life-long dream accomplished."
- "It was a very spiritual, moving experience. I feel very privileged to have been able to participate. I wonder how much longer people will be allowed to do this. I hope someone doesn't spoil it for everyone by doing something stupid."
- "Made me even more incredulous about hunting whales."

4.3.10 Respondents' intent to return to the GBR again to see minke whales

In 2008 a new question was added to the live-aboard questionnaire: "How likely is it that you will visit the GBR again, for the purpose of seeing minke whales?" (Question 38, Appendix 13) with a multiple choice option provided (1 = "very unlikely"; 2 = "possibly in the future"; 3 = "very likely in the future"; 4 = "definitely will visit again (to see minke whales)"). From the 2008 live-aboard sample, 436/441 (98.9%) responded to this question. A summary of responses to this question for Australian and overseas respondents (n=160 and 276, respectively) is provided below (Table 4.15)

Table 4.15: Live-aboard respondents' intent to return to the GBR again to see minke whales (2008 only; n=436)

Likelihood of returning to the GBR again to see minke whales	Australian respondents (n=160)	Overseas respondents (n=276)
Very unlikely	19 (11.9%)	29 (10.5%)
Possibly in the future	73 (45.6%)	156 (56.5%)
Very likely in the future	42 (26.3%)	66 (23.9%)
Definitely will visit again	26 (16.3%)	25 (9.1%)

4.4 Stakeholder key informant survey results

4.4.1 Background and experience of key informants

Sixteen stakeholders (backgrounds and affiliations described above in Section 4.2.2) were interviewed as part of a key informant survey (KIS) to elicit the range of social values associated with the GBR dwarf minke whales and the SWW activity, identify management issues facing the SWW activity (reported in Chapter 5) and develop sustainability objectives for the GBR SWW activity (reported in Chapter 6).

KIS respondents were asked a series of questions at the beginning of each interview to establish their previous experience and knowledge of dwarf minke whales and associated tourism management issues (Appendix 16). All respondents had been aware of dwarf minke whales in the GBR for at least several years prior, with a mean of c.13 years prior knowledge and/or direct previous experience with dwarf minke whales (ranging from three to >20 years; the combined 'knowledge' of dwarf minke whales in the GBR among the 16 KIS respondents totalled >197 years). Thirteen of the 16 KIS respondents had themselves previously experienced swimming with dwarf minke whales in the GBR.

4.4.2 Industry values of dwarf minke whales and the SWW experience

All KIS respondents were asked: "What do dwarf minke whales mean to you?" Responses varied between individuals however several themes emerged that were common among stakeholder groups (i.e. industry, managers, NGO representatives). Among industry KIS respondents (n=9), a wide range of values and themes emerged in response to this question, which are grouped below into social and business values.

4.4.2.1 Social values of the SWW experience

Six of these respondents shared details of their personal values and experiences with dwarf minke whales, including some strong personal and/or emotional feelings associated with previous SWW experiences. For example (*NB. R1-16 refers to individual respondents; MC refers to the interviewer)*:

- "If we get too deep I'll start crying. To my family, it's probably been one of the more special experiences that I've had or been able to share with hundreds of people… of all the amazing adventures that the Barrier Reef has offered, the minke whale eye-to-eye experience is right there at the top of them. Rather than being adrenaline, it's emotional or connecting." (R8)
- "Personally, they're a beautiful creature and I suppose I feel quite privileged to be able to dive with them and get up close as we do to them." (R3)

Three industry KIS respondents were asked (Q.19; Appendix 16): "How do you think the minke whale experience for your clients compares with other experiences your vessel offers at different times of the year?" (*NB. time restrictions prevented this question being asked of all industry respondents*.) These three respondents indicated that seeing dwarf minke whales was one of the top experiences that they were able to provide for their clients. Example responses included:

- "The whales themselves I think is a real highlight I would say in anyone's lifetime… But you know, we've got good encounters these days with hammerheads and also mantas which blow people away as well. But even as fantastic as it all is, I'd say that minkes at the end of the day are probably at the top of the tree. To get that close to them, that's the difference." (R2)
- "I think it's, well, almost the main experience." <MC: *It's a highlight?*> "It's a highlight; I mean there's the cod feed and the sharks and then the shark interaction at Osprey and then the minkes so they're the three highlights. So, depending on what people are wanting to see, depends on which one's the top." (R9)

4.4.2.2 Business values of the SWW experience

The business values of dwarf minke whales were expressed by all nine industry respondents. These respondents all commented that dwarf minke whales were valuable to their clients' experiences and hence to the economic bottom line for their business. One respondent noted that the SWW experience had contributed to an increase in occupancy rates for the live-aboard dive industry during a traditionally low

season. Examples of broad statements of the business value of the whales to SWW-endorsed live-aboard operators included:

- "Well, it's not just to <*operator name*> but it's to the whole dive tourism live-aboard industry in Cairns. It has taken what is traditionally a low season, the windy, cold winter, which usually has fairly low occupancy, to full occupancy. It's added a new experience…" (R8)
- "During the minke whale season our boat is generally completely full." (R7)
- "A great way to promote our business to people who want to have this wildlife experience and want to interact with the minkes. It's great to get the feedback, the trips that they do when they sight them. I don't think we could manage a year without them now because we're so used to having you know, those few months of minke time." <*MC: So they're very important to your business?*> "Very important yeah, very important." (R9)

Three respondents noted the uniqueness of the swimming-with-dwarf minke whale experience in the GBR (with limited SWW opportunities involving other cetacean species in other countries), emerged as an important 'competitive edge' for the GBR SWW industry. For example:

- "I guess as far as mega-fauna goes, we can claim that there's more sightings and longer encounters at a site like Lighthouse Bommie than anywhere else in the world, is a nice claim to be able to hang the project on. And it gives us, with diving on the GBR and Coral Sea, we're in competition with many fantastic dive locations in the world and it's good to have some star in the crown so to speak, some extra service that's unique and gives that extra credibility to the diving service operated on the GBR." (R2)
- "For the people on the boat, very few people in the world get to do it, we're very privileged here." (R10)

Specific importance to SWW-endorsed live-aboard operations

Two industry KIS respondents representing live-aboard operations were asked (Q.24; Appendix 16): "To what extent is your operation financially dependent on minkes?" The responses from these two operators were quite different – one attributed a substantial proportion of their business during the minke season to their ability to offer the SWW experience, whilst the other indicated that business would continue as usual without the occurrence of dwarf minke whale encounters. For example:

- "I think that if we weren't allowed to interact with the minkes, now I'd suggest that yeah – there would be an impact. Or if they just stopped coming… things are changing, so I think they're really, really important these days, for us to have something different to offer to attract the tourists." (R2)

- <*MC: Would your business suffer if interactions with minke whales no longer occurred*?> "I don't think so. I think business would be as usual. We've been doing it too long." <*MC: What is the importance of the swim-with-minke whales experience to the marketing of your operation*?> "Yes, we've done a bit more with it over the past years with it now on our webpage and brochure and nice new poster with all the minkes so it is important." (R9)

Specific importance to SWW-endorsed day-boat operations

The two SWW-endorsed day-boat operators that were interviewed noted that dwarf minke whales were good for their business in a more general sense. For example:

- "From the business point of view they're unique in that they're particularly attractive to tourists and therefore they are, simply put, a good thing for business." (R6)

The extent to which dwarf minke whales were contributing to the business and marketing of one SWW-endorsed day-boat operator was explored a little further with one respondent, who had recently begun promoting the SWW activity in company brochures:

- <MC: *You're marketing the minke whales now, are they becoming an important part of your business at that time of year?*> "It's peripheral, at the time of the year when we're getting encounters, we make sure that all our agents in Cairns and Port Douglas know about it, and that time is a hot topic. The press obviously has shots, so yeah. Year round, it's not a huge part to be honest, but for that specific winter period, it is an extra plus and if we get a good encounter it's really good for our marketing girls to show that." (R4)

4.4.3 Values of dwarf minke whales and the SWW experience to other stakeholders

Responses to the question "What do dwarf minke whales mean to you?" among KIS respondents from other stakeholder groups (3 managers, 3 conservation NGO representatives and a cetacean scientist) were quite distinct from those by industry respondents. Whilst some of these respondents indicated a personal fondness for the whales (e.g. "I just think they're actually magnificent looking creatures;" *R12*), most provided a more 'neutral' response. Such responses about the value of dwarf minke whales as a species included:

- "…all whales are important to us, and dwarf minke whales wouldn't be any more or less important…" (R1)

- "Whales in general don't invoke any particular emotions in me… None of the protected species or iconic species are any more special to me than others." (R13)

Management agency respondents however noted additional values/benefits associated with the GBR SWW industry, including opportunities for their agency to engage directly with tourism operators, their clients and other stakeholders, and for the opportunity to promote sustainable tourism and management of the Great Barrier Reef Marine Park. In one response, the added benefit of promoting their agency's achievements in managing the SWW activity was also suggested. Such responses included:

Opportunities for engaging with the tourism industry, tourists & other stakeholders:

- "Professionally, they <*dwarf minke whales*> offer some fantastic opportunities for us, as an agency, to engage more closely with the tourism industry, and therefore more broadly to work more closely with people that are seeking to learn more about what goes on out there." (R1)
- "For me the dwarf minke whale industry is an opportunity to actually promote the conservation of whales to the passengers that go out there. It provides an opportunity to promote them to the general GBR community, especially those that live in the Cairns, Port Douglas area..." (R12)

Opportunities to promote sustainable management:

- "It's also an opportunity to demonstrate to the world that you can actually manage something like this in a sustainable manner. Swim-with programs are canned around the world especially in relation to dolphins, I think the fact that we have a different situation, a less contained minke whale population if you will, in comparison to the dolphin tourism, it gives us the opportunity to actually demonstrate to the world that, look, where there's appropriate safeguards in place and appropriate monitoring, you can have a sustainable swim-with industry." (R12)

KIS respondents representing other organisations (research and conservation NGOs) indicated a professional interest in the GBR SWW activity, its management and research into the GBR dwarf minke whale population. General concerns about the welfare of cetaceans involved in swim-with programs were raised, however there did not appear to be any specific concerns about the GBR SWW activity impacting dwarf minke whales. One respondent indicated that the GBR SWW industry had the opportunity to raise public awareness of the whaling issue, and by allowing people to

relate to this species they may become more supportive of whale conservation. Example responses included:

Organisational interest in management & research:

- "…there's a high level of interest, because obviously the management of marine mammal and tourism interactions of which this is a core part, is a primary area of marine mammal – human interactions, so a high level of interest from that..." (R14)
- "…the work that *<the Minke Whale Project research team>* are doing is, as far as we know, the best work that's being done on trying to establish the impacts or otherwise of a swim-with program. So we see this as one of the rare and very important attempts to document potential impacts and to find ways of actually, possibly conducting the activity without any long-term negative impacts. So that's something that we think is really important." (R15)

Value of dwarf minke whales for raising awareness of whaling issue:

- "On another level, the dwarf minkes are very important to us because of their potential use, I can't think of a better word but, in relation to Antarctic whaling. We think … that people will become much more concerned about the whaling if they think that it's their whales that are potentially being impacted. I mean of course we don't know whether the dwarf minkes that go to the GBR are a target for the Antarctic whalers, but it could be that they are." (R15)

4.5 Discussion

This study presents a comprehensive account of the range of social values associated with dwarf minke whales and the GBR swimming-with-dwarf minke whales experience. Results presented in this chapter include: (1) an in-depth analysis of elements contributing to GBR tourists' 'minke whale experience', (2) SWW participants' perceptions, values and expectations associated with dwarf minke whales and the SWW experience, (3) key differences in the SWW experience between passengers on live-aboard and day-boat SWW-endorsed operations, and (4) identification of a range of stakeholders' values of dwarf minke whales and the GBR SWW activity.

4.5.1 Defining the GBR 'minke whale experience'

Swimming with dwarf minke whales is an extraordinary wildlife tourism experience. From the results presented above it is clear that GBR SWW participants reported extremely levels of high satisfaction with their 'minke whale experience' overall, with a wide range of contributing elements. The most important elements identified in this study that are associated with the GBR minke whale experience include:

(i) *Closeness to whales*: more than 80% of SWW participants reported being approached by a whale to six metres or closer; more than 60% reported being approached to three metres or closer, and more than 20% reported being approached to one metre or closer. This finding is consistent with that reported by Valentine et al. (2004).

(ii) *The 'in-water' setting*: watching the whales within their natural environment enhances the authenticity of the wildlife watching experience and enables closer and more personal interactions.

(iii) *Seeing many whales*: predominantly reported by SWW participants on live-aboard vessels that experience numerous encounters over the duration of their three to six-day trip.

(iv) *Length of interactions*: predominantly reported by SWW participants on live-aboard vessels (NB. the mean in-water interaction duration was found

to be 135 minutes; Chapter 3, Table 3.3) and frequently mentioned as a positive and sometimes unexpected attribute of the interactions (Tables 4.12, 4.13).

(v) *Inquisitive behaviour of the whales*: This was associated with behaviour displayed by the whale(s), perceived as 'friendly,' 'playful' and 'curious'. Eye contact with the whales and a 'personal experience' were features associated with the two-way nature of the interactions.

(vi) *Interactions being "on the whales' terms"*: a high proportion of SWW participants identified the interactions as occurring "on the whales' terms" with whales initiating approaches to humans.

(vii) *The whales' aesthetic appeal and physical attributes*: a relatively high frequency of responses included references to the whales' attractiveness and size.

(viii) *Good management and interpretation*: a relatively high proportion of respondents made positive comments about the management of their minke whale encounter(s) and the quality of information they received when explaining their satisfaction and expectations associated with the experience. The presence of researchers on board some trips was also included in some responses as a positive addition to the experience.

For a large proportion of SWW participants, the above elements were reported to have contributed to a very special and memorable experience that exceeded their expectations and resulted in very high levels of satisfaction (in particular, the live-aboard SWW participants who provided a mean satisfaction rating score of 9.02/10). A benchmarking review of tourism satisfaction studies by Pearce (2006) found an inherent positivity bias in results produced by satisfaction rating scales. Pearce noted that small differences in the mean scores can reflect substantial differences in the quality of the tourist experience. From his review, Pearce (2006) notes that on standard 1-10 rating scales, mean ratings above 7.8 are considered good, while scores above 8.5 are meritorious.

A relatively high proportion of respondents conveyed an emotional element to their experience (and some described this as 'spiritual'). Some described their experience as the fulfilment of a lifetime goal or ambition (e.g. 'once in a lifetime').

Anthropomorphic comments (i.e. those attributing humanistic qualities to the whales' behaviour, for example 'friendliness') were provided by only a small proportion of SWW respondents. The abovementioned elements are discussed in further detail below.

Proximity to whales

The most frequently mentioned element by respondents when explaining their satisfaction with the minke whale experience was 'closeness' to the whales (Table 4.12). Numerous studies have shown that the close proximity of wildlife to tourists is a key component of many wildlife tourism experiences. Closeness to whales has been identified as an important part of the whale watching tourist experience in some studies (e.g. Muloin, 1998; Pearce & Wilson, 1995), however Orams (2000) found that among vessel-based humpback whale-watching tourists in Tangalooma (QLD Australia) the proximity to whales was not a major influence on tourist satisfaction. In his study, Orams identified a range of variables influencing participant satisfaction, including aspects of the vessel, the weather conditions and social interactions, as well as the number of whales seen and the whales' behaviour. Such a broad range of elements also play an important role in the overall trip satisfaction of the GBR SWW participants (e.g. as reported in Valentine et al. 2004). The opportunity to swim with the whales in this case however may influence tourists' desire and expectation to experience a much closer interaction than would occur from a vessel-based encounter.

This study reinforces findings by Valentine et al. (2004) who also found significant correlations between passengers' satisfaction rating and distance to which respondents indicated they had been approached by a whale. Valentine et al. found that approximately 14% of passengers in the 1999-2000 sample indicated they had been approached to less than 2m, with 60% indicating they were approached to within 4m. This study found a substantially higher proportion of SWW participants indicating that they had been approached this close: 44.7% to within 2m and 69% to within 4m (Table 4.10 & Fig. 4.3). While it is important to note the caveats associated with using underwater distance estimations by people without specific training, and that most people generally underestimate underwater distances to objects when closer than 10m (Luria & Kinney, 1970), such limitations can be assumed to apply equally to this study and that by Valentine et al. The finding in this study is largely attributable to

the live-aboard sample (i.e. day-boat respondents' median distance estimation of 5m was significantly greater than live-aboard respondents' median estimate of 3m) and is likely to be influenced by the substantial increase in industry 'effort' in recent years (as reported in Chapter 3), whereby SWW-endorsed live-aboard vessels are dedicating a larger proportion of their trip itinerary to finding and interacting with whales and the number of reported encounters nearly doubled. Experiencing more encounters and in-water interactions with dwarf minke whales per trip on the SWW-endorsed live-aboards is thus a more likely explanation for a higher proportion of SWW-participants getting closer to the whales (i.e. with more opportunities to do so), rather than any long-term trends in the whales' behaviour.

The high proportion of SWW participants being approached "closely" (defined as 3m or closer; 62.4% of SWW respondents) and "very closely" (defined as 1m or closer; 21.4% of SWW respondents; Table 4.10) by a six-metre wild whale (weighing several tonnes) raises concerns about the elevated risk of harm to both humans and whales and about SWW-participants' temptation to touch (noting that three respondents indicated a desire to touch a whale; Table 4.13). If a whale is touched or grabbed, it could be startled and react by accelerating rapidly using large kicks of its tail (i.e. a flight response) and potentially collide with a swimmer or another object in the water, or become entangled in a rope. A risk assessment matrix developed by Mangott (2010) identifies an increasing risk associated with a range of described behaviours if they occur in close proximity to swimmers. So far no incidents involving harm to GBR SWW participants have been documented although whale-swimmer contact has occurred several times. A videotaped incident in 2004 shows a swimmer rubbing an open hand along the left flank of a whale resulting in no obvious reaction from the whale. It is possible that similar touching incidents have occurred previously/since however they have not been observed by researchers or reported by vessel crew. Whilst rare, in most of the recorded cases of physical contact a whale has gently bumped into/brushed against a person or object they are holding (e.g. the documentary 'Mystery of the Minkes' shows a whale bumping the lens port of the video camera with its snout; Natural History New Zealand, 2002). An incident of greater concern was recorded in 2007, in which a whale had briefly become entangled in a surface rope and had startled, kicked hard several times and broken free. In this

case only one swimmer was in the water and the whale had swum over the top of the rope some distance from the swimmer.

The 'in-water' setting

The authenticity/natural setting in which wildlife tourism takes place is recognised as an important contributor to the visitor experience (Schänzel & McIntosh, 2000; Curtin, 2005), as is the 'platform' (i.e. from on land, vehicle or vessel as well as in-water viewing) from which wildlife are viewed (Higham, Lusseau & Hendry, 2008). Authenticity in wildlife tourism is associated with the natural setting of the experience. Increasing levels of human infrastructure and physical boundaries separating visitors from the wildlife represent decreasing authenticity in the wilderness setting. In a comparative study of nature tourists at three different sites in Borneo, Markwell (2001) found that in settings with fewer physical structures or boundaries that separated visitors from nature, the visitors experienced a greater sense of discovery, wonder and enjoyment.

Being 'in the water' with a whale is therefore likely to be considered to be a more authentic experience than whale watching from a boat; it involves immersing oneself in an environment that 'belongs' to the whale. It is likely also that the in-water aspect of the encounters increases the sense of adventure associated with the experience. Curtin (2006) notes in her analysis of the swimming-with-dolphins experience that snorkelling in cold choppy water in a remote location requires a degree of skill from the participants which is considered adventurous. Being 'in the water' with dwarf minke whales was mentioned by a high proportion of both live-aboard and day-boat respondents when explaining their satisfaction, and the day-boat respondents that swam with whales gave a significantly higher satisfaction rating than those who saw minke whales from the vessel only (Table 4.8). Other aspects of the GBR minke whale experience that are likely to contribute to its perceived authenticity include the geographic remoteness of the sites at which whales are encountered, the number of people present and the number of other boats operating in the area. In this regard there are clear differences between live-aboard and day-boat operations. Live-aboard vessels travel farther from the urban centres, carry fewer people and visit areas of lower density of use.

The use of surface ropes for snorkelers to hold during in-water interactions represents a low-level physical boundary to mediate the SWW experience. While a few respondents wanted to leave the surface rope and swim with the whale(s) on SCUBA (Table 4.12), a much larger proportion recognised the value of the rope(s) for their role in managing people's behaviour in the water (i.e. preventing people from swimming towards or chasing whales), as well as for its perceived role in facilitating closer passes by the whale(s) over the duration of an interaction. Mangott (2010) established that over the duration of in-water interactions, the whales' passing distances to swimmers do indeed decrease significantly.

Numbers of whales and duration of encounters

Other outstanding features of the swimming-with-dwarf minke whales experience (predominantly reported by live-aboard respondents) were seeing many whales and the long duration of encounters (Table 4.12). Live-aboard respondents saw significantly more whales than day boat respondents (Table 4.9) and spent more time interacting with them (Chapter 3). As reported in Chapter 3, longer encounters involving many whales are most likely to occur at key 'hotspots' such as Lighthouse Bommie, which due to its remote location is so far only accessible to live-aboard vessels. The longer trip duration and more flexible itineraries of live-aboard vessels increase their likelihood of experiencing several encounters and allows interactions in some cases to persist for many hours. The mean and median number of whales reported to have been seen by live-aboard respondents in this study (11.73 and 6 whales respectively; Table 4.9) are similar to findings by Valentine et al. (2004). The notable difference between the mean and median number of whales reported is due to the skewed distribution of these data (Figure 4.2); only a small proportion of respondents reported seeing a much higher number of whales on their trip (up to 90 reported in this study). These results are consistent with whale sightings reports by the SWW-endorsed operators (Chapter 3); most trips that report sightings of such high numbers of whales occur within a brief period at the peak of each minke whale season (late June to early July). It appears likely that for the relatively few respondents on trips that do encounter such numbers of whales, this occurrence has a substantial impact on their experience and satisfaction.

Comparing the GBR SWW experience with other swim-with-cetaceans programs (excluding captive swim-with programs) reveals that the duration of interactions with other species is typically much shorter. Curtin (2006) describes swimming-with-wild dolphin encounters as 'fleeting glimpses'. Herzing (1999) reported that common and bottlenose dolphins in the Bahamas interacted with swimmers for an average of eleven minutes before they lost interest and departed the area. In Port Phillip Bay, Victoria (Australia) a study of swimming-with-dolphins tours found that the mean individual swim time for participants was just three minutes (Scarpaci et al., 2003). Similarly, Scheer, Hoffman and Behr (2004) reported that swim-with interactions involving free-ranging short-finned pilot whales in the Canary Islands lasted between 12-14 minutes on average. While at the time of writing there are no published accounts of the duration of interactions for swim-with programs involving larger baleen whales (e.g. swim-with humpback whales tourism in Tonga and in the Dominican Republic) anecdotal reports to the author from GBR SWW participants that have experienced the SWW programs in these locations suggest that such encounters were much shorter than those with dwarf minke whales in the GBR. Even for other large marine animals that are the subject of dedicated swim-with programs (e.g. pinnipeds and whale sharks) such long encounter durations appear to be uncommon (e.g. Scarpaci, Nugegoda & Corkeron, 2005; Davis, Banks, Birtles, Valentine & Cuthill, 1997).

Mangott (2010) states that dwarf minke whales' behaviour (i.e. prolonged voluntary interactions and close approaches to humans) differs from most free ranging wildlife that encounter humans in both terrestrial and marine environments. He described dwarf minke whales' behaviour as 'exceptionally exploratory' and found that as an individual whale's familiarity with vessels and swimmers increased (i.e. over repeat encounters) they made closer approaches. This exploratory (also described as curious, inquisitive or 'friendly') behaviour emerged as an additional outstanding feature of the SWW experience and is explored below in further detail.

Inquisitiveness and initiation of approaches

The perception or recognition that interactions are 'on the whales terms' (with approaches to stationary swimmers initiated by the whales, rather than vice-versa) is a particularly important feature of SWW participants' experiences and is again

associated with the distinctive and unusual 'exploratory' behaviour shown by dwarf minke whales (Mangott, 2010). Most other swim-with programs involving marine 'megafauna' (i.e. large animals such as cetaceans, pinnipeds and whale sharks) involve vessels approaching an individual or group of animals and placing swimmers in proximity to them, or in the animals' path of travel (e.g. Davis et al., 1997; Scarpaci et al., 2005; Curtin, 2006; Curtin & Garrod, 2008).

The whales' inquisitive behaviour and closeness of approaches (with occasional eye contact between human and whale) led several respondents to interpret their interactions as a product of mutual curiosity and interest (e.g. "You feel them watching us as much as we are watching them;" and "Who's looking at who?" <*sic*>). DeMares (2000) describes this phenomenon as 'reciprocity of process' and links it to the emergence of a 'peak experience' among many whale watching participants. Maslow (1968) first described the psychological state of a 'peak experience,' which is characterised by a sense of connectedness to one's self and life, joy, excitement, exhilaration, aliveness and harmony.

Experiencing a 'sense of wonder', perceived mutual interest and a feeling of personal 'connection' to another species has been documented in other wildlife tourism studies, predominantly involving primates and marine mammals (Shackley, 1996; Amante-Helweg, 1996; Curtin, 2006). Eye contact in particular has been described as a profound element of tourists' experiences with cetaceans and is also associated with 'peak experiences' in wildlife watchers (DeMares & Krycka, 1998; DeMares, 2000; Curtin, 2006).

The personal and self-reflective element of the experience reported by some respondents is potentially responsible for triggering some of the anthropomorphic comments (e.g. "*They were so curious, gentle and smart*"). 'Human-like' characteristics such as these influence people's interpretation of the animal's behaviour, which is compared with that in humans. Anthropomorphism (the tendency to ascribe human characteristics when interpreting other species) has been documented in responses from dolphin-watching tourists (Amante-Helweg, 1996) and such perceptions of dwarf minke whales are evident in some SWW participants' questionnaire responses.

Physical and aesthetic characteristics

Many respondents included descriptions of the whales' physical characteristics in their statements, most common among which were references to the whales' beauty and size. Whilst dwarf minke whales are relatively small when compared to their congenerics (being the second smallest of baleen whales) for many SWW participants it is likely that these were the largest animals (at least in the marine environment) that they had ever encountered in such close proximity (e.g. "*Biggest animal I've seen in the ocean, beautiful creatures, relaxing to watch, it's great that they approach people*"). The physical and aesthetic characteristics of cetaceans have been found to be important contributing factors to their appeal to tourists. Tremblay (2002) notes that perceived 'charisma' possessed by some wildlife is a complex attribute which encompasses aesthetic characteristics such as 'cuteness', behaviours that relate to humans (e.g. playfulness) and their 'approachability'. Large size, mammalian features and perceived intelligence (inferred from brain size and social habits) are additional attributes of animals that are considered most appealing to wildlife tourists (Shackley, 1996; Tremblay, 2002).

Management and interpretation

An unexpectedly high proportion of respondents indicated that the manner in which their encounters were managed contributed to their satisfaction with the experience. It appears in many cases that such comments were associated with consideration for the whales' welfare, with compliance on the part of other passengers and with facilitation of the experience in a smooth manner. Conversely, a number of negative responses associated with the management of encounters were associated with poor facilitation of the experience (e.g. too many people or poor organisation). Birtles et al. (2002b) identified pre-encounter briefings of SWW participants as the most important feature associated with passengers' perceptions of a well-managed interaction. In this study, good interpretation and preparation for minke whale encounters also contributed to respondents' satisfaction with their minke whale experience (Table 4.12).

A comparison of questionnaire respondents' satisfaction ratings in this study with the previous assessment of satisfaction with the minke whale experience reported in

Valentine et al. (2004) reveals no discernable difference – both present very high mean rating scores for live-aboard respondents (9.02 and 9.00 out of 10 respectively). A comparison of these two mean ratings of how well respondents' expectations were met by the experience are again very similar (4.19 out of 5 for live-aboard respondents in this study and 4.33 in Valentine et al. 2004). Whilst such rating scores represent only a superficial indication of tourists' satisfaction, such consistency across a temporal gap of more than five years between sampling periods (1999-2000 for Valentine et al. and 2006-2008 for this study) during which (a) the Code of Practice was voluntarily adopted by SWW operators (in 2002) and (b) SWW endorsements were issued to operators by the GBRMPA (in 2003) requiring adherence to the Code, suggests that the quality of the SWW experience for participants is undiminished by these significant developments.

The presence of researchers on some live-aboard SWW trips also contributed positively to some respondents' minke whale experience. The proportion of trips on which researchers were present is shown in Appendix 7. When on-board (in addition to their observation and data recording duties), researchers usually present one or more evening slide-show presentations to guests about dwarf minke whale biology and research, and are accessible to guests throughout the trip and answer many of their questions about the whales. One live-aboard operator (*Undersea Explorer*) consistently provided in-kind vessel berths for researchers each minke season (from 1996 to 2008) and conducting minke whale research was promoted as one of the primary objectives of their itineraries (as reported in Chapter 3). Other live-aboard operators in recent years seem to have recognised the additional value of having a 'minke whale expert' on board to share their knowledge with passengers (as well as potential additional marketing advantages for attracting ecotourists interested in learning about such research) and the number of in-kind berths they have offered to Minke Whale Project researchers increased substantially over the three years of this study (as shown in Appendix 7).

4.5.2 Values and benefits of the GBR minke whale experience

In their review of community and personal benefits attributed to parks and wilderness in the U.S., Roggenbuck and Driver (1999) argue that their National Wilderness Preservation System would not exist without the widespread recognition of such benefits. Understanding the values and benefits of wilderness and wildlife resources is therefore a critical component of their allocation, management and protection. Facilitated/commercial uses of wildlife and wilderness, for example wildlife tours, provide important experiential benefits to the tourists, as well as economic benefits to tourism operations which flow through the community. Roggenbuck and Driver (1999) identify additional 'off-site' benefits including the proximity of the resource as a source of community satisfaction and pride.

4.5.2.1 Values and benefits for SWW participants

Results from this study show that the GBR swimming with dwarf minke whales activity has many experiential attributes that have been shown to contribute to a 'peak experience' among wildlife watching tourists. Such experiences provide numerous benefits to the well-being and psychological condition of humans, including relief from stress, happiness and euphoria, increased awareness and learning, social/group cohesion and 'self-actualisation' (Maslow, 1968; DeMares & Krycka, 1998; Roggenbuck & Driver, 1999). Self-actualisation is described as a feeling of personal development, connectedness to life and the world, accompanied by a sense of inner peace and harmony and is theorised to be the highest level of tourists' motivation when seeking travel experiences (Pearce, 1988; adapted from Maslow's "hierarchy of needs", 1968). The desire to repeat an experience has also been found to be associated with other 'peak' wildlife watching experiences (Curtin, 2006; Dobson, 2007). This study found that more than a third (36.5%) of 2008 live-aboard respondents indicated that they were very likely to return (or would definitely return) to the GBR to see minke whales again in the future (see Table 4.15).

Enhanced environmental awareness

Personal development resulting from 'peak' wildlife tourism experiences has been documented to change participants' perceptions and attitudes of the animals involved. Dobson (2007) reported that the negative perceptions of sharks held by many shark-diving tourists' (e.g. as 'ruthless man-eaters') were broken down when they observed the shark(s) in their natural environment, resulting in greater appreciation.

When asked if the minke whale experience had changed them in any way, many SWW participants indicated an increased awareness of whales, conservation and the environment (Table 4.14). Such responses have been identified in other wildlife tourism studies, for example Schänzel and McIntosh (2002) showed that penguin watching tourists in New Zealand experienced 'mood' benefits and reported enhanced environmental awareness. 'Peak experiences' themselves however do not necessarily generate a greater environmental awareness. Curtin (2006) compares tourists' recollections from swimming-with-dolphins programs in the wild and in captivity. Both wild and captive dolphin swims resulted in the achievement of 'peak experiences' among participants. However, captive dolphin swimmers tended to be more anthropocentric (i.e. perceiving that the dolphins were provided for their personal entertainment), possibly due to the zoo-like setting and the unnatural portrayal of dolphins to correspond with their popular media stereotypes. Curtin refers to this as to the 'Disneyfication' of the animals and their kingdom. The authenticity of the setting (i.e. viewing the animal in its natural habitat) combined with appropriate interpretation of the experience, are thus important elements for achieving enhanced awareness, understanding and appreciation of wildlife and their environment.

Whilst the relationship between environmental attitudes and the adoption of environmentally-friendly behaviours is not yet well established, providing appropriate interpretation in association with peak wildlife experiences is considered to affect longer-term changes in tourists' environmental attitudes and potentially their behaviour (Orams, 1995; Townsend, 2003).

4.5.2.2 Values and benefits to the tourism industry

From the results shown above it is clear that dwarf minke whales have a high business value for SWW-endorsed live-aboard vessels, with 36.6% of questionnaire respondents on live-aboard trips indicating that their primary reason for taking their GBR trip was to see and/or swim with dwarf minke whales. Responses from live-aboard operators interviewed in the Key Informant Stakeholder (KIS) survey confirm their awareness that a significant proportion of their business depends on providing SWW interactions during the minke whale season, however the extent of this varied between operators and was related to the extent to which they marketed minke whale encounters. Encounters with minke whales however were recognised by all SWW-endorsed live-aboard operators as one of the best (if not *the* best) wildlife encounters their operation provided, among other wildlife interactions such as close encounters with sharks (attracted with food at Osprey Reef in the Coral Sea) and potato cod (also fed by several operators at the Cod Hole).

The values and benefits of dwarf minke whales and the SWW activity to the SWW-endorsed day boat operators differed from the live-aboard operators in several ways. Interactions with the whales were clearly recognised as enhancing day-boat passengers' experiences when they occurred, but were considered a rare 'bonus' and were not perceived to be an important component of their overall product. Occasional sightings of dwarf minkes as well as humpback whales did however provide opportunities to market their operation in local news media via press releases detailing the sightings accompanied by photos. Possessing one of the few available SWW-endorsements also appears to have given these operators a slight marketing advantage over non-SWW-endorsed local day-boat operators: 7.5% of day-boat passenger questionnaire respondents indicated that the opportunity to see and/or swim-with dwarf minke whales had influenced their choice of vessel (Table 4.5; *NB. all three SWW-endorsed day-boats advertised their possession of a SWW permit on their websites and in their brochures over 2006-2008 and still do at the time of writing*). However, the fact that the SWW-endorsed day-boat operators' itineraries did not vary in response to the minke whale season (i.e. no active searches for whales were conducted and vessels did not stay longer at sites if whales were encountered) and that their itineraries are almost identical to many other non-SWW-endorsed day-boat

operators that visit the same Reef system and share many of the same sites and moorings, indicates that passengers have no greater chance of encountering dwarf minke whales on these vessels than they do on most other non-SWW-endorsed day-boats in Port Douglas.

The advertising of minke whale encounters by the SWW-endorsed day-boats has the potential to be misleading due to the relatively low occurrence of minke whale sightings. More than one quarter (26.3%; n=152/576) of day-boat respondents indicated that they expected to see minke whales on their day-trip however only 42 of these people actually saw minke whales and only 18 swam with them. The low probability of encountering minke whales by the SWW-endorsed day-boats (as reported in Chapter 3) should therefore be made clear in the marketing materials of these vessels to avoid disappointment among clients eager to see and/or swim with the whales.

4.5.2.3 Local community benefits

Almost a quarter of questionnaire respondents on the SWW live-aboard vessels indicated that seeing minke whales was the primary reason for their visit to the local region. This finding is similar to that reported by Valentine et al. (2004), and this tourism market segment represents a substantial economic contribution to local community. A recent study by Stoeckl et al. (2010a) found that each year the five live-aboard dive-vessels that utilise the Ribbon Reef region (four of which hold SWW-endorsements) contribute between $16.1 and $27.6 million (depending on the choice of regional multiplier) to the regional economy. During the months of June and July, a substantial proportion of these vessels' regional economic contribution can therefore be attributed directly to their encounters with dwarf minke whales and this is the subject of a follow-up study investigating the relative proportions that are attributable to individual marine species (Stoeckl et al., 2010b).

Dwarf minke whales, like other whales, dolphins and other animals that form the basis of a dedicated wildlife tourism industry, can be regarded as wildlife 'icons' of their region. Stoeckl, Smith, Newsome and Lee (2005) found substantial regional

economic benefits and to an extent some 'dependency' in the Monkey Mia and Hervey Bay communities that was attributed to tourism based on their marine wildlife icons (dolphins and humpback whales respectively). Regional economies that rely heavily on tourism, such as Cairns and Port Douglas, are particularly vulnerable to rapid declines caused by global events beyond their control (Stoeckl et al., 2005). Recent events that are widely regarded to have affected global tourism travel include terrorism events and war (e.g. events of 11th September 2001 and the 2003 US military invasion of Iraq), pandemic diseases (e.g. SARS in 2002/03) and economic recession (e.g. the 2008/09 Global Financial Crisis). The effects of such events are exacerbated in long-haul destinations such as Australia and remote Far North Queensland. Towards the end of this study (end 2008 and early 2009), two of the five SWW-endorsed live-aboard operators ceased trading, with one publicly citing the effects of the Global Financial Crisis as the reason for closure (Port Douglas & Mossman Gazette, 2009). It is possible that new operators will take the places of these two, however they will need to be sufficiently resilient to absorb similar impacts that may occur in the near future.

Wildlife icons are frequently used in tourist destination marketing. Tremblay (2002) proposes that these iconic animals become symbols of place and culture, and tourists relate to them with a mixture of cognitive and affective values. Findings from the KIS survey revealed that SWW-endorsed operators recognise the uniqueness of the GBR dwarf minke whale phenomenon (i.e. the predictable aggregation of this species and aspects of the swim-with-activity are not known to occur anywhere else in the world) and consider this to be an important marketing advantage at a destination level when competing with other diving destinations around the world. In 2004, dwarf minke whales were considered by the Queensland State Government in a short-list of marine species from which one animal was selected (which eventually was the Barrier Reef anemone fish, *Amphiprion akindynos*) as the State Aquatic Emblem (CRC Reef Research Centre, 2004). Whilst dwarf minke whales feature prominently in the brochures and websites of the SWW-endorsed operators, there is presently no wider promotion of the whales as a regional wildlife icon at a destination-level (i.e. for Cairns, Port Douglas or Far North Queensland), however it is possible this may develop in future. Care must be taken however to ensure any such promotion of the GBR SWW experience (including that by the SWW-endorsed operators) is done

responsibly and does not foster unrealistic expectations of the experience in an attempt to attract visitors. Tremblay (2002) recommends that appropriate presentation of iconic wildlife watching experiences should include an authentic portrayal of the animal, its behaviour and environment, and warns that there is a potential for animal icons to develop undesirable symbolic value if they become impacted by tourism and gain negative publicity.

4.5.2.4 Management values and benefits

Non-industry KIS respondents (Reef managers, wildlife NGO representatives and researcher) highlighted a range of different values and benefits associated with dwarf minke whales and the GBR SWW activity than those identified by industry representatives. At a personal and professional level, these respondents did not consider dwarf minke whales as a more 'important' species than any other. Reef managers perceived the SWW activity (in the context of its development over the Dwarf Minke Whale Tourism Monitoring Program) as a good opportunity to engage with other stakeholders in collaborative management. Reef managers also saw the SWW activity as an opportunity to promote ecologically sustainable management to the tourists themselves.

KIS representatives of wildlife conservation NGOs indicated a high level of professional interest in the development and management of the GBR SWW activity, citing concerns for the potential impacts generally associated with swimming-with-cetaceans programs. The Whale and Dolphin Conservation Society (WDCS) for example has a policy to not support commercial swim-with-cetaceans programs, stating that harassment of the animals can lead to disruptions to feeding, resting, nursing and other behaviours and can potentially cause long-term impacts on the health and wellbeing of individual cetaceans as well as at a population level (WDCS, 2009). All non-industry KIS respondents however perceived the management of the GBR SWW activity as a good model when compared with other examples of whale watching and marine wildlife tourism worldwide.

4.5.2.5 Research benefits

The presence of researchers on board some SWW trips contributed to the satisfaction of many SWW participants (Table 4.12). Needless to say, the in-kind contribution of vessel berths by the SWW operators greatly benefitted the research and monitoring of the whales and the SWW activity. As highlighted in Chapters 3 and 5, research and monitoring data returns increased in each of the three years of this study as did the number of researcher places provided aboard the vessels. The growing proportion of passengers on the live-aboard vessels that take underwater photographs and video footage (from approx. 37% of the 2006 sample to 48% of the 2008 sample) is also likely to have contributed to the increasing photo-identification data returns reported by Sobtzick (2011). When combined with a 'peak wildlife experience', the opportunity for on-board marine scientists to augment the interpretation of the SWW experience for tourists in an authentic manner has the potential to deepen or reinforce the environmental awareness the tourists gain. Participation in such trips also provides researchers the opportunity to communicate findings and outcomes of their research directly with end-users (i.e. tourism operators, crew and tourists), to observe and understand industry and tourist perspectives, and to learn new insights from discussions with experienced crew and passengers.

4.5.2.6 Benefits to the whales

The Australian Green Party Leader, Senator Bob Brown said recently of the value of Australian wilderness and wildlife: "If you can't put a dollar price on it … politicians can't understand it" (Presentation at James Cook University Mayo Law Lecture, 21/8/09). Wildlife tourism creates an economic value for the wildlife that are utilised. Whilst it is unfortunate that the non-monetary values of wildlife and wilderness are so often overlooked, the increased attention that wildlife and wilderness tourism can bring to species or habitat, combined with the associated economic value, can provide impetus to its protection and conservation.

The GBR SWW industry represents the only non-consumptive commercial use of dwarf minke whales. Whilst the Japanese 'scientific' whaling program in the

Southern Ocean does not currently target dwarf minkes, their continued exploitation of the IWC loophole allowing whaling for scientific purposes and their expanding quotas for an increasing number of species (e.g. Antarctic minkes, humpbacks, fin, sei and Bryde's whales; ICR, 2002; Bowett & Hay, 2009) raises concerns that dwarf minkes may be targeted in the future. Such concerns were evident in some statements by questionnaire respondents when asked if they felt they had been changed in any way by their minke whale experience (e.g. "*Made me even more incredulous about hunting whales*"). Through their familial association to Antarctic minkes, dwarf minke whales in the GBR and the SWW activity can raise tourists' and the wider public's awareness of the whaling issue and can promote non-consumptive values of minke whales and other cetaceans.

There is also a potential for the GBR SWW tourism industry to promote wider conservation issues for the marine environment, which is facing increasing degradation associated with unsustainable human activities including overfishing and pollution, as well as rising sea surface temperatures and acidification associated with climate change. World leading coral reef and climate scientists predict catastrophic changes to the ecology of the world's coral reefs and the productivity of oceans within the next century unless urgent action is taken to reduce atmospheric CO_2 production by humans (Veron, 2008). Birtles et al. (2001a) noted that wildlife tourism operators have a special opportunity and indeed a real responsibility to raise tourist's awareness of environmental conservation issues, by combining affective wildlife experiences with appropriate and high quality interpretation. Wildlife and nature tourism operators have much to contribute to and gain from the improvement of the wider public's awareness and understanding of human impacts on the environment, as the wildlife and environments on which these operators depend are increasingly threatened.

Whilst this study showed strong positive emotional responses among many SWW participants, and a proportion of participants indicating that they had been changed in some way (Table 4.14). The 'peak' nature of the SWW experience, when combined with high quality interpretation has the potential to influence longer-term changes in the environmental attitudes and behaviour of participants, however measuring such changes and attributing the cause(s) is inherently difficult. Stories and anecdotes

involving past SWW participants known to the author suggest that some people have attributed some of their long-term behavioural changes to their SWW experience (the author included). Further research to quantify the potential for such changes, and the elements that contribute to such outcomes is highly desirable. Research and other efforts directed at maximising the possible benefits for the whales and their habitat should also be strongly supported by the operators that depend on continued interactions with these whales.

Other tangible benefits resulting from the SWW experience include participants' direct contributions to research and monitoring, through their donation of underwater photos and video footage to a long-term photo-identification study (Sobtzick, 2011), and financial contributions to the Minke Whale Project to support ongoing research.

4.5.3 Summary

This study provides the first comprehensive evaluation and description of the key elements that contribute to the GBR swimming-with-dwarf minke whales experience. A number of these elements are in common with other marine wildlife tourism experiences (e.g. swimming-with-dolphins) however some appear to be unique to dwarf minke whales (e.g. the extended duration of encounters, the initiation of interactions by the whales and their highly inquisitive behaviour leading to very close approaches to SWW participants). The management of the in-water interactions and interpretive/educational aspects on the vessels were also found to be important elements of the SWW experience. These elements contributed to affect a powerful 'peak' wildlife watching experience for a high proportion of the SWW participants. These peak experiences provoked an increased awareness of whales, the marine environment and conservation issues among many participants.

Many differences in the minke whale experience were found between the live-aboard and day-boat SWW endorsed vessels. Live-aboard passengers experience more numerous and closer whale interactions for much longer durations than do day-boat passengers. Passengers on SWW-endorsed day-boats have a relatively low probability of seeing dwarf minke whales on any given day-trip and only a small

proportion of these passengers experience an in-water interaction. Day-boat passengers that did experience an in-water interaction with dwarf minke whales however reported significantly higher satisfaction levels than those who observed the whales from the vessel only. Many day-boat passengers expected to see minke whales on their trip and did not. Marketing of the SWW experience by the SWW-endorsed day-boat operators is therefore potentially misleading to their clients as it does not reflect their low probability of encountering minke whales.

A wide range of social values of dwarf minke whales and benefits of the SWW activity were identified for the SWW industry, tourist participants, managers, researchers, other key stakeholders and the local community. Dwarf minke whales are a wildlife icon for Far North Queensland. Their predictable annual winter aggregation and interactive behaviour is a unique drawcard for the region and is a primary attraction for many overseas and interstate visitors. The collaborative management of the SWW activity that has occurred over recent years has enabled managers, SWW tourism operators, researchers and other key stakeholders to engage with and learn from one another, and promote the sustainable use of the whales and the GBR to Reef tourists.

Chapter 5: Management of the swimming-with-whales activity

5.1 Introduction and chapter objectives

5.1.1 Management framework

Management of whale watching in Australian waters is principally governed by the Environment Protection and Biodiversity Conservation (EPBC) Regulations 2000 (Commonwealth of Australia, 2000), which specifies that due to their protected status, whales and dolphins must not be killed, taken, injured or interfered with. These and other regulations outlining vessel interaction protocols are mirrored in the Great Barrier Reef Marine Park Regulations 1983 (GBRMPA, 1983). These regulatory protocols are combined with other guidelines and recommendations for managing whale watching via various platforms (e.g. vessels, aircraft) in the somewhat more accessible and user-friendly *Australian National Guidelines for Whale and Dolphin Watching 2005* (Commonwealth Department of the Environment and Heritage, 2005). These Guidelines set a national standard for all cetacean watching activities, with the aim of minimising potential impacts on individual cetaceans and populations. These Guidelines also allow for additional or alternative levels of management under a two-tiered structure: Tier One consisting of nationally applicable minimum standards and Tier Two allowing for species and/or location specific management protocols. National standards (under Tier One) for in-water interactions with cetaceans (i.e. swimming and diving) effectively prohibit the activity on a commercial or deliberate basis, by specifying that "*swimmers (including snorkellers) and divers should not enter the water closer than 100m to a whale or 50m to a dolphin, and should not approach closer than 30m to any animal*" (p.14). In cases where cetaceans approach people already in the water, these people are not in contravention of the guidelines, however they must not swim towards a whale or attempt to touch it, and are advised to move slowly to avoid startling a whale.

5.1.2 Management of the GBR swimming-with-whales activity

The *Code of Practice for dwarf minke whale interactions in the Great Barrier Reef World Heritage Area* (Birtles et al., 2008) provides a number of additional and unique management protocols for this species and location-specific activity, falling under Tier Two of the national guidelines. A Code of Practice was originally proposed by Arnold and Birtles (1999) in response to concerns about inappropriate behaviour by swimmers and divers who were often being approached by the whales at popular dive tourism sites during the winter months. Based on field observations of in-water interactions the use of surface ropes was recommended, which swimmers (using snorkel) hold onto in order to remain relatively still and predictable in the water. This approach was shown to be very effective for managing the swimmers whilst allowing the whales to approach and move freely around and underneath the static snorkelers. Swimming-with-whales participants were also often approached closely, resulting in high levels of tourist satisfaction (Birtles et al., 2002a; Valentine et al., 2004).

Following refinement of the Code of Practice in 2001 (based on field evaluations and industry feedback; Birtles et al., 2001b), tourism operators conducting SWW activities came together at a workshop and formally agreed to adopt the Code to manage their SWW interactions. Up until this time, the majority of minke whale encounters in the GBR were reported by six live-aboard dive vessels (as described in Chapter 3) and the Code had been developed for these vessels, which carried a maximum of 12 to 30 passengers (*NB. the CoP recommended a maximum of only 12 snorkelers spread along on two surface ropes at any one time during in-water interactions*). In 2003, the Great Barrier Reef Marine Park Authority (GBRMPA) placed a cap on the SWW activity and issued special new endorsements (often referred to as 'permits', however the endorsements were attached to the operator's existing Marine Parks tourism permit) to nine operators to carry out SWW activities in the Offshore Port Douglas and Ribbon Reef Sectors of the GBRMP (as shown in Fig 3.1, Chapter 3). Among the new 'permitees' were three day-boat operations, carrying between 40 and 90 passengers.

The possession of a SWW-endorsement allows an operator to: "*(i) place swimmers in the water for the purpose of swimming with whales, (ii) place swimmers in the water less than 100m (but not closer than 30m) from dwarf minke whales, and (iii) use an aircraft or additional vessel to find whales*" (Birtles et al., 2008; p.1). The two permit conditions for the SWW-endorsed operators included (1) adhering to the Code of Practice and (2) completing and submitting Whale Sighting Sheets for all dwarf minke whale encounters.

In 2003, the GBRMPA initiated and provided funding for the Dwarf Minke Whale Tourism Monitoring Program, a six-year period of research and monitoring of the SWW activity carried out by the Minke Whale Project (led by Birtles, Arnold & Valentine). Tasks associated with the Monitoring Program included analyses of the Whale Sighting Sheets and the organisation of annual Pre- and Post-Season Workshops for key stakeholders to review management of the SWW activity and evaluate its sustainability. In 2008 the Code of Practice was revised and updated with the involvement of stakeholders (Birtles et al., 2008). The process by which the Code was revised is reported and evaluated below as part of this study.

In 2010, following the completion of the Dwarf Minke Whale Tourism Monitoring Program and its final report (Birtles et al., 2010) the GBRMPA initiated a review of the GBR SWW activity. The outcomes of this review have not been publicly announced at the time of writing.

Management agency compliance and monitoring presence in the study area

A request was made by the author to the GBRMPA to quantify the number of days during the 2006-2008 minke whale seasons (June and July) on which Marine Parks compliance staff were conducting monitoring in the study area (Fig 3.1, Chapter 3). Unfortunately such information could not be released, however no members of the Minke Whale Project research team reported any sightings of a management agency vessel during fieldwork over this period. Staff from the GBRMPA and Queensland Parks and Wildlife however did participate in trips aboard the SWW-endorsed vessels during the 2008 minke seasons, either as a full-fare paying passenger (n=1) or as a volunteer research assistant for the Minke Whale Project (n=3). In all of these cases the identity and affiliation of the person was known to the operator.

5.1.3 Previous research contributing to management of the SWW activity

Previous studies that have contributed to the current management of the GBR SWW activity include the initial field evaluations of management protocols in the Code of Practice (Arnold & Birtles, 1999; Birtles et al., 2001b), studies of SWW participants' experiences and perceptions (Curnock, 1998; O'Neill, 2000; Birtles et al., 2002b; Valentine et al., 2004), evaluations of interpretive tools (Smith, 2000; Komiya, 2002; Hasling, 2003; Hawthorne, 2003) and an investigation into the management of minke whale encounters on SWW-endorsed day-boats (Mangott, 2004; 2005). Outcomes of experiential studies included elucidation of passenger perceptions of the effectiveness of specific management protocols and the identification of pre-encounter briefings as the most important attribute of well-managed SWW interactions (Birtles et al., 2002b). Mangott's studies (2004; 2005) of day-boat encounter management identified difficulties associated with preparing larger numbers of mostly inexperienced snorkelers for SWW interactions on these vessels. Time restrictions and communication difficulties on these vessels made the delivery of pre-encounter briefings challenging, particularly when minke whale encounters occurred infrequently and unpredictably. Recommendations arising from this study included practical suggestions to assist the delivery of key messages from the Code of Practice to SWW participants before they entered the water.

5.1.4 Context & objectives for Study Three

Study Three sought to evaluate the management of the GBR SWW activity in an holistic appraisal, including the practical application of the Code of Practice during minke whale encounters, as well as the overarching processes and decisions that affected the management of the SWW activity and industry. Key questions for the study included:

- How effective is the current management of the SWW activity?
- To what extent are SWW-endorsed operators complying with the Code of Practice?

- How effective are the current management processes (i.e. the stakeholder workshops) at addressing management issues?
- Are stakeholders satisfied with current management processes and outcomes?

Specific objectives of Study Three were therefore to:

1. Evaluate the management processes and outcomes of stakeholder workshops held over 2006-2008.
2. Identify key management issues associated with the SWW activity as perceived by tourism operators, managers and other stakeholders.
3. Evaluate the roles of vessel crew in the management of SWW interactions and explore ways of ensuring high standards of encounter management.
4. Investigate SWW participants' perceptions of the management of their minke whale encounters.
5. Evaluate the potential use of passenger surveys as a compliance monitoring tool.

5.2 Methods

A mixed method approach was taken to address the study objectives and four sources of data were drawn upon for analyses, including:

(1) Minutes of stakeholder workshops,
(2) Interviews with stakeholder key informants (Key Informant Survey, as outlined in Chapter Four; including tourism operators, managers and representatives from wildlife conservation NGOs),
(3) Interviews with experienced crew from SWW-endorsed vessels, and
(4) Passenger questionnaires from tourists on SWW-endorsed vessels, collected over three minke whale seasons (2006-2008).

5.2.1 Analysis of stakeholder workshops

The author helped to organise and participated in seven Dwarf Minke Whale Tourism Monitoring Workshops, held between May 2006 and December 2008. All workshops were held in Cairns at a hired venue. These workshops, funded by the GBRMPA under the Dwarf Minke Whale Tourism Monitoring Program were held biannually (pre- and post-minkes season) from 2003-2008, for the purpose of reviewing the SWW activity and its management. An additional special workshop was held in April 2008 to revise the Code of Practice and develop sustainability objectives.

Key stakeholders that attended all workshops included SWW-endorsed operators, representatives from the GBRMPA and Minke Whale Project researchers. Representatives from Queensland Parks and Wildlife (QPW; Marine Parks) also attended regularly. Additional invitations to each workshop were also extended to the Commonwealth Government's Cetacean Policy and Recovery Section, the Whale and Dolphin Conservation Society (WDCS) Australasia and the International Fund for Animal Welfare (IFAW) Asia Pacific, however representatives from these organisations only attended some workshops. Invitations were not extended to other Reef tourism operators (i.e. non-SWW-endorsed operators) at the specific request of the GBRMPA.

The format of these workshops was well-established prior to the commencement of this study. Several individuals from the different stakeholder groups (industry, managers and researchers) attended these workshops continuously through the Dwarf Minke Whale Tourism Monitoring Program. The ongoing involvement of these key personnel contributed greatly to the progress and outcomes of the workshops, due to their familiarity with other stakeholders' perspectives and their understanding of the management issues.

At the commencement of this study in 2006, formal minutes of the workshops were instituted, with the author assuming the role of rapporteur. Draft minutes of each workshop were circulated to participants for comments and corrections were incorporated into a final draft which was adopted at the next workshop. Electronic

copies (PDF format) of the finalised minutes were uploaded to a password-protected website that was accessible to all participants.

Summaries of management discussions, key decisions and outcomes from each workshop, including the number of attendees from each stakeholder group, are presented below (Section 5.3). These workshop summaries are de-identified (and the full minutes withheld) for confidentiality reasons. Copies of the agenda for each workshop however are included as Appendix 5.

5.2.2 Key Informant Stakeholder interviews

A detailed description of the stakeholder Key Informant Survey (KIS) participants and the interview format are outlined in the previous chapter (Section 4.2.2). Interview questions for this study were focussed on the management of the SWW activity, for example impressions with current management, compliance and reporting of incidents, the Code of Practice and perceptions about the future of the industry and ongoing management of the SWW activity. The complete list of interview questions is provided in Appendix 16.

5.2.3 Crew interviews

Semi-structured interviews were conducted with crew from SWW-endorsed vessels. Respondents were selected on the basis of recommendations from owners/managers of the SWW operations, for being highly experienced with managing and observing minke whale interactions. A stratified sample (n=15) was selected across the SWW-endorsed vessels, including both live-aboards and day-boats. It was made clear that neither the identity of the respondents nor the vessel/operation for which they worked would be identified with any statements made during the interviews. Interviews were recorded and transcribed for subsequent analysis. Interview questions (included as Appendix 18) focussed on practical issues associated with management of minke whale encounters, including: perceptions of the effectiveness of the Code of Practice, perceptions of management of minke whale encounters on their vessel, concerns for

potential impacts on the whales, the preparedness of passengers for in-water interactions, the value of interpretive materials and the potential for additional training for crew to assist their management of encounters.

5.2.4 Passenger questionnaires

A detailed description of the passenger questionnaire, the sample achieved and data analyses (including statistical analyses and content analysis of open-ended questions) is provided in the previous chapter (Section 4.2.1). This study drew on specific questions that were relevant to the management of the SWW activity, including passengers' ratings and perceptions of the management of their minke whale encounter(s), their preparedness for in-water interactions and the information provided to them about minke whales on their Reef trip. Several new questions were added to the questionnaire in 2008 (Appendix 13), for evaluation as potential management/compliance sustainability indicators. These new questions are identified in the results (Section 5.6).

5.2.5 Development of an interpretive DVD

In 2007 an interpretive DVD ("Meet the Minkes"; Appendix 3) was developed for use by SWW endorsed operators as an interpretive tool, to promote awareness of the Code of Practice and compliance with its protocols. A 15 minute segment was written by the author, accompanied by underwater and surface footage, illustrating key management protocols for SWW participants and encouraging their contributions to the research data collection. Two additional 15 minute DVD chapters were also developed by Minke Whale Project research colleagues and added to the final DVD to address specific objectives of their studies, based on the biology and photo-identification of the whales (Sobtzick, 2011) and their behaviour (Mangott, 2010). The DVD was distributed to all SWW-endorsed operators prior to the commencement of the 2007 minke whale season. The use and effectiveness of the DVD as an interpretive tool was explored in the passenger questionnaires, with results reported below.

5.3 Results: stakeholder workshop processes and outcomes

Workshop participation

Attendance at the workshops ranged from 20 to 37 participants, with a minimum of six SWW-endorsed operators attending (for three workshops) and a maximum of all nine attending one workshop (Table 5.1 below). Industry representatives included business owners (one to four per workshop), operations managers (three to five per workshop), administrative staff and vessel crew (three to eleven per workshop). Between one and four representatives of the GBRMPA attended each workshop. One or two representatives of the Queensland Environmental Protection Agency/Parks and Wildlife (EPA/QPW) were present at five of the seven workshops. Representatives of the Commonwealth Government's Cetacean Policy and Recovery Section (based in Canberra), the Whale and Dolphin Conservation Society Australasia (WDCS; based in Adelaide) and the International Fund for Animal Welfare Asia Pacific (IFAW; based in Sydney) attended one workshop each.

Table 5.1: Summary of attendance at stakeholder workshops, 2006-2008

Workshop	**Industry participants**	**SWW-endorsed operators represented** (No. of owners)	**Management agency participants**	**NGO participants**	**Researchers** (including 3 PhD students)	**Total participants**
2006 Pre-Season *26th May 2006*	**26**	**8** (4)	**2** (GBRMPA)	**-**	**6**	**34**
2006 Post-Season *15th December 2006*	**18**	**7** (4)	**4** (GBRMPA + EPA/QPW)	**-**	**5**	**27**
2007 Pre-Season *25th May 2007*	**20**	**7** (3)	**4** (GBRMPA, EPA/QPW + Commonwealth Cetacean Policy & Recovery Section)	**-**	**4**	**28**
2007 Post-Season *16th November 2007*	**17**	**6** (1)	**4** (GBRMPA + EPA/QPW)	**1** (WDCS)	**5**	**27**
CoP & SO Workshop *18th April 2008*	**13**	**6** (2)	**2** (GBRMPA)	**-**	**5**	**20**
2008 Pre-Season *30th May 2008*	**26**	**9** (3)	**5** (GBRMPA + EPA/QPW)	**1** (IFAW)	**5**	**37**
2008 Post-Season *12th May 2008*	**13**	**6** (3)	**5** (GBRMPA + EPA/QPW)	**-**	**4**	**22**

5.3.1 Workshop format and processes

The format was approximately the same for each Pre- and Post-Season Workshop. Workshops ran for an entire afternoon, lasting between three and 4.5 hours, with a brief break for afternoon tea. Each workshop was chaired by Dr Alastair Birtles (MWP research team leader). Following a brief welcome and introduction, the proposed agenda was reviewed and adopted. Commencing at the 2006 Post-Season Workshop, minutes from the previous workshop were then formally adopted with nominations and seconding from the floor. Brief reports on management policy, initiatives and compliance reporting were then given by management representatives on behalf of each agency in attendance. Additional comments/updates were also provided by representatives of the wildlife conservation NGOs when present. At each Post-Season Workshop, a representative from each SWW-endorsed operator was invited to provide a brief update on their impressions of the previous minke whale season and any management issues that arose. Any such issues (e.g. reports of non-compliance) were added to the agenda for discussion later in the workshop.

A research report/update was given by members of the MWP research team and included PhD study updates by the three PhD candidates (including the author) and preliminary results (at Post-Season Workshops) from the previous minke whale season. These results included:

- a report on the data collected over the season and the industry's contribution to this data collection,
- results from Whale Sighting Sheets and passenger questionnaires,
- photo-ID study findings (e.g. re-sightings of well-known individual whales), and
- highlights from each minke season (e.g. including unusual behaviours observed).

Additionally at each Pre-Season Workshop new data sheets for the coming minke whale season were disseminated and explained, and a range of interpretive materials (including new materials as well as replenishment of existing materials) were distributed.

The second half of each workshop was focussed primarily on the discussion of management issues, including proposed amendments to the Code of Practice (e.g. the introduction of new protocols). Key issues and outcomes are summarised below for each workshop. At the conclusion of each Post-Season Workshop, awards were presented to operators and individual participants for contributions to data collection (e.g. the highest number of each data sheet, most images for the photo-ID study), for the most in-kind access provided to researchers, as well as other categories that arose periodically (e.g. for collecting passenger donations to support ongoing research). Awards included printed certificates (for companies) and chocolate bars (for individuals). Minke whale underwater video footage highlights from each season were also shown at the conclusion of each Post-Season Workshop. Additional pre-season crew training workshops for day-boat crew were held the day after each Pre-Season Workshop, aboard one of the SWW-endorsed day-vessels in Port Douglas.

The format of the special Code of Practice and Sustainability Objectives workshop (held in April 2008) differed due to its specific aims of reviewing and updating the Code of Practice and discussing, fine-tuning and adopting sustainability objectives. A very brief update on research activities was given prior to commencing core business. Outcomes of the first half of this workshop (i.e. revision of the Code of Practice) are presented below. Details of the development of sustainability objectives are reported in Chapter 6.

5.3.2 Summary of key workshop outcomes

A summary is provided below of the key management issues that were discussed, and the outcomes that arose from each of the 2006-2008 stakeholder workshops. These summaries are derived from the workshop minutes and show the process by which emerging management issues were addressed collaboratively by the stakeholders. Among the workshop outcomes were several new management protocols that were incorporated into the Code of Practice. Omitted from the following summaries are details of the regular updates and research presentations given by the Minke Whale

Project (MWP) research team, as well as other routine agenda items (e.g. distribution and explanation of new data collection instruments and interpretive materials).

5.3.2.1 May 2006 Pre-Season Workshop

Based on previous workshop discussions and research findings presented by the Minke Whale Project research team, two new encounter management protocols were introduced for workshop discussion and were proposed as amendments to the Code of Practice: (i) "*Vessel Approach Distances and Departure Protocol*" and (ii) "*Protocol for Behaviour with a Cow and Calf*".

The first protocol included a recommendation that vessels should keep a minimum distance of 1000m (or 0.6nm) from any vessel that is involved in an encounter with minke whales. The basis of this recommendation was observations of whales leaving a moored vessel to approach another vessel that passed within 600-800m of the moored vessel. The proposed new protocol greatly exceeded the requirements of the Australian National Guidelines for Whale and Dolphin Watching (2005), which stipulates that up to three vessels may be present within a 300m caution zone around a whale. While no direct evidence was available to indicate an impact on the whales, such events had previously impacted the experiences of SWW participants on the moored vessels (i.e. associated with the sudden disappearance of 'their' whales). A precautionary approach was also advocated to minimise interruptions to the whales' behaviour and reduce their potential increased energy expenditure in transits between vessels.

The second protocol included recommendations for vessels to exercise greater care if a cow-calf pair is seen. Encounters with cow-calf pairs were noted to be rare, with only a low number of interactions involving calves reported each season. Specific recommendations (that exceeded requirements of the 2005 Australian Guidelines) included: (i) when steaming, stopping the vessel immediately if a cow and calf are seen, (ii) not motoring towards a cow-calf pair (*NB. the 2005 Australian Guidelines and EPBC Regulations stipulate that a calf must not be approached closer than 300m, and that 'swimming should not occur' with calves or pods containing calves*), (iii)

recording additional details (i.e. times of first and last sighting of the calf) in the Whale Sighting Sheet, and (iv) if approached by a cow and calf, delaying the vessels departure (as much as possible) until the pair leave the area. The few encounters with dwarf minke whale cow & calf pairs in the GBR were noted to not last for very long.

Following discussions and feedback from some industry participants at the workshop, minor revisions were made to the new protocols and they were formally adopted as amendments to the Code of Practice, with unanimous support from all workshop participants.

5.3.2.2 December 2006 Post-Season Workshop

It was reported by a GBRMPA representative that new Whale and Dolphin Watching Regulations, associated with the Australian National Guidelines for Whale and Dolphin Watching (2005), had come into effect in June 2006. An implication of the new Regulations was a requirement to update the Code of Practice to conform with changes in terminology, names and legal requirements of the Regulations. It was recommended that when the Code of Practice was updated, it should incorporate all relevant regulations and legislation, for ease of use as a 'one-stop' document for vessel crews. It was recommended that any changes to the wording of protocols should be done collaboratively, involving industry, managers and other stakeholders and that the adoption of these changes should be dependent upon industry approval.

A summary of whale-related incidents (allegations of compliance infringements) for the entire GBRMP that were reported to the GBRMPA during 2006 was presented to the workshop. An industry representative noted that there was reluctance among Reef tour operators to report such incidents due to the small size of the industry and familiarity between operators. Clarification was provided by management agency representatives of the incident reporting process (including requirements to proceed to a prosecution case). Possible compliance actions available to the GBRMPA included: (i) education, (ii) advisory or warning letters, (iii) infringement notices, (iv) prosecution and (v) administrative actions.

Subsequent workshop discussion points included: (i) that several incidents involving SWW activities being undertaken by non-SWW-endorsed vessels were observed during the 2006 season, however none had been formally reported to the GBRMPA, and (ii) the GBRMPA could not act in any way unless such incidents were formally reported. A management representative added that enforcement actions and prosecutions could not be undertaken on the basis of these workshop discussions. Recommendation that arose from these discussions included (i) that if operators were concerned about compliance infringements and potential impacts on the whales and want managers to respond, they must submit formal reports (i.e. Incident Report Forms) to the GBRMPA, and (ii) the compulsory requirement to submit Incident Report Forms could be included as a new protocol in the Code of Practice. Industry participants were urged to consider these recommendations prior to the next workshop.

Feedback was provided by industry participants on the implementation of the "*Vessel Approach Distances and Departure Protocol*" and "*Protocol for Behaviour with a Cow and Calf*" during the 2006 minke season. No problems were noted, however industry participants were encouraged to take careful measurements of approach distances between vessels during the 2007 minke season and report their observations at the 2007 Post-Season Workshop.

5.3.2.3 May 2007 Pre-Season Workshop

An update was given by a GBRMPA representative, which included notification of the recent implementation of a revised Operational Policy on Whale and Dolphin Conservation in the GBRMP (GBRMPA, 2007); *NB. Feedback from the GBR SWW industry stakeholders was sought on a draft of this Policy in 2006; comments were provided by the MWP research team and incorporated*). This new Policy removed limits/caps on the number of whale watching permits in several GBRMP Planning Areas (including the Cairns Planning Area) and introduced a requirement for whale watching-permitted operations to hold 'high standard' eco-certification/accreditation (e.g. as provided through the Nature and Ecotourism Accreditation Program; Ecotourism Australia, 2003). Assurance was given however that the cap on the

number of SWW endorsements would remain in place at least until the industry is reviewed by the GBRMPA, after the completion of the six-year Dwarf Minke Whale Tourism Monitoring Program in 2009.

A representative of the Commonwealth Department of the Environment and Water (Cetacean Policy and Recovery Section) attended this workshop and gave a brief presentation on the Department's role in the protection and management of cetaceans in Australian and internationally. Additional clarification of the Australian National Guidelines (2005) was given, including details and implications of the recently amended whale and dolphin watching regulations.

Other significant outcomes at this workshop included two operations volunteering to assist with fundraising for research operational costs, by facilitating the collection of donations from passengers. A not-for-profit and tax deductible fund had recently been established by the Minke Whale Project for this purpose. These donations would be collected on the basis of a $5 per day levy for passengers on advertised minke whale watching itineraries, however passengers were allowed to opt-out of the levy should they not wish to donate. Remaining operators agreed to facilitate donations from their passengers by circulating donation forms, which could be posted to the MWP.

5.3.2.4 November 2007 Post-Season Workshop

A summary report was given by a GBRMPA representative on whale watching compliance incidents in the GBRMP. It was noted that none had been received relating to dwarf minke whales.

An industry representative reported seeing a minke whale become entangled briefly in a snorkel rope during the 2007 minke season. The event was also witnessed and documented in detail by a MWP research volunteer. This report triggered a detailed workshop discussion on the use of ropes, potential for entanglement and the minimisation of such risks. Recommendations were made for trialling different rope

deployments in 2008 (e.g. different diameters and materials that are less likely to form loops), with operators to report their observations at the subsequent workshop.

An industry representative reported that SWW-endorsed members of the Cod Hole and Ribbon Reef Operators Association (CHARROA; which accounted for seven of the nine SWW endorsement holders) had met prior to the workshop and had passed a resolution to make reporting of all compliance incidents obligatory for all members:

i. 'Minor' (non-regulatory) breaches would be reported initially to the MWP research team on a trial basis for two seasons, with incidents to be discussed at Post-Season Workshops.
ii. Serious breaches (of regulations) would be reported to both the GBRMPA and the MWP research team.

It was suggested that this blanket policy of compulsory reporting by CHARROA members would alleviate pressure from the crew and staff if they were confronted with a decision to report an observed incident.

A senior representative of the Whale and Dolphin Conservation Society (WDCS) Australasia attended the workshop and gave a brief presentation on WDCS activities and its swim-with-cetaceans policy. Concerns about the potential impacts associated with swim-with-cetaceans programs were noted, however the representative complimented the collaborative management and research approach adopted by stakeholders of the GBR SWW activity, adding that this represented a world-leading approach. Towards the end of this workshop, the first of four mini-workshops to develop sustainability objectives was held (details of this process and outcomes are provided in Chapter 6).

5.3.2.5 April 2008 Code of Practice & Sustainability Objectives Workshop

The first half of this special workshop was devoted to discussion and adoption of new and updated protocols in the Code of Practice, whilst the second half was focussed on the development and refinement of sustainability objectives. Additions/revisions to

the Code of Practice that were incorporated via unanimous agreement from workshop participants included (*NB. page numbers refer to the current Code of Practice; Birtles et al., 2008*):

1. Clarifying the activities that SWW-endorsed operators are allowed to do; that non-SWW-endorsed operators are not allowed to do (Preamble and explanation box, p.1;);
2. Mandatory reporting of breaches of compliance (including 'minor' and 'major' breaches as outlined above; 1.4 & 1.5, p.4);
3. Description of 'Dwarf minke whale behaviour and potential signs of disturbance' (explanation box, p.5);
4. A new diagram representing the Vessel Approach Protocol (2.8 and Fig. 2, p.5);
5. A requirement to record additional details for sightings of cow & calf pairs (2.13, p.6);
6. Guidelines for pre-swim briefings (4.1 & 4.2, p.6);
7. Guidelines for management of in-water interactions by vessel crew (4.3 – 4.8, p.7);
8. Guidelines on the use of ropes and prevention of entanglements (4.9 – 4.18, p.7-8); and
9. Amendment to the wording of the recommendation against the use of underwater strobes/flashes for cameras (5.12, p.8).

5.3.2.6 May 2008 Pre-Season Workshop

The revised Code of Practice was introduced and copies were distributed to SWW-endorsed operators for implementation in the 2008 minke whale season. Feedback was sought on its implementation during the 2008 minke season, in particular on new protocols for the use of ropes and prevention of entanglements.

In 2008 a greatly expanded research data collection effort was being undertaken by the MWP research team, with assistance from 18 trained volunteers (with substantial in-kind field access provided by the SWW operators). Concerns were expressed by

an industry representative about the continuity of research and monitoring from 2009 onwards when funding for the six-year Dwarf Minke Whale Tourism Monitoring Program was expected to end.

A representative of the International Fund for Animal Welfare (IFAW) Asia Pacific attended the workshop and gave a brief presentation on IFAW's international campaigns promoting sustainable whale watching tourism. The representative added that he considered the GBR SWW activity to be a leading example for the sustainable management of whale watching worldwide.

5.3.2.7 December 2008 Post-Season Workshop

A brief presentation was given by a GBRMPA representative of whale watching compliance reports in the GBRMP, which included one incident involving a vessel conducting SWW activities in the Ribbon Reefs without a SWW endorsement. Representatives at the workshop reported that they had collected detailed evidence of this infringement, however the GBRMPA representative reported that the alleged offender had been sent an advisory letter only and the incident had not been investigated further 'due to insufficient evidence'.

Several queries were made about the GBRMPA's review of the SWW activity after 2009. Concerns were expressed by industry participants about:

i. the potential removal of the permit/endorsements (opening up the industry to more operators), and
ii. a potential increase in the number of SWW-endorsed vessels (e.g. from vessels with roving permits that can access the Ribbon Reefs and known minke whale 'hotspots' for a brief period each year).

Managers responded that the management approach taken so far was considered to be successful, and that '*the use of permits as a 'barrier to entry' mechanism is a favourable approach, and it is likely they will be retained. The more difficult decision however will be setting the maximum number of permits to be allocated'* (extract from approved minutes). The review of the SWW activity was to commence in 2010. A

Final Report from the Minke Whale Project research team, drawing on findings from the previous six years of monitoring, would form the basis for this review.

GBRMPA's proposed process for reviewing the SWW activity in 2010 was outlined and included:

(i) the establishment of a working group,
(ii) internal consultation between the State and Commonwealth management agencies,
(iii) external consultation with stakeholders, including industry, Tourism & Recreation and Conservation Reef Advisory Committees,
(iv) a policy review and
(v) possible policy and Regulation amendments.

A query was made by a researcher regarding GBRMPA's willingness and ability to adopt an adaptive management approach to this activity. The management response was that '*although developing and trialling adaptive management frameworks is within the GBRMPA's capacity, adaptive management would require political support as well as policy/plan amendments, and would have to be matched with significant resources'* (extract from approved minutes).

Other notable events reported at the workshop that occurred in 2008 included the transfer of ownership of two SWW permits. For one of these (*Taka*), the vessel and company were sold to another dive tourism company and the vessel continued to operate the same itinerary. The other permit had not been used at all prior to its transfer of ownership (to *Eye to Eye Marine Encounters*) in 2008.

5.3.2.8 Summary

The brief summaries provided above of each workshop highlight a range of management issues that arose in workshop discussions, and demonstrate the collaborative and transparent approach by which they were addressed. It is important to note that all pre- and post-season workshops were augmented by reports on the latest research findings (including updates on each of the three PhD projects) and

detailed feedback was provided to industry participants on their contributions to research and monitoring data collection (as shown in the agendas; Appendix 5). The unanimous support achieved in these workshops for incorporating new management protocols into the Code of Practice (several of which greatly exceed regulatory requirements) is indicative of the workshops' effectiveness as a management tool. Examples from the above summaries are contrasted with results in the following three sections (from (a) the stakeholder key informant survey, (b) the crew survey and (c) passenger questionnaires) in the discussion section (Section 5.7).

5.4 Stakeholder key informant survey results

Details of the background and experience of the stakeholder key informant survey (KIS) respondents that were interviewed are provided in Chapter 4 (Section 4.4.1).

5.4.1 Stakeholder impressions of current management of the SWW activity

Industry & managers' impressions of current management

KIS respondents were asked: "what do you think about the current management of swim-with-minke whales tourism in the GBR?" Industry perspectives were generally positive, with important attributes highlighted that had contributed to their perception of a successful management framework, including (i) a Code of Practice that is effective but not overly restrictive for operators and (ii) a positive collaboration between industry, researchers and managers in making management decisions. Such perceptions are illustrated by the following responses (*NB. R1-16 refers to individual respondents; MC refers to the interviewer)*:

- "Very good actually, I mean we've got a good relationship with all you guys and it's all going really, really well. And I think the good thing is that we're all working together which is important and we've developed the Code of Practice and it's not restrictive." (R2)
- "I think so far it's been done fairly well. I think we need to keep looking at all the new issues all the time and just keep abreast of everything." (R10)

When prompted to elaborate on their specific impressions of the Code of Practice, all industry respondents indicated that they were happy with the Code, however two respondents suggested some difficulties in managing larger numbers of passengers (e.g. on day-boats). Example responses included:

- "Yes I don't find that the Code of Practice inhibits us in any way." (R2)
- "It works extremely well, even when the day boat with 80 people on board sometimes, that's much harder obviously than a live-aboard with only 20, but it works well and the crew are well trained and they keep it rolling smoothly. We're very limited on how much time we allow individuals to be in the water, obviously if 80 people want to have a go we can't spend hours with one group." (R4)

Management respondents had similar praise for the collaborative management approach that had developed; for example:

- "Very precautionary, from the point of view of government agencies. It's very precautionary and I guess open, but the management of the industry is largely self-driven and as such it's very impressive. It's world-leading and the world is watching and supporting what's going on." (R1)
- "I think that it's best practice. I think we can still do better, but compared to the way that other activities are managed, I definitely think that we've got that minke whale project as a really good model. It's hugely inclusive and collaborative and I think that it's definitely breaking new ground as to how other activities in the park could be managed in the future." (R13)

Problems with non-SWW-endorsed vessels

A problematic issue that was raised by two industry respondents and one manager was the occurrence of incidental SWW interactions involving non-SWW-endorsed operators. One industry representative expressed some dissatisfaction that such interactions were occurring regularly and had not been adequately addressed in the management framework. Such responses included:

- "I believe that there have been infringements that have not been investigated adequately…" (R8; *industry*)
- "There seems to be the odd boat or two that's out there that's probably diving with whales that shouldn't be. That's possibly something that needs to be looked at I think." (R10; *industry*)
- "I do see problems with the way it's currently managed, because and the reason I said I liked minke whales, is because of their interactiveness, but they don't necessarily know who has the permit... I think that's one area we need to ramp up in the future." (R12; *manager*)

Favourable management impressions among other stakeholders

'Outside' impressions, from four KIS respondents that had not previously attended any GBR dwarf minke whale stakeholder workshops (including one cetacean scientist and three representatives of wildlife conservation NGOs), were favourable, with approval expressed for the involvement of scientists at an early stage of the industry's development, and the collaborative approach that had been taken towards management of the activity so far. A general awareness and concern for potential impacts associated with swim-with-cetacean programs was shown by all of these respondents, however all suggested that the above positive attributes, as well as the interactions occurring on the whales' terms, made the GBR SWW activity an exception among SWW programs. For example:

- "I have to say I'm probably less concerned about that industry than any other swim-with industry that I've heard about… I can't think of any other situations where it's the animals approaching the boats all the time, rather than the boats going out seeking the animals, so that seems to be a crucial difference. So yeah, I'm generally concerned about swim-with programs. With this specific program, I'm less concerned and quite intrigued really." (R11; *NGO representative*)
- "Certainly compared with other swim-with-whale programs that have been problematic and there have been substantial difficulties identified with the management of those interactions, this one seems to be far and away a substantially better managed interaction with a lot of sensitivity about ensuring that it's the whales that manage the interaction and initiate and terminate the interaction without pursuit, so the impression has been very positive." (R14; *cetacean scientist*)

5.4.2 Industry compliance and reporting of incidents

Industry perspectives on compliance

Industry respondents' impressions of compliance with management guidelines were explored further ("Do you think there are any problems with compliance in the industry at present?"). There was a general agreement that all SWW-endorsed operators were making efforts to ensure they complied with management protocols and no problems involving these operators were noted. The issue of non-SWW-endorsed (or 'unpermitted') vessels conducting deliberate SWW activities was raised by four respondents. Example responses include:

- "Not so much the permitted people because we've all got something to lose if we do something wrong. The biggest danger is the un-permitted people that might try and muscle in and private people." (R4)
- "Well there are, the problems are in two areas. One with private vessels and the [*the other being*] non-permitted vessels… It seems to me that the non-permitted operators are not complying and that might be a way for the regulators to avoid non-compliance, by taking away the fact that they have got restrictions on them." (R6)

Reluctance to report incidents

Industry respondents' willingness to report compliance incidents involving other vessels was explored further. While respondents acknowledged a need to report compliance breaches to the GBRMPA in order to protect their 'resource' and interests, some reluctance to submit formal incident reports was noted; in particular for incidents that were perceived as 'minor' breaches and those involving other vessels that are well known to the respondent (i.e. other tour operators conducting regular itineraries in the same area). Informal measures, such as notifying or warning the perpetrator over the radio, to address such compliance breaches was a preferred response. For example:

- "I think that the difficulty is, is dobbing in on somebody who you actually have to work with, so I'm saying that's the hard part." (R2)
- "Yes, in small towns there's always this problem with if you're dobbing in people that you're working with... If we saw someone doing something that we thought was wrong, we'd get on the radio or the mobile phone preferably so it's private… We don't go taking photographs and dobbing people in, you need your allies. You never know when you're going to need the help of a competitor." (R4)

These respondents however indicated that they would formally report more serious breaches, or a persistent failure to comply by a 'rogue' operator:

- "If they were doing something really bad, we would certainly interfere, if we saw them going in on a dinghy and trying to nudge the animal or something like that. I think all the operators would react pretty strongly to that."(R4)
- "If the breach warrants it, we would lodge an incident report." (R6)

While the spatial extent and scale of non-SWW-endorsed minke whale interactions in the GBRMP to the south of the Ribbon Reefs Sector are as yet unquantified, the limited number of live-aboard operators conducting regular itineraries to the Ribbon

Reefs indicates that such interactions in this relatively remote area have so far occurred on a small scale, involving a few 'non-endorsed' vessels. The small scale of these 'non-endorsed' interactions in this area, the familiarity among the live-aboard operators (and reluctance to report each other) and a perception that the SWW activity *per se* does not harm the animals, are likely contributing factors to a lack of a management response dealing with this issue so far. This 'turning of a blind eye' to such incidents appears to have been acceptable at least to some industry representatives, however may become unacceptable should the scale increase. Such sentiments are reflected in the following statement by one respondent:

- "As you know some of us have got permits and some don't have. [*The*] some that don't have them do want them and they're good operators, but the difficulty with compliance is that if you see somebody doing something that they shouldn't be doing, quite simply that means that if they're swimming around with minkes and they don't have a permit, but they're not actually having a negative impact on the animals any more than we may or may not be, so, what's the problem there? … Because they're sort of effectively not doing what they should be doing, it's ok if it's only one boat, although it's not. Technically it's not ok, but if was another 20 boats doing the same thing, we'd all be up in arms about it." (R2)

5.4.3 Use of passenger surveys for monitoring industry compliance

Due to the remoteness of the area in which most SWW interactions occur, monitoring compliance with management protocols among the SWW-endorsed operators themselves also poses challenges. Two respondents suggested that passenger surveys could be used for monitoring operators' compliance with management protocols, however one added that such reports from passengers should not be a basis for prosecution, but could trigger further investigation of the matter:

- "I suppose we don't advertise the fact is that the passengers can actually fill out an incident report, the GBRMPA Incident Report <*Form*>, I mean they can do that… Passengers, they fill out the minke whale questionnaires anyway … and I daresay that there's the odd thing that may come up in there. … But I don't think that it's too big an issue right now, but there are things that happen..." (R2)
- "I believe that by having the thing in a mandatory envelope and the questionnaire on every boat will give you what the customers think their boat people did, as a permit requirement… So that doesn't mean that you're prosecuted by that form… You couldn't take them to court on those questionnaires, because I could have booked on the boat as the opposition, just to fill

out their form wrong… I think there's nothing more powerful than the eyes of your clients, but you have to be protected from them. That's what the industry's afraid of… I don't really see any reason to ever have enforcement on a boat out there doing minke whale patrols. " (R8)

Potential conditions on the use of passenger questionnaire data to identify individual vessels for which results show a management problem were explored further. While management respondents (n=2) were supportive of increased transparency of such data (i.e. such results identifying individual operators) to assist management processes and decisions, industry respondents (n=3) were hesitant and expressed some concerns. Potential misuse of such data, if made widely available, by industry competitors was an important concern. For example:

- "The industry is saturated, therefore… it's not just competitive, it's ruthlessly competitive. So when you have ruthless competition, you have participants that are vulnerable to misrepresenting information… I think it would be preferable if the information is used the way it is at the moment, in-house. You'd have to make a good case to make the information available to your competitors and I can't see the case." (R6; *industry*)

5.4.4 Management agency responses to 'minor' compliance breaches

While the GBRMPA and Queensland Dept. of Environment and Resource Management work together under a clear policy framework for responding to breaches of GBRMP Regulations, their potential responses to breaches of non-regulatory protocols (many of which appear in the Code of Practice) are less clear and have not yet been tested. While only one management agency respondent had sufficient time during the interview to provide comments on this issue, their response suggested that consultation with the industry would form part of a process in deciding an appropriate management response to a compliance problem:

- [*MC: How would your agency respond if a permitted SWW operator was not fulfilling its permit conditions?*] "…It really goes back to a matter for industry, to work out what response the industry feels is appropriate… So if the industry were to say, as part of the management framework, this is the action that we support as an industry, then I think that the government would support that by taking that action..." [*MC: If a permitted operator didn't comply with the voluntary protocols, what kind of enforcement process would apply?*] "Same answer, I think the industry has to consider the seriousness of it… It's not the kind of thing that one would go to court over, so the kinds of actions that one would take would be administrative

actions as in suspending permits, that kind of thing, and one can only do that with the support of the industry." (R1; *manager*)

Potential management responses to non-regulatory infringements of the Code of Practice by SWW-endorsed operators are yet to be explored in a forum with industry and management participants.

5.4.5 Scale of the SWW industry

KIS respondents were asked: "Do you think that the present number of minke permits is appropriate?" Prompts that followed this question asked respondents' consideration of an appropriate industry size in terms of (i) ecological sustainability (i.e. minimising potential impacts on the whales), (ii) economic sustainability (i.e. market share and competition between operators), (iii) maintaining social values of the experience (e.g. the effects of more boats and people) and (iv) the compliance of operators and use of management resources.

Managers' perspectives: limiting scale on an ecological basis

While none speculated on potential impacts on the whales associated with specific numbers of operators, two management respondents noted that the unknown extent of incidental non-endorsed interactions presented problems in attributing any impacts to the SWW-endorsed industry. Another perspective included an acknowledgement that the setting of such limits were typically based on an arbitrary number with no ecological basis, thus other considerations (e.g. social and management) are likely to become more important factors assisting such decisions. Example responses included:

- "I'd like to the see the maximum access available within a well managed industry, I guess. As a number, any cap is a reactive response, so there's no science to a number. The government gets to a point where they're drawing a line in the sand… I don't see any harm coming to the whales by increasing it – it's down to how the industry itself is managed, where the profitability factor is and the quality of the experience that's offered, as in sharing the resource, are the main consideration to the numbers, not the whales themselves." (R1)
- "That's the big unknown I think because of the incidental, and not having a good handle on the incidental at all. Yes, if you could guarantee that you know, you've got nine operators and they're the only ones interacting with minkes, you've got your interaction per unit effort,

it's a lot easier to set out than you do at the moment… So, yes [*a limited number of*] permits makes it good for managing that, trouble is, it will only ever be part of the picture." (R12)

Managers' perspectives: limiting scale on an economic basis

While management respondents were supportive of the economic sustainability of the industry, doubt was cast on the legitimacy of their agency's use of economic criteria in management policy decisions. The seasonality of dwarf minke whale encounters was also raised, as SWW-endorsed operators cannot be (and aren't) entirely dependent on the whales as their only 'product'. For example:

- "There is strong support for ensuring a profitable industry, that's critical; however, I think that that industry will agree that it's not the role of government to involve itself in what that level is." (R1)
- "I would imagine that you could have more than nine from an economic perspective, because none of those businesses exist solely because of swimming with minke whales… I don't think it ever will be a business' sole activity, I think they will always offer the dive trips and the island visits…" (R13)

Managers' perspectives: limiting scale on a social basis

Managers' comments on the social values of the SWW experience suggested that the delivery of high quality experiences for tourists was more dependent on the performance of the individual operator rather than the number of operators. For example:

- "I don't know if the number of permits is as relevant if everyone's operating to that high standard of interpretation, ensuring passengers are well briefed, don't have unrealistic expectations and know the rules, I don't know if number of permits then relates to that or not. You know, possibly less so, is my thinking." (R12)

Managers' perspectives: management basis for limiting scale

Managers' perspectives on industry size in relation to compliance and enforcement varied slightly (but were not contradictory), with one noting that management of this industry is largely dependent on self-regulation (thus such considerations need not be deterministic of an appropriate industry size) and another suggesting that fewer operators would simplify industry compliance and enforcement:

- "The industry will always be self-enforcing, it will never be a priority given the resources the government has for enforcement… If there are blatant infringements then those can be managed, but it will always be self-regulatory to a significant extent." (R1)

- "Oh, yeah sure. I mean it's much easier if you have a number and you know, operators know exactly who the boats are, how they're meant to be behaving etc. and anyone else operating outside of that. You know, it does make it easy for compliance." (R12)

Industry desire to see no increase in industry scale

All industry respondents indicated a desire for the current number of permits to not be increased. Concerns expressed included a decreased market share (i.e. economic loss) due to more competition, potentially diminished social values of the tourist experience, increased potential for impacts on the whales and increased compliance problems. Example responses include:

- "For us as far as the live-aboards are concerned, I think we really would all struggle if there were more permit holders doing what we do… [*Increasing the number of operators*] would take away the whole remote experience. That's what our divers enjoy, that's what we sort of market as well – that they have this remote diving experience where there's just you and the great ocean, and you're out there on a boat in the middle of nowhere… It does get a bit busy in minke season because you get a few boats converging on the same area… I'd suggest that more boats would have bigger impacts on the whales… It's self-regulated at the moment and we're all watching each other's backs I think. That would obviously become more difficult to manage with more permit holders out there." (R2)
- "I think if you throw it open to too many operators, it could build up [*to*] over use. I mean, it's easy for me to say that – I have a permit. But I do genuinely feel that it's probably about the right number." (R4)

A different perspective, offered by two industry respondents, was that the fulfilment of key criteria by SWW-endorsed operators is more relevant basis for setting a scale for the industry, rather than the selection of an arbitrary number of permits to be issued. For example:

- "What's the demand, are people going to get a permit because they want to now, but they haven't already decided to run a business in the area that is also going to do whales? … So what's the criteria? I would say, lets look at the criteria of how they're going to give [*permits*] and who they're going to give them to, before the question of how many." (R8)

A precautionary perspective: difficulties in retrieving permits once issued

One of the remaining 'outsider' KIS respondents was able to provide comments on this issue. Caution was advised in relation to issuing such permits, as once given they can be very difficult and costly to retrieve from operators (e.g. if biological impacts are established):

- [*MC: Do you have any thoughts about an optimum size for industries like this?*] "Not at all, because I think it's so case specific… The problem is that once you allow a certain number of operators in to access a resource, it's extremely difficult to then bring them back. The government has to buy out, it costs a lot of money, it causes a lot of conflict. You know they've just reduced the number of operators out of Monkey Mia from two to one, and it just about tore the town apart." (R14; *cetacean scientist*)

5.4.6 Information sharing between stakeholders

All but five respondents were asked about their impressions of the current level of communication and transparency of information shared between GBR SWW industry stakeholders. Overall respondents indicated that they were satisfied (or very satisfied) with the current level of information sharing and communication between stakeholders, in particular via the biannual stakeholder workshops, at which amendments to the Code of Practice were made. Example responses included:

- "Outstanding… Look, it's so much better than anything else we're involved in that it's pretty hard to add anything." (R1; *manager*)
- "I think it's superb… I think it's World's Best Practice." (R15; *NGO representative*)

Comments were made by two respondents about information flow to stakeholder groups that did not regularly attend the workshops (e.g. representatives of the Commonwealth Government's Cetacean Policy and Recovery Section and representatives of wildlife conservation NGOs). While these groups were not often able to be directly involved in management processes for the GBR SWW activity, these respondents (one manager and one NGO representative) indicated that they were satisfied with the information flow to these organisations. Other stakeholder groups that had so far not had input into the management of the SWW activity were also noted by one respondent:

- "I think we do a pretty good job of keeping the Department involved and aware of what's going on down in Canberra, so we probably take that role on more so than the operators and you guys. I'd say some of the groups are not engaged whatsoever, including the local NGO's, local government, and there's the other two big areas, the recreational users and the unpermitted operators." (R12; *manager*)

5.4.7 Stakeholder perspectives on adopting an adaptive management approach

KIS respondents were asked: "What do you think about the SWW industry moving towards an adaptive management approach?" All responses to this question (n=6) were generally supportive. One management agency respondent added that the current processes used in management of the SWW activity should already be considered adaptive. Example responses included:

- "I don't think it needs to move towards it, I think it's there. The fact that it has workshops every year, studies its impacts, the effort that it puts in, as it is right now. To self analyse and self-manage means that by definition it's adaptive. And we've seen that in the evolution of the industry over a short time. Just the last workshop changed the CoP, that sort of thing – that's adaptive." (R1; *manager*)
- "It's obvious that has to be the case. I mean all natural, environmental management necessarily must be adaptive if it's going to be successful I think. And particularly when you're operating from a base of inadequate data, that's all you can do, because as you collect more data, you can refine the management process." (R15; *NGO representative*)

The traditionally reactive (rather than adaptive) nature of government agencies in responding to management problems was cited by one respondent as a potential barrier, and cautionary remarks were given by another about timeframes required to incorporate changes into government policy and legislation, however these were not perceived as too large an impediment to implementing an adaptive management model:

- "Generally I don't think that government management is sophisticated enough in what it does to be adaptive... I think what we are reactive rather than adaptive. An example of that is the nine permits that exist. We adapt, but we adapt after changes occur. I think you would need a more sophisticated management regime in the first place in order to make it adaptive. I certainly support it, I mean it's a great concept and in many areas it works." (R1; *manager*)
- "It depends on how much we need to put in legislation and being quite careful about what we put in legislation as opposed to policy, recognising my previous comments about how long it takes to amend legislation... So yeah, I do think there will be some problems, but I don't think they'll be insurmountable, but it's a learning curve for everyone." (R12; *manager*)

5.5 Crew interview results

5.5.1 Background and experience of respondents

A total of 15 experienced vessel crew from SWW-endorsed live-aboard (n=11) and day-trip vessels (n=4) were interviewed during the 2007 minke whale season. The sample of respondents represented all three SWW-endorsed day-boat operations and four of the five SWW-endorsed live-aboard operations that were operating at the time. The roles of these respondents included: Skipper, Trip Director, Dive Instructor, Engineer, Videographer, Interpreter/Snorkel Guide and Marine Biologist, with several respondents holding multiple qualifications and regularly performing multiple roles for their company. The respondents were asked several questions at the beginning of each interview to establish their previous experience with dwarf minke whales and in the GBR tourism industry. All respondents had previously worked through at least one minke whale season with their current employer. A summary of the sample's relevant experience is provided below in Table 5.2.

Table 5.2: Summary of crew interview respondents' relevant experience working in the GBR tourism industry and experience with dwarf minke whales (n=15)

	Mean in years	Range in years
Duration working in GBR tourism industry	9.3	3-20
Duration working for present operator	6.6	1-17
Known about dwarf minke whales in the GBR	8.1	2-16

5.5.2 Awareness and perceived effectiveness of the Code of Practice

Live-aboard crew: perceived effectiveness of the Code

All 15 respondents stated that they were familiar with the Code of Practice, however three indicated lesser familiarity with the National Guidelines for Whale and Dolphin Watching (2005). When asked their opinion on the effectiveness of the Code, all live-aboard respondents agreed that it was effective and indicated that they were

supportive of the Code. One respondent however noted some difficulties associated with deploying ropes from an anchored vessel, however this was not considered a major issue. Example responses included (*NB. C1-16 refers to individual respondents; MC refers to the interviewer)*:

- "Yeah, completely, mostly people accept the Code of Practice and it's relatively easy to organise and it's not very difficult. Very simple, understandable and also acceptable." (C7)
- "Yeah, I mean it's effective, it's not always practical… Mainly where you have to have the boat anchored, and the whales want to be on the windward side of the boat, therefore you run into trouble." (C10)

One live-aboard respondent made a suggestion to improve the Code of Practice, by recommending that when scuba divers are returning from a dive whilst snorkelers are interacting with whales, they should keep a distance from the area beneath the snorkelers to prevent detracting from their SWW experience (*NB. This recommendation was subsequently incorporated in an explanatory box in the revised Code*; Birtles et al., 2008, p.7).

Day-boat crew: problems communicating the Code of Practice

Day-boat respondents provided mixed responses regarding the effectiveness of the Code of Practice for managing interactions on their vessels. A key issue raised was the difficulty in communicating the Code to the larger group of passengers in the limited available time each day. Example responses included:

- "On a day boat, we've got a certain amount of time to get through everything during the day… We can't make people listen to briefs and that's where it all falls down, briefing in the morning. There's a morning brief, a signing on brief, the diver brief, the intro brief. By the end of the day they just shut down to briefs..." (C4)
- "On a rough day, when you're heading out and you're trying to keep people's attention to try to teach them how to stay alive in the water, and then you mention minke whales, it sort of gets lost in the vomit, as they're trying to contain their breakfast, and it can be ineffective because, in a way, it's too much information… By the time you get to minke whales, or mentioning minke whales, they're not listening anymore." (C12)

Day-boat crew: problems managing large passenger numbers

Two respondents noted further challenges associated with managing the large number of passengers during an in-water interaction. For example:

- "What has happened on several occasions is that we pull up at a site, we've done the snorkel [*briefing*]… and a minke whale comes in. No opportunity for briefing, and that's when the shit hits the fan. That's when you've got 20 people on a rope, they're all climbing over each other on the end of the rope, there's divers who haven't been in the snorkel brief at all and they don't know what a minke whale is doing, and they'll just come out with their big powerful flippers and they're diving down on the minke whale, you know, it's just chaos." (C12)

Day-boat crew: perspectives on maximum number of swimmers

Two opposing points of view were given on the recommended maximum number of people placed in the water at one time for day-boats during an in-water interaction; one in support of the current level (the Code of Practice recommends 12), and the other suggesting it be increased:

- "I think it's necessary to make sure we don't start freaking out the whales, because if we say, ok use 20, it's a lot harder to police 20 strangers than 12 strangers because they get excited they just see a whale and want to swim with it. You could put a hundred people on the line, it's just going to make it harder and harder to police the number of people you put on. So 12 people is fine in my opinion." (C4)
- "Well I think with the 80 passenger boats, as long as they swim along side of the boat, they don't make movements towards the whales and they go and sit on the line, I don't really see that it's that different whether there's 20 of them hanging on the line as opposed to say eight doing the same thing." (C5)

5.5.3 Self-assessment of minke whale encounter management on individual vessels

Live-aboard crew: passengers and new crew occasionally swimming towards whales

Respondents were asked "How well do you feel minke whale encounters are managed on this vessel?" All live-aboard crew indicated that they felt interactions on their vessel were well managed, however some difficulties in controlling over-enthusiastic passengers were noted, as well as occasional incidents where new/inexperienced crew have swum towards a whale. Example responses included:

- "You do occasionally notice that some people don't comply with the rules as strictly as one would like, particularly with letting the lines go and swimming towards them. People get excited and go off in auto – that's the only area and again, they're not major breaches, just the occasional swimming towards." (C2)

- "I think they're managed in an excellent way. The only thing is sometimes the crew members, especially the new ones, are so overwhelmed that they might be … swimming away from the rope and if that happens then you've lost all credibility to try to control your passengers. But I think that it's almost always done in an excellent way, we rarely have that problem, usually it's the beginning of the season, before everybody was briefed on the whales, in the last week of May…" (C3)

Day-boat crew: difficulties with unpredictable encounters and time restrictions

Despite the difficulties associated with managing larger groups of passengers identified above, the day-boat respondents' appraisals of their operation's management of minke whale encounters were generally positive. However time limitations, due to the operations' requirement to visit three different Reef sites each day, were noted as an additional challenge for engaging in and managing in-water interactions with whales (e.g. when a whale arrives at the site shortly before the vessel is scheduled to depart). This unpredictability and the irregularity of encounters occasionally catches the crew 'off-guard'. For example:

- "The ones where it just comes up and swims between everyone and we've got intro divers hanging on the line and [*certified scuba divers*] coming in, they're completely uncontrolled because the whales just initiated it... But when one swims up and does a few swim by's and we've got the rope out, that's really controlled well – that works well, it just comes back to, if we've briefed them properly on the way out, when we do have an encounter that's unexpected, we've got half a chance of trying to police it accordingly to the permits." (C4)

5.5.4 Usefulness of interpretive materials

Respondents were asked: "How useful do you feel the information materials about minke whales on your boat are for preparing passengers?" All respondents indicated that the resources available to them were adequate and/or very useful. Three live-aboard respondents gave additional positive comments about the usefulness of the new interpretive DVD ('Meet the Minkes') that had been distributed to the industry for the 2007 minke whale season. The use of colourful/eye-catching images was also highlighted as a desirable attribute of effective interpretation. Example responses include:

- "The brighter lit and the better quality... If you've just got these little black and white things floating around like what we had last year… This year's a lot more professional, a lot more

colourful, a lot more readable, so people will sit there and read it now… It's a lot more appealing to the eye, which means it's got a lot more chance of being read and looked at." (C9; *live-aboard*)

- "The new DVD, I thought that was really great. Particularly the behavioural one and the photo ID one because it really kind of gave them a sense of the importance and the being involved in this bigger project." (C15; *live-aboard*)

Day-boat crew: suggestion to improve communication of the Code of Practice

A recommendation was made improve communication of the Code of Practice to larger groups of passengers on day-boats included by simplifying the key points for passengers and developing of a more effective device to communicate these points:

- "Along the lines of 'Snorkel-Help' handouts, just points, A,B,C,D,E… I think that'd be the best way because you guys have given us heaps of information. It's the way we present it and I think [*with*] little bullet forms like that, we can throw half a dozen out on the back chair when one roles up so everyone can go – 'oh yeah, we have to hang onto the rope'…" (C4; *day-boat*)

5.5.5 Observed/perceived impacts on the whales

Respondents were asked: "Have you ever observed any actions of passengers of crew which you feel may have had negative effects on the whales?" Most respondents (from both live-aboards and day-boats) admitted to having observed at least one incident involving passengers or crew swimming towards whales (and in one case touching a whale), however several added that they did not perceive that these incidents resulted in a significant impact on the whales. Example responses included:

- "Just the standard things that we see every year, people not holding the rope, letting go of the rope, drifting away from the rope which everyone needs to be reminded of that from time to time. Not that I think it's got a significant negative effect on the whales, but we certainly do want everyone to try and follow the guidelines." (C1; *live-aboard*)
- "Just the excited turkey that swims right up to them when a group are sitting on a rope being calm and collected and freaks the whale off… So, that's the only thing, the person that doesn't listen in a brief and then gets all excited and makes a big loud, splashing scene when they see a whale." (C4; *day-boat*)

Live-aboard crew: incidents involving other vessels approaching too closely

When prompted on whether they had observed any actions by other vessels that they felt may have impacted the whales, three live-aboard respondents indicated that they had observed another vessel passing by their moored vessel (which was engaged in an in-water interaction) at a relatively close range, which resulted in the whales leaving the moored vessel and moving to the passing vessel. For example:

- "Nothing beyond a vessel coming past another boat and 'stealing' their whales, borrowing their whales, luring their whales away or whatever you want to call it. Again, not necessarily to the detriment of the whales, the whales will do what the whales want to do." (C1)
- "The only thing that's a little bit irksome is that sometimes they come by a bit close to steal the whales." (C3)

General concerns about impacts from SWW activity

When asked if they were concerned about potential impacts associated with this kind of whale watching tourism (i.e. swimming-with-whales), none of the respondents expressed concerns about effects from the current SWW-endorsed industry. Two live-aboard respondents expressed concerns about a potential increase in the number of SWW-endorsed vessels, and a third expressed concerns about incidental encounters by non-SWW-endorsed vessels. Example responses included:

- "I can see if a lot of boats, or more permits were issued, there's a definite section of reef where it's more predominant that you're going to have an interaction. So the more people that find out about this area, then the more you're going to have boats and you know, there's got to be a limit to the amount of boats you can have in the area, otherwise you're going to have 20 boats in this area trying to compete for five or six whales…" (C14; *live-aboard*)
- "…at the moment, I don't see any negative impacts at all on the whales, but that could easily slide out of control if more permits are issued and it's harder to, you know the more permits you've got out there, the harder it is to control and monitor the people that are doing it." (C15; *live-aboard*)

Concerns for whales when outside the GBRMP

Four respondents expressed concerns about the 'friendly' behaviour of dwarf minke whales resulting in an increased risk of them being hunted when outside the GBR. For example:

- "Only in the possibility that they learn that approaching boats and approaching people is a fun and safe thing to do and then they try it somewhere else where whaling is occurring." (C1)

5.5.6 Perceived benefits of additional crew training for managing minke whale encounters

Respondents were asked: "Do you think any extra training about minke whales would be helpful for crews?" Answers to this question were highly varied, among both day-boat and live-aboard respondents, with approximately half (n=8) indicating general support for the idea, with others expressing reservations and scepticism about the need for or benefits of such training. For many of the vessels a high crew turnover was identified as a reason in favour of providing additional pre-minke season training for crews. This problem however was not evident for all vessels and several respondents indicated that the more experienced crew (including themselves) were very capable of managing minke whale encounters without the need for additional training. Example responses included:

- "They all have to read the rules and regulations, that's a requirement and they all do that, but I'm not sure if there's any more training that they need to do." (C2; *live-aboard*)
- "…a lot of our staff are itinerant, they tend to come and go and they don't really know anything about whales when they turn up, and they're here for the short term, so unless they turn up when the whales are here in season, they don't tend to know much about them anyway. And then by the time they pick up the relevant information with regards to minke whales and whales in general, they're moving on anyway, so we're constantly training our staff, it's an ongoing thing." (C5; *day-boat*)

Crew attendance at pre-season workshops

The inability of many crew to attend pre-season workshops, due to work schedules, was noted by three respondents. Two of these people had previously attended workshops and agreed that they provided useful information for crew at the beginning of each season. To communicate important messages to a wider audience of vessel crew, suggestions were made to hold two pre-season workshops (allowing crew from different shifts to attend) and to conduct crew training sessions on the vessels whilst they were in port. For example:

- "I think you should do two [*pre-season workshops*] so we can get half the crew on one, half the crew on the other… because basically two-thirds of my crew are always out at sea... Either that, or come on board." [*MC: Come on board?*] "Yeah, probably about two to three weeks before the minke season, maybe not do the whole trip, just come on early and sit us down for an hour..." (C9; *live-aboard*)

Mixed opinions on crew/guide accreditation

The suggestion of having a trained (and/or accredited) 'minke whale guide' on vessels was met with similarly mixed reactions. While the idea appealed to some, others thought it unnecessary. For example:

- "If we can turn around and say this person's a qualified minke whale guide… people listen. … We can be more professional… offer a better service if we had people that were qualified. That goes with any position on the boat… If crew can get a ticket, they get excited, they go out of their way to do stuff, so yeah – definitely." (C4; *day-boat*)
- "I think there's way too much certification and accreditation for everything these days… it's just not necessary." (C10; *live-aboard*)

Crew training to assist research and monitoring

When asked about the potential for crew with additional training to contribute to research and monitoring data collection, varied support for such a role was also noted. Time limitations and the current workload for many crew was noted, suggesting that additional research duties would be an unwelcome burden for some. Three respondents however that had become familiar with researchers participating in trips on their vessel expressed their favour for researchers fulfilling this role whilst providing additional interpretation. Example responses included:

- "I don't really see where we'd find time to do a whole lot more in the way of research and writing reports and paperwork, as much as I am fully supportive of the research, I'm personally pretty flat out just keeping up with the paper work I've got already and running the trip." (C1; *live-aboard*)
- "I don't think you need the whole crew going off to do stuff, but it's good to have had someone in the crew and also someone like yourself on board, I think that works well." (C3; *live-aboard*)

5.6 Passenger questionnaire results: minke whale encounter management

A description of the passenger questionnaire sample, demography and experiences of swimming-with-whales (SWW) participants is provided in detail in Chapter 4 (Section 4.3). This section presents the passengers' responses to a series of questions related to the management of their minke whale encounter(s).

5.6.1 Passengers' evaluation of the management of minke whale encounters

Passengers were asked: "Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew?" Responses included a scaled rating (a ten-point semantic differential scale, ranging from 1= 'Very poorly managed' to 10 = 'Extremely well managed') followed by a brief statement to explain their rating score. A positivity bias was evident in the results, with the distribution of rating scores being highly skewed towards 'extremely well managed' (median = 10) with an overall mean rating of 9.35 (n=1702; see Fig. 5.1; *NB. 65% of respondents gave a rating of 10/10*). A comparison of live-aboard (mean=9.44, ±SE=0.026; median=10; n=1539) and day-boat respondents (mean=8.48, ±SE=0.153; median=9; n=163) however revealed that the day-boat passenger ratings were significantly lower (Mann Whitney U Test: $Z_{1-1701} = -7.527$; $p<0.001$; displayed in Fig. 5.2 under Section 5.6.3).

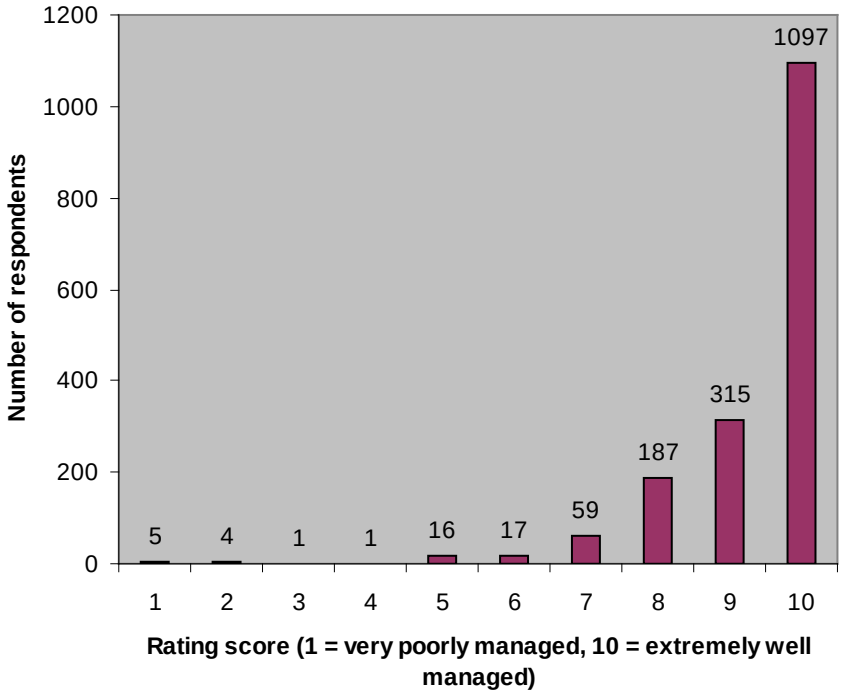


Figure 5.1: **Frequency distribution of passengers' ratings of how well they felt their minke whale encounters were managed (n=1702)**

A total of 1086 respondents provided a short open-ended statement explaining their rating score. A content analysis of these statements produced 1,553 coded elements that were attributed to either 'good' (ratings 8-10), 'fair' (ratings 5-7) or 'poor' management (ratings 1-4) of minke whale encounters by the vessel crew (summarised below in Table 5.3). Consistent with the highly skewed rating scores, the vast majority of comments/elements (93%; 1446/1553) were positive, highlighting a number of attributes associated with good management. Among these, the most frequently mentioned were good organisation/professionalism of crew (by 39% of respondents), the occurrence of briefings (21%), use of the Code of Practice (13%), small group sizes or a limited number of people in the water (12%) and the provision of adequate opportunities (e.g. length of time, repeat encounters) for interacting with the whales (12%).

Table 5.3: Summary of comments/elements associated with crew management of minke whale encounters (n=1086)

Description	Live-aboards (n=1003)	Day-boats (n=83)	Overall proportion of respondents (/1086)
GOOD rating (8-10); Elements of well managed encounters	***(1346)***	***(100)***	
Crew were organized / professional / set good example	413	11	39%
Good briefings / explanations / interpretation provided	222	9	21%
Guidelines / Code of Practice made clear / enforced / followed	126	14	13%
Small group size / limited number of people in the water	120	11	12%
Sufficient/many opportunities provided to interact with whale(s)	113	13	12%
Whales controlled interaction / not threatened / shown respect	88	14	9%
Safety precautions taken / felt safe	66	2	6%
Use of rope(s)	50	10	6%
Had spotters/people looking for whales / knew how to find whales	45	8	5%
Good supervision / monitoring of encounter / swimmers	46	3	5%
Researchers on board / participation in research	18		2%
Encounter went smoothly / nothing went wrong	6		0.6%
Interaction involving snorkelers only / no SCUBA	4		0.4%
Allowed to interact on SCUBA	3		0.3%
Other (non-specific or off-topic)	26	5	3%
GOOD rating (8-10); Negative elements	***(38)***	***(7)***	
Too many people in the water / crowding	13		1%
Rules / guidelines not presented clearly	7	1	0.7%
Inadequate supervision / monitoring / control of swimmers	6	2	0.7%
More information wanted / not enough info provided about whales	2	2	0.4%
Wanted more time for encounters	3	1	0.4%
People swam towards whales / didn't hold on to rope	3		0.3%
Concerned about the use of SCUBA during encounters	2		0.2%
Crew broke rules / swam towards whales	2		0.2%
Boat pursued whales		1	0.1%
FAIR rating (5-7); Elements of fair management	***(11)***	***(1)***	
Good briefings / information	4		0.4%
Good organization / management of encounter(s)	3	1	0.4%
Care shown for diver / whale safety	2		0.2%
Looking out for whales	1		0.1%
Told to hold rope	1		0.1%
FAIR rating (5-7); Negative elements	***(21)***	***(13)***	
Crew disorganized / uninterested / managed encounter(s) poorly	5	7	1%
Lack of / no whale encounters / lack of effort searching for whales	4	3	0.6%
Inadequate / no briefing / information before encounter(s)	3	2	0.5%
Too many swimmers in water / crowding / too much movement	3	1	0.4%
Concerned about the use of SCUBA during encounters	3		0.3%
Other people not following guidelines	1		0.1%
Unexpected encounter(s)		1	0.1%
Other (non-specific or off-topic)	2	1	0.3%
POOR rating (4 and below); Negative elements	***(4)***	***(1)***	
Did not stop boat when whales were seen	2		0.2%
Concerned about the use of SCUBA during encounters	2		0.2%
Little interpretation / poor explanation(s)		1	0.1%
Other comments (no rating given)	11	-	1%
TOTAL CODED ELEMENTS	**1431**	**122**	

Example responses associated with 'good' management included:

- "Very professional, showed care towards both the whales' safety and our safety but made every effort to ensure a great experience."
- "Highly professional, courteous, well organised and friendly. Good explanation of minke protocols."

Negative comments/elements overall were relatively few, however such comments were made by some respondents that had given high rating scores (8-10; see Table 5.3 above). Negative comments/elements that were most frequent included crowding or too many people in the water during an interaction (by 1.4% of respondents), disorganisation and/or a lack of interest shown by the crew (1%), insufficient information/briefings provided before encounters (0.8%), inadequate presentation/explanation of the Code of Practice (0.7%) and inadequate supervision/monitoring of the interaction (0.7%). Examples of such responses included:

- "Too many people in the water at once, no help given in which direction to watch."
- "Divers allowed to scuba with whales. Divers allowed to chase whales. Staff scuba'd with whales, snorkellers held back from entering water by divers - snorkellers only allowed 5-10 min in water several times [*sic*]."
- "I wasn't informed about the rope or possibility of seeing the whales before entering the water, but everything after was good."

5.6.2 Negative impacts on passengers' minke whale experience

In 2006 and 2007, respondents were asked (Q.26, Appendix 11): "Did any of the following impact negatively on your minke whale experience?" A list of potentially impactful scenarios (outlined below in Table 5.4) was provided and respondents were instructed to select as many as were applicable. Among the options were well-known occurrences that are beyond anyone's control (e.g. weather, visibility) and several potential interaction management problems that could be addressed by the crew (e.g. crowding and breaches of the Code of Practice, such as people swimming towards a whale). Results for both live-aboard and day-boat passengers are shown below in ranked order of their frequency (Table 5.4).

Table 5.4: Frequency of suggested elements that impacted negatively on passengers' minke whale experience (2006-2007 only; n=1142)

Element description	Live-aboard respondents (n=1097)	Day-boat respondents (n=45)	Overall proportion of respondents (/1142)
Seas too rough	210	13	19.5%
Whales not coming close enough	146	15	14.1%
Bad visibility	149	3	13.3%
*Rope was too crowded	136	3	12.2%
Encounters with whales too short	117	16	11.6%
Not enough whales	106	13	10.4%
*Too many divers/snorkelers in the water	105	2	9.4%
*Splashing/kicking by other passengers	93	5	8.6%
*Other divers chasing/following whales	32	1	2.9%
*Whale(s) being scared away	25	3	2.5%
*Bubbles from SCUBA disturbing the whale(s)	24	-	2.1%
Nervousness about being in the water with whale(s)	13	4	1.5%
Potentially dangerous marine animals (e.g. sharks/sea snakes)	10	-	0.9%
Being scared by the whale(s) behaviour	2	-	0.2%
*Divers taking flash photos	4	-	0.4%
*Food scraps in water	1	-	0.1%
Other	42	12	4.7%

**Indicates element that can be managed or prevented by crew*

The above results show that the most frequent detracting elements of passengers' minke whale experience are beyond the control of vessel crews (i.e. the weather, whales not coming close enough, poor underwater visibility), however several elements that were identified by respondents with moderate frequency are clearly related to vessel crews' management of the encounters (e.g. in-water crowding, the number of swimmers and their in-water behaviour). Elements indicating a breach of the Code of Practice (e.g. other divers chasing/following whales; n=32) occurred with relatively low frequency. Half (n=16) of these cases in the live-aboard sample are attributable to one vessel, with the remaining cases distributed between three others.

In 2008, the format of the above question was changed to an open-ended style (Q. 25 Appendix 13): "Was there anything that impacted negatively on your minke whale experience?" The open-ended question format reduces potential bias associated with prompted option questions and allows respondents to respond in their own way, expressing their foremost concerns (Bogdan & Taylor, 1975). A summary of the responses is provided below (Table 5.5). The overall response rate for this question was 76% (402/531). Among those who commented, 44% indicated that nothing had detracted from their minke whale experience. Consistent with results from the

previous version of this question, the weather was the most frequently mentioned negative element. Key differences however between results for this question and those for the previous version (2006-2007) include a much lower frequency of elements related to encounter management (e.g. 'too many people in the water' was mentioned by only 1% in 2008, however was 'ticked' by >9% of respondents in the multiple choice format provided in 2006-07), and a wider variety of detracting elements. Example responses to this question included:

Encounter management issues

- "That the boat videographer was swimming away from the rope and duck-diving."
- "Scuba divers in the water at the same time, snorkelers not given instructions about spacing on the line or lying position prior to the encounter."
- "Too many snorkelers crowded on the end of the rope meant too much splashing that might have frightened the minkes."

Concern for impacts on the whales

- "I do worry about humans affecting their natural behaviour."
- "Concern for continuance of specific "whale watching" expeditions on the whales."

Table 5.5: Summary of elements that impacted negatively on passengers' minke whale experience (2008 only; n=402)

Description	Live-aboard respondents (n=308)	Day-boat respondents (n=94)	Overall proportion of respondents (/402)
No detracting experiences	145	30	44%
Weather / sea conditions	***72***	***26***	
Bad / rough weather / seas	36	19	14%
Cold water	30	6	9%
Poor visibility	4	1	1%
Strong current	2		0.5%
Personal / equipment problems	***25***	***5***	
Personal or equipment problems (general)	13	2	4%
Seasickness	10	3	3%
Jellyfish sting	2		0.5%
Potential / perceived impacts	***29***	**-**	
Perceived impacts / concern for impacts on the Reef	26		6%
Concern for impacts on the whales	2		0.5%
Whales scared away	1		0.2%
Wanted more from minke whale encounter(s)	***12***	***8***	
Not enough encounters / whales	7	3	2%
Didn't see whale(s)	2	2	1%
Wanted to get closer to the whale(s)	2	1	0.7%
Wanted to interact longer (more time)	1	1	0.5%
Didn't swim with whale(s)		1	0.2%
Encounter management related	***8***	***6***	
Too many divers / snorkellers in the water	3	3	1%
Rope was too crowded		3	0.7%
Problems with scuba divers in water at same time as snorkellers	2		0.5%
Insufficient instructions / briefing prior to encounter	1		0.2%
Not enough places on rope	1		0.2%
Crew member left the line / rope & swam towards whale	1		0.2%
Other	***40***	***22***	
Too many people on the boat		9	2%
Disappointed with coral / reef sites	4	4	2%
Personal issues with other passengers on board	4		1%
Wanted to see other Reef species – not seen	3		0.7%
Wanted more information about whales	3		0.7%
Wanted trip to focus more on whales, less on diving	2		0.5%
Wanted trip to focus more on diving, less on whales	2		0.5%
Wanted more involvement in research	1		0.2%
Other (off-topic or non-specific)	21	9	7%
TOTAL CODED ELEMENTS	**331**	**97**	

Of additional interest among responses to the above question (Table 5.5) were those expressing concern for wider impacts on the Reef itself. Example responses included:

- "Hearing of climate change's impact on the Reef without being encouraged to offset emissions associated with the trip."
- "Seeing some impacts of visitors to reef, dead coral and crew allowing people to feed fish."

5.6.3 Pre-encounter interpretation and preparation

Pre-minke whale encounter preparation, briefings and the use of interpretive materials were investigated in further detail. Respondents were asked to rate the quality of the information they received about minke whales on their trip (semantic differential scale; 1 = "very poor" to 10 = "excellent"; Q. 26, Appendix 13). The overall mean rating score was again very high (mean = 8.81; median = 10) and the distribution highly skewed towards the 'excellent' end of the scale. A comparison of the live-aboard (mean=9.04, ±SE=0.036; median=10; n=1518) and day-boat subsamples (mean = 6.76, ±SE = 0.189; median = 7; n=167) revealed a significant difference between these groups (Mann Whitney U: $Z_{1\text{-}1684} = -13.116$; $p<0.001$; see Fig. 5.2).

Respondents were asked to indicate which sources of information about minke they received/had access to whilst on their trip, selecting from a list of 15 potential sources that had previously been identified and/or made available to SWW-endorsed operators (Q.27; Appendix 13). The mean number of different information sources received/accessed by day-boat passengers (that had encountered minke whales on their trip; n=176) was 2.16 (±SE=0.176; median=2; n=80) and was significantly lower (Mann-Whitney U; $Z_{1\text{-}1600} = -10.523$; $p<0.001$) than the mean number for live-aboard respondents (mean= 5.96 sources, ±SE=0.088; median=5; n=1521; see Fig 5.2).

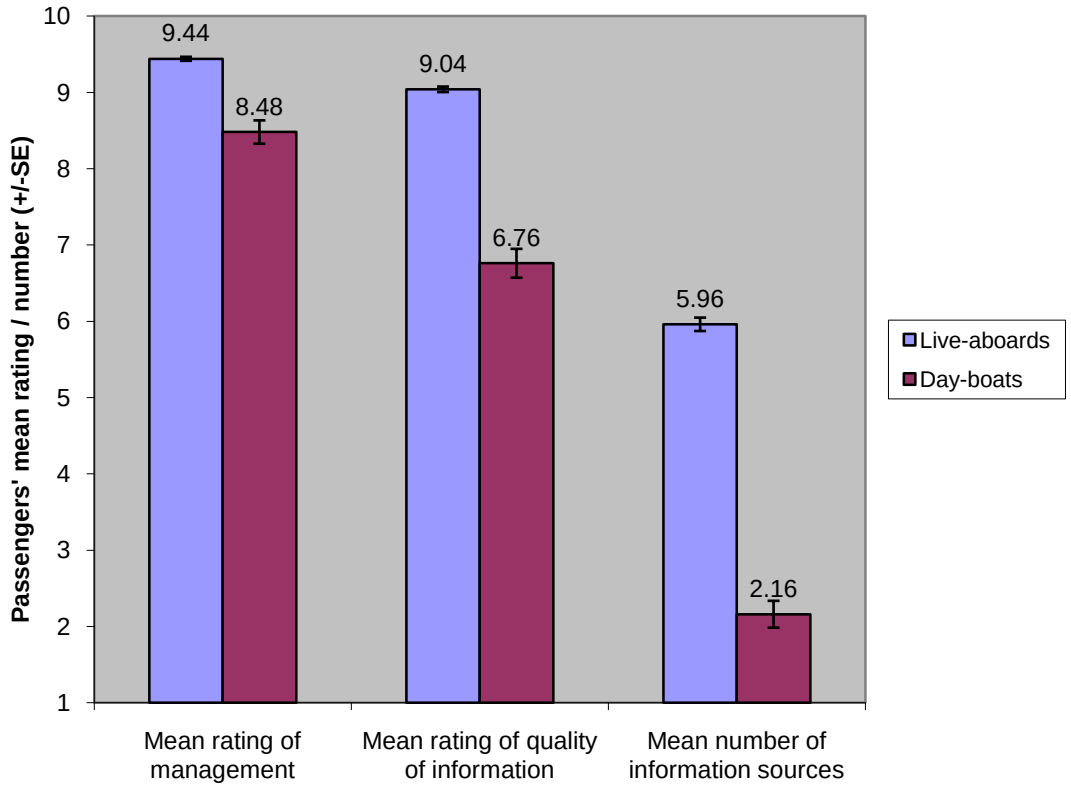


Figure 5.2: **Comparison of live-aboard and day-boat passengers' mean ratings (±SE) of (a) how well their minke whale encounter(s) were managed (n=1702), (b) the quality of the information they received about minke whales (n=1685), and (c) the total number of information sources they received/had access to on their Reef trip (n=1601)**

Importance of pre-encounter briefings by crew

The sources of information about minke whales that were most widely received/accessed by passengers on all SWW-endorsed vessels were briefings from crew (Fig. 5.3 below). Pre-dive briefings for scuba divers are standard procedure on all vessels before divers enter the water at a new dive site. On live-aboard vessels, these briefings are usually addressed to all passengers, however on day-boats, such briefings are conducted with smaller groups (i.e. the small proportion of passengers participating in scuba diving). Responses to this question indicate that for 76% of live-aboard and 32% of day-boat respondents, information about dwarf minke whales was provided in their pre-dive briefing(s). Specific pre-minke whale encounter briefings, given before passengers enter the water to swim with the whale(s) are considered particularly important for the management of encounters; 71% of live-aboard and 41% of day-boat respondents indicated that they had received such briefings.

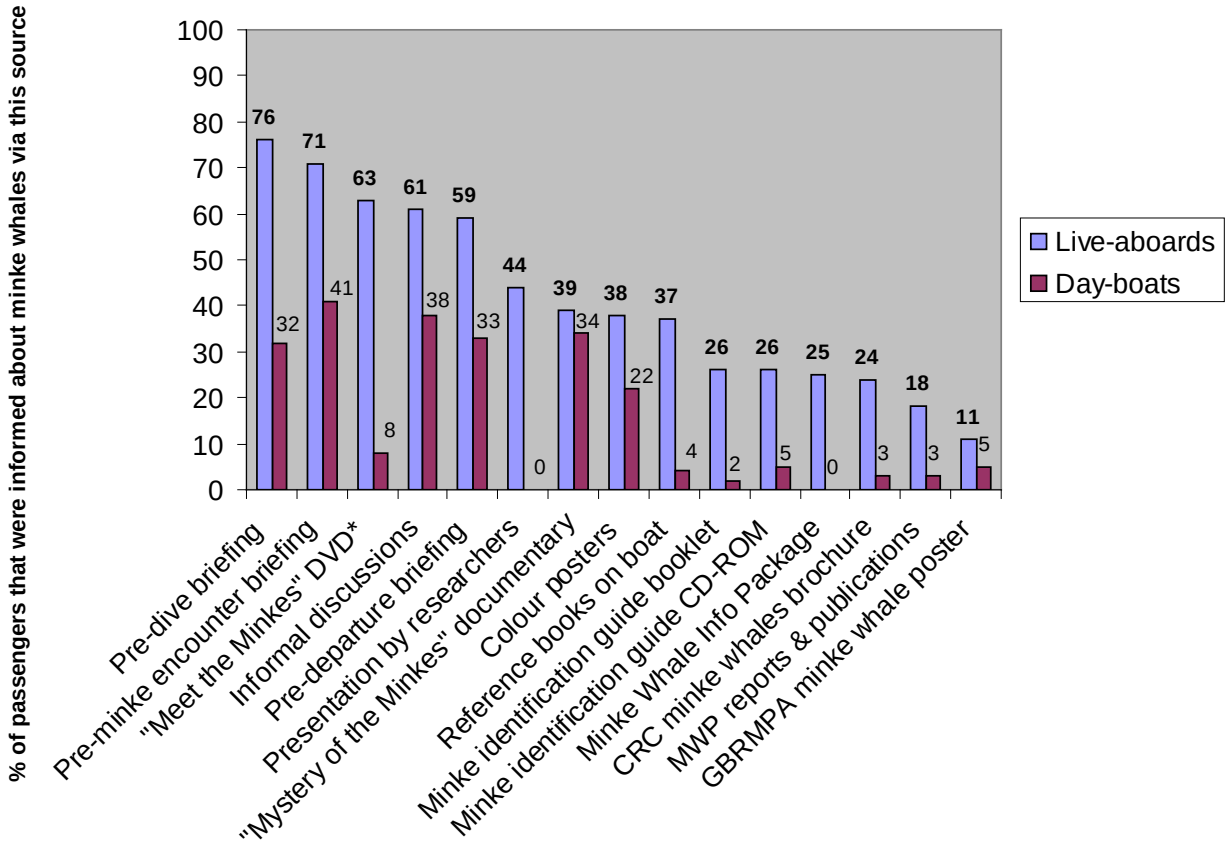


Figure 5.3: **Proportion of passengers that received information about minke whales from different information sources on their vessel** (n=1634; live-aboard sub-sample n=1527; day-boat sub-sample n=107) **Meet the Minkes Interpretive DVD was introduced in 2007.*

Respondents were asked to indicate the best source of information about minke whales on their trip. The highest proportion of respondents (35%) indicated that this was the crew and/or briefings provided by crew (Fig. 5.4). Researchers were present on trips that accounted for 70% of the total passenger questionnaire sample (n=1527/2171) and were the next most frequently mentioned source of information (by 30% of all respondents). Researchers frequently interact with passengers and crew whilst on vessels and answer many of their questions. On the live-aboard vessels, researchers often give one or more evening presentations on dwarf minke whale biology and the research being conducted. Minke whale DVDs/videos (including both the 2007 "Meet the Minkes" and the NHNZ 2002 documentary "Mystery of the Minkes") were identified as the next most important source of information (by 22% of respondents). All remaining sources of information about minke whales were considered 'the best source' by a substantially smaller proportion of respondents (see Fig 5.4).

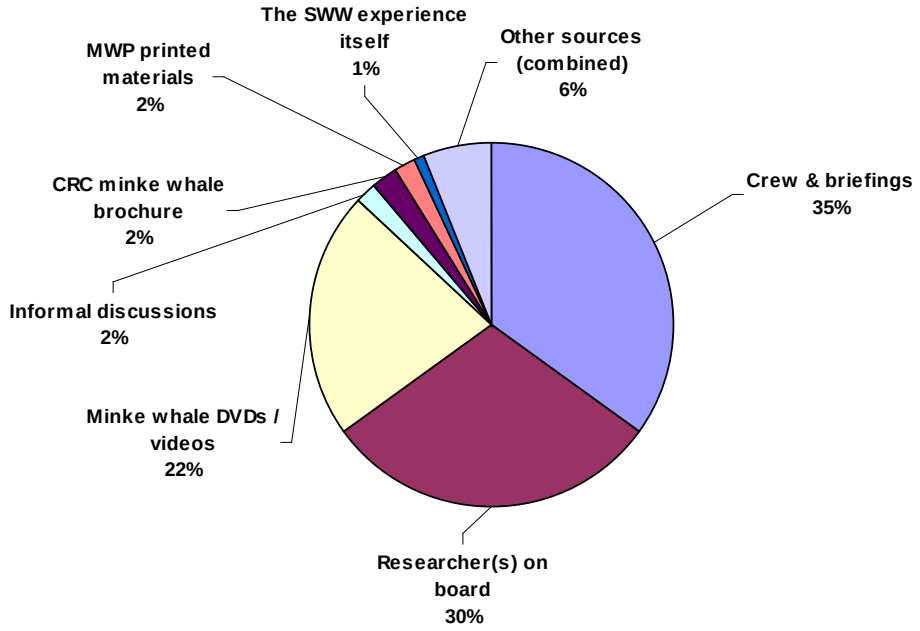


Figure 5.4: **'Best source of information about minke whales' indicated by passengers (n=1423)**

5.6.4 Passenger preparedness for minke whale encounters

Respondents were asked (Q.25; Appendix 11): "Do you feel you were adequately prepared for your encounter(s) with minke whales?" A yes/no response option was provided with space for brief comments/explanation. Overall, 93% of the sample responded 'yes' to this question. A comparison of the live-aboard and day-boat samples revealed that 22% (35/159) of day-boat respondents indicated that they did not feel adequately prepared, compared with only 5.2% (80/1524) of live-aboard respondents reporting the same. A between-year comparison of the live-aboard subsample revealed a decrease in this proportion over the three seasons (6.1% in 2006, 5.3% in 2007 and 4.2% in 2008). A meaningful comparison of the day-boat sample between years could not be made due to the low sample sizes for individual vessels in 2006 and 2007.

A total of 805 respondents (754 from live-aboards, 51 from day-boats) provided short responses to explain their yes/no selection (summarised in Table 5.6). The most frequent reasons cited by passengers for their 'yes' response were: receiving a briefing before their minke whale encounter(s) (30% of respondents), becoming familiar with the Code of Practice/guidelines (20%), being shown the 'Meet the Minkes' DVD (15%), receiving information from crew (14%) and presentations/talks given by researchers (12%). Example responses included:

- "Lots of pre-encounter briefings, explanations, printed material and biology talks."
- "Good briefing. Having a researcher on the boat made a huge difference."
- "There was not a single moment when guests were ignorant of the rules and code of conduct. Behaviour of each guest doing the right thing reflects back on the briefing given before each encounter."

Among the small proportion of respondents that provided reasons they did not feel adequately prepared for their minke whale encounter(s), the most common reasons cited were: insufficient information provided before the encounter (by 3% of respondents), personal and/or equipment problems (2%) and the unexpected occurrence of the minke whale encounter (2%). Example responses included:

- "I wasn't informed about the rope or possibility of seeing the whales before entering the water but everything after was good."
- "I did not know how to behave in presence of the whales."
- "A video or some background information (scientific) would have been nice."

Table 5.6: Summary of passenger comments about their preparedness for their minke whale encounter(s) (n=805)

Description	Live-aboards (n=754)	Day-boats (n=51)	Overall proportion of respondents (/805)
Yes, because:	***(955)***	***(27)***	
Received briefing before encounter(s)	238	3	30%
Familiarised with Code of Practice/guidelines/rules beforehand	153	9	20%
Shown video / DVD ('Meet the Minkes')	119	1	15%
Crew were knowledgeable / informative	104	7	14%
Presentations / information provided by researchers	94	1	12%
Good / appropriate / necessary information provided	71	2	9%
Had previous experience / knowledge / knew what to expect	63		8%
Felt safe / comfortable with equipment / whales	35	4	5%
Received brochure / printed information	29		4%
Told about whales' biology / behaviour	28		3%
Told about whale sightings / when whales were spotted	11		1%
Well prepared / informed (non-specific)	10		1%
No, because:	***(47)***	***(18)***	
Not enough information provided before encounter(s)	20	6	3%
Personal / equipment problems	15	1	2%
Did not expect to see whales on this trip	5	10	2%
Did not see video / DVD before encounter(s)	3		0.4%
Lack of information about the whales in general (e.g. biology)	2	1	0.4%
Expected to use SCUBA with whales	1		0.1%
Did not understand briefings (language)	1		0.1%
Other comments	***(74)***	***(11)***	
Unable to prepare for personal feelings / experience	15	2	2%
Wanted more information about the whales	8		1%
Guidelines were enforced by crew	5	1	0.7%
Preparation not necessary before encounter	5		0.6%
Don't know / don't understand	2	2	0.5%
Scared at first then gained confidence	1		0.1%
Video could be improved	1		0.1%
Other / non-specific / off-topic	37	6	5%
TOTAL CODED ELEMENTS	**1076**	**56**	

A small proportion of respondents (2%) indicated that they were unprepared for their feelings/emotions associated with the minke whale experience. Example responses included:

- "Everyone involved did a first class job of preparation but I doubt that I could ever have been prepared for the impact, significance, overwhelming first encounter."
- "You get some idea but you would never really comprehend what it means to be so close to them, to hear them, have them look you straight in the eye until you experience it for yourself."

5.6.5 Familiarity with the Code of Practice

In 2008 the new question was added to the MWQ as a potential sustainability indicator for evaluation (Q.31, Appendix 13): "Are you familiar with the Code of Practice for dwarf minke whale interactions in the GBRWHA?" From the total 2008 sample, 81% (n=426/525) responded 'yes'. A comparison of the live-aboard and day-boat subsamples revealed a much greater proportion of day-boat passengers (46%; n=46/100) than live-aboard passengers (13%; n=53/425) were unfamiliar with the Code.

5.6.6 Comparing individual vessels

Passenger questionnaire responses from eight SWW-endorsed vessels were compared for the following questions: (i) "Do you feel you were adequately prepared for your encounter(s) with minke whales?" and (ii) "Are you familiar with the Code of Practice for dwarf minke whale interactions in the GBRWHA?" (Q.33 & 31, Appendix 13). Results show substantial variation in the proportion of passengers that indicated they were (a) inadequately prepared for their minke whale encounter(s) and (b) unfamiliar with the Code of Practice (Figure 5.5 below; *NB. vessel names are not revealed due to a confidentiality agreement*). The differences between these proportions for live-aboard and day-boat respondents are reported above, however the results below reveal similarly high variation among the live-aboard vessels, in particular, the proportion of respondents that were unfamiliar with the Code of Practice (ranging from 2.7% to 78%; Fig. 5.5).

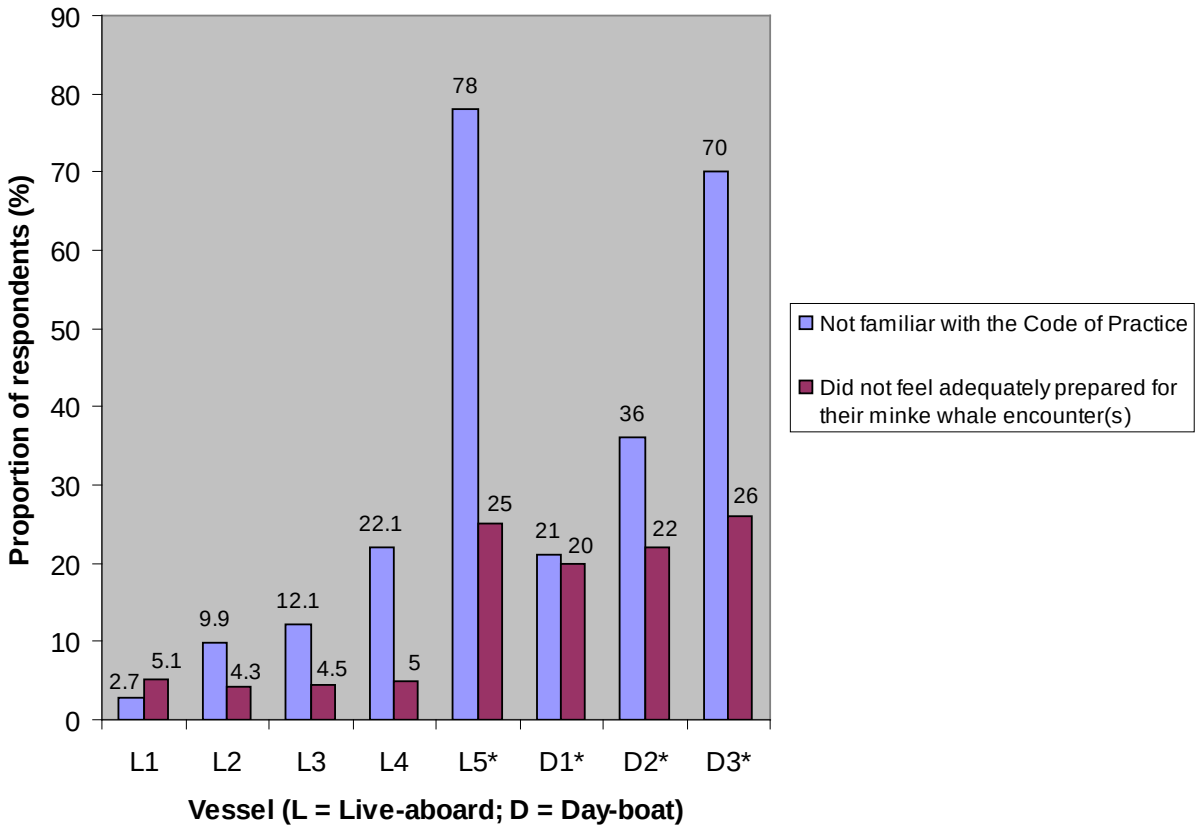


Figure 5.5: **Comparison of the proportion of passengers on eight SWW-endorsed vessels that indicated (a) they were not familiar with the Code of Practice (2008 only; n=510) and (b) they did not feel adequately prepared for their encounter(s) with minke whales (n=1664)** **Indicates low sample size (n<70) attained for these vessels for both questions.*

Management perceptions, information quality and number of information sources

Comparisons were made of the mean scores given by passengers on four live-aboard vessels (with sufficient sample sizes for statistical tests of significance) for (a) rating of how well minke whale encounter(s) were managed by the crew and (b) rating of the quality of the information about minke whales received on the trip, as well as (c) the number of information sources about minke whales received by passengers. Significant differences between the vessels were found for all three variables (Kruskal Wallis Tests: (a) $\chi^2_{1,1503} = 59.642$, $p<0.001$; (b) $\chi^2_{1,1482} = 194.651$, $p<0.001$; (c) $\chi^2_{1,1495} = 450.680$; $p<0.001$). The mean scores (±SE) for each variable per vessel are shown below (Fig. 5.6; *NB. Mean scores for a fifth SWW-endorsed live-aboard vessel are shown in this figure for comparative purposes however were not used in the above statistical tests due to the low sample size achieved for this vessel*).

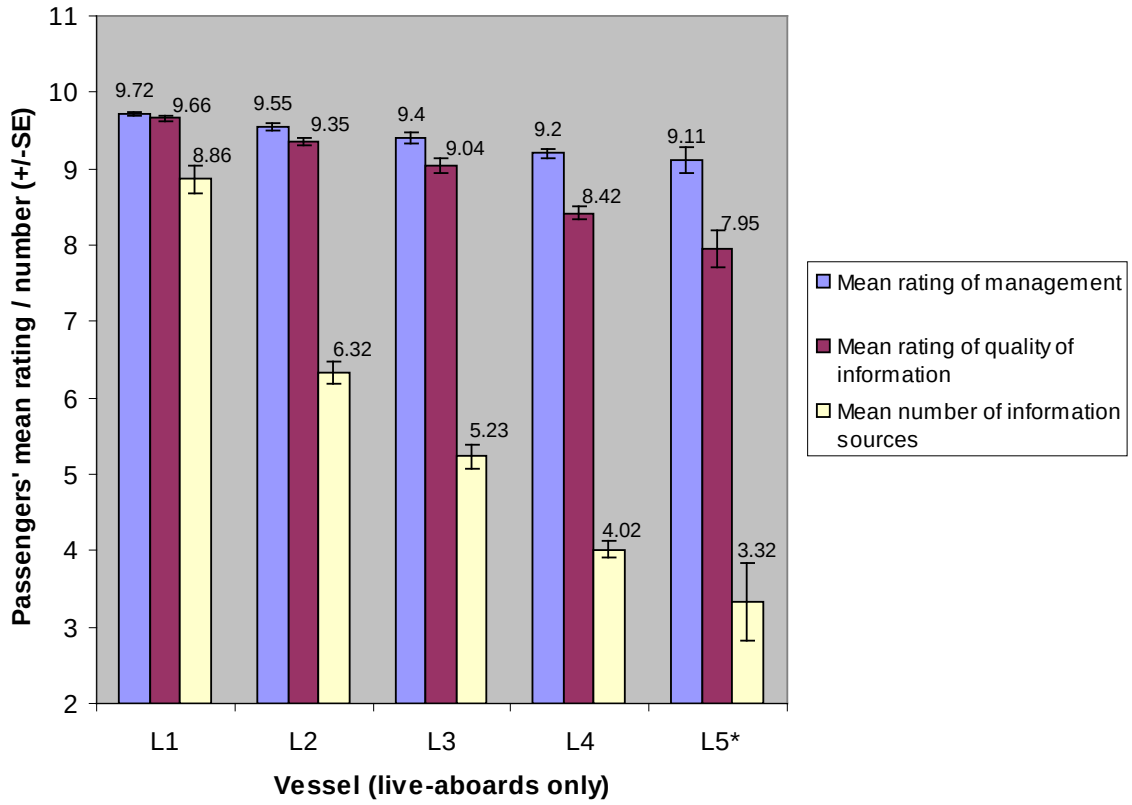


Figure 5.6: **Comparison of mean ratings (±SE) by passengers on five SWW-endorsed live-aboard vessels, for (a) how well their minke whale encounter(s) were managed, (b) the quality of the information they received about minke whales, and (c) the total number of sources of information about minke whales they received on their trip (n=1592)** **Indicates low sample size for this vessel and its exclusion from tests of statistical significance.*

The results above (Fig. 5.6) reveal that while the mean management rating for all vessels was very high (all above 9/10), the rating of the information quality varies considerably on the different vessels, as does the number of information sources (about minke whales) made available to passengers.

5.6.7 Management, information quality and satisfaction

Spearman's Rank correlations were performed to investigate potential relationships between passengers' satisfaction rating with their minke whale experience, the rating of how well encounters were managed and their rating of the quality of information received about minke whales on their trip. Significant positive correlations were found between: (i) passengers' satisfaction rating and their rating of how well their

minke whale encounters were managed by the vessel crew ($r = .454$; $p<0.001$), (ii) passengers' satisfaction rating and their rating of the quality of information about minke whales they received on their trip ($r = .372$; $p<0.001$), and (iii) passengers' rating of encounter management and the quality of information received ($r = .529$; $p<0.001$). Caution is advised in interpreting these results however, due to the potential for co-correlates associated with different vessels which are likely to have influenced these results (e.g. as shown in Fig. 5.6 above).

5.6.8 Passenger perceptions of impacts and sustainability of the SWW activity

Respondents were asked (Q.34, Appendix 13; 2008 only): "Did you observe anything during your trip that might have caused a negative impact on the whale(s)?" This question was added to the survey in 2008 for evaluation as a potential sustainability indicator. A total of 440 respondents (365 from live-aboard vessels and 75 from day-boats) answered the question, among which 90% (395/440) gave a simple response of 'no' (responses summarised and presented below in Table 5.7). Examples from the relatively few affirmative responses (indicating a perceived impact) included:

- "Yes, some scuba divers ignored code and swam towards the whales photographing them."
- "Some of the snorkelers forgot all the instructions when they saw the whales, rushing for them."

Among the few negative responses that provided further explanation, the most frequent included: (i) interactions occurring on the whales' terms (i.e. the whales chose to approach and were able to leave at any time) and (ii) swimmers behaved appropriately or adhered to the guidelines. Example responses included:

- "No, all interactions were voluntary on their part."
- "No, everyone on the trip was delighted to see the minke whale and observed the rules."

Several respondents, not noting an observed impact or incident, expressed more general concerns for the wellbeing of the whales (summarised in Table 5.7 below); for example:

- "Hard to tell, circling boats isn't behaviour in the wild. Just because animals choose to do something doesn't make it healthy (e.g. junk food)."

Table 5.7: Summary of passengers' observed/perceived impacts on the whales (2008 only; n=440)

Description	Day-boats (n=75)	Live-aboards (n=365)	Overall proportion of respondents (/440)
No	**71**	**324**	**90%**
Yes, because:		***(15)***	***3.4%***
Swimmers splashing / kicking /making noise		5	1%
Photographer / videographer chased whale		3	0.7%
Too many people in water		2	0.5%
Scuba divers not holding chain/rope		2	0.5%
People swam towards whales		2	0.5%
Boats were close to whales		1	0.2%
No, because:	***(2)***	***(11)***	***3.0%***
Encounter on whales terms (can choose to approach/leave)		4	0.9%
We followed guidelines / behaved appropriately / respectfully	1	2	0.7%
Encounter was well managed		2	0.5%
Whales are intelligent	1	1	0.5%
Whales are not disturbed by human presence		1	0.2%
Whales are curious		1	0.2%
No, as long as:		***(2)***	***0.5%***
Whales' behaviour not changed		1	0.2%
Don't use flash photography		1	0.2%
Other comments / concerns:	***(2)***	***(16)***	***4.1%***
Whales may become too familiar with humans / habituated		3	0.7%
People will breach guidelines		2	0.5%
Effects of human interaction in general		1	0.2%
Scuba bubbles may scare whales		1	0.2%
Risk of vessel strike		1	0.2%
Other (ambiguous or off-topic)	2	8	2%
Don't know / impacts are unknown	**-**	**5**	**1%**
TOTAL CODED ELEMENTS	**79**	**373**	

The following question (Q.35, Appendix 13) was asked of live-aboard passengers: "Do you have any concerns about the sustainability of this kind of tourism?" This question was also added to the questionnaire in 2008 as a potential sustainability indicator for evaluation. A yes/no option was provided, followed by a space for brief comments. A total of 22% (88/407) of respondents indicated 'yes'. Brief explanations for their response were provided by 229 respondents. A wide variety of reasons for both 'yes' and 'no' responses were provided (summarised below in Table 5.8). Explanations for both 'yes' and 'no' responses were categorised as either definite (e.g. 'yes/no because…') or conditional (e.g. 'yes/no, as long as…'), the latter occurring most frequently. A number of the themes/coded elements in the conditional statements for both 'yes' and 'no' responses were similar.

Table 5.8: Summary of live-aboard passengers' statements explaining their reasons for being concerned/not concerned about the sustainability of this kind of tourism (2008 only; n=229)

Description	n	Proportion of respondents (/229)
No because:	***(113)***	
Whales control approaches (to vessels/swimmers)	31	14%
Whales were relaxed / not stressed / curious / seem happy	30	13%
Activity is well managed / Code of Practice is in place	28	12%
Controlled access, limited number of operators	7	3%
No problems with the way it is currently done	5	2%
Swimmers are passive / whales are not approached/chased	4	2%
People enjoy interaction / appreciate experience	3	1%
Tourists and the industry respect the whales	3	1%
It is sustainable	1	0.4%
Dive operations are in the area anyway	1	0.4%
No, as long as:	***(44)***	
People follow rules/Code of Practice / interact properly	16	7%
Whales remain in control of interactions	8	3%
Access remains controlled / limited	7	3%
Done the same way / status quo remains	4	2%
Whales are not harassed or harmed	4	2%
People are educated / well prepared	3	1%
Great Barrier Reef sustained	1	0.4%
Research continues	1	0.4%
Yes because:	***(18)***	
We don't know enough/need to learn more about minkes	5	2%
Industry has negative impacts on environment/pollution	3	1%
Risk of hunting	2	1%
Commercialism/increasing popularity	2	1%
Wider impacts are beyond control of this industry	2	1%
Concerned about close human-whale interactions	2	1%
Concerned about private vessels	1	0.4%
People don't follow the rules	1	0.4%
Yes if:	***(90)***	
Uncontrolled access/numbers of boats	27	12%
People don't know / follow rules/Code of Practice	16	7%
Whales become habituated	10	4%
Increased risk of hunting	9	4%
Whales negatively impacted in any way	8	3%
Industry negatively impacts the reef/environment	7	3%
Whale behaviour changes/distractions from normal activities	5	2%
Whales become too friendly with boats / get too close	3	1%
Whales lose interest in boats / avoidance	2	1%
Whales are threatened outside Australian waters	1	0.4%
Whales stop migrating	1	0.4%
Boats chase whales	1	0.4%
Other:	***(40)***	
The activity raises awareness / has educational/research benefits	10	4%
Don't know enough to comment/unsure	7	3%
Research should continue	3	1%
Needs careful management	3	1%
Access should be controlled / limited	2	1%
Depends on whales remaining interested in boats	1	0.4%
Hope it continues	1	0.4%
Other (non-specific or off topic)	13	6%
TOTAL CODED ELEMENTS	**305**	

5.6.9 Passengers' awareness of broader impacts associated with their trip

On live-aboard vessels in 2008, a new question was introduced (as a potential sustainability indicator) to explore passengers' awareness of their Reef trips' ecological and carbon footprints, and any activities they undertook to address these (Q.37, Appendix 13): "Have you taken any steps to reduce or offset the ecological footprint or carbon emissions of your trip to the GBR?" A yes/no response option was provided followed by space for a brief description of steps that respondents had taken. Among the respondents, 31% (125/402) indicated that they had taken such steps. A summary of the explanatory comments is shown below (Table 5.9). While the most frequently mentioned activity was participation in a carbon credit/offset program (n=23), a wide variety of activities were mentioned, some of which appeared to be unrelated to their Reef trip and were more likely to be activities undertaken at home (e.g. participating in recycling).

Table 5.9: Summary description of steps taken by live-aboard passengers to reduce or offset the ecological footprint or carbon emissions of their trip to the GBR (2008 only; n=402)

Summary description	**n**	**Proportion of respondents (n=402)**
Yes	***(125)***	
Participated in carbon credit/offset program (e.g. provided by airline)	23	6%
Reduced electricity consumption (e.g. turn off appliances)	19	5%
Reduced use of motorized transport / used public transport / other means	14	3%
Participate in recycling	11	3%
Reduced rubbish / waste / disposed of rubbish appropriately	10	2%
Minimized water consumption	7	2%
Use ecologically friendly/biodegradable products (e.g. shampoo)	6	1%
Used eco-certified tour operator(s) / accommodation	2	0.5%
Minimized flights	2	0.5%
Planted trees	1	0.2%
Paid reef tax	1	0.2%
Yes (other / non-specific)	29	7%
No	***(16)***	
No opportunity to do so	1	0.2%
No, stupid question	1	0.2%
No (other / non-specific)	14	3%
Other	***(7)***	
Carbon offsets are a scam	1	0.2%
Don't know how / unaware	6	1%

5.6.10 Passengers' willingness to contribute to a carbon offset scheme

A follow-up hypothetical question was asked about passengers' willingness to contribute to a carbon offset scheme should they return to the GBR to see minke whales again in the future (Q.39, Appendix 13). Among the respondents, 42% (n=157/370) indicated a willingness to contribute to offsetting the carbon emissions of their dive trip and 35% (131/370) indicated a willingness to contribute to offsetting the carbon emissions of their entire journey from home. The median amount that respondents suggested they were willing to contribute in both cases was $50 AUD, ranging from $2 to $500 for their dive trip and from $2 to $1000 for their entire journey from home.

5.6.11 Passengers' willingness to contribute to minke whale research and monitoring

Similar to the above hypothetical questions, live-aboard passengers were asked if they would be prepared to contribute an additional fee for research and monitoring of minke whales and the swim-with interactions, should they return to the GBR to see minke whales again in future (Q.39, Appendix 13). A higher proportion of respondents (64%; n=235/370) indicated a willingness to do this, than for making a contribution to a carbon offsetting scheme. The median amount suggested by respondents was also $50 AUD, ranging from $1 to $1000.

5.7 Discussion

5.7.1 Summary of findings

The results from this study identify a range of management issues associated with the GBR SWW activity, drawing on four sources of data, including:

(i) Minutes of stakeholder workshops (Section 5.3),

(ii) Stakeholder key informant survey (KIS) interviews (Section 5.4),

(iii) Interviews with experienced crew from the SWW-endorsed vessels (Section 5.5), and

(iv) Passenger questionnaires (Section 5.6).

These management issues include those associated with 'on-the-water' management of the SWW interactions by vessel crew, as well as processes and decisions involving the stakeholders in a series of workshops.

Analysis of the stakeholder workshop minutes (Section 5.3) showed these workshops to be a very effective forum for addressing emerging management issues and implementing changes to the Code of Practice, with a good level of participation by industry, managers and researchers. Several of the new protocols incorporated into the Code of Practice over 2006-2008 via these workshops greatly exceeded the basic regulatory requirements (e.g. the "Vessel Approach Distances and Departure Protocol"). The stakeholder workshops facilitated information sharing and social learning among the stakeholder groups, and are regarded as a key component of an adaptively managed SWW activity.

The stakeholder KIS (Section 5.4) revealed a high level of satisfaction among stakeholders for the Code of Practice and for the management processes by which changes to management protocols were made (i.e. via the workshops; Section 5.4.1). Industry KIS respondents identified concerns about management compliance by non-SWW-endorsed vessels, however acknowledged a reluctance to submit formal reports for compliance incidents (Section 5.4.2). This issue was recognised in stakeholder workshops leading to new Code of Practice protocols making such reporting mandatory. Issues relating to the future management of the GBR SWW activity were

explored (in consideration of the GBRMPA's 2010 review), encompassing issues such as the scale of the industry, compliance and monitoring, and stakeholders' perspectives on adopting an adaptive management approach. These issues are discussed in further detail below.

The crew interviews (Section 5.5) showed differences between live-aboard vessels and day-boats in the management of SWW interactions, with the larger numbers of passengers and the limited time available on Reef day-trips presenting challenges for communicating the Code of Practice and for managing passengers in the water. Feedback was also provided on the usefulness of interpretive tools and suggestions were made to improve communication of key points from the Code of Practice to passengers. These interviews revealed a high turnover of vessel crew on many SWW-endorsed vessels and issues associated with training of crew that can potentially assist their management of SWW interactions (Section 5.5.6).

Findings from analyses of the passenger questionnaires (Section 5.6) included an overall perception of good management of SWW interactions by passengers. However, significant differences were found between the SWW-endorsed vessels (including significant differences between live-aboard and day-boats; Fig. 5.2) for passengers' ratings of the management of their SWW interactions and the quality of information about minke whales provided on-board (Section 5.6.6). Key elements attributed to good management of minke whale encounters were identified, underscoring the role of vessel crew and the importance of briefings prior to in-water interactions (Table 5.3). Several new questions were added to the survey in 2008 to evaluate their use as potential sustainability indicators. Results of these and other questions retained through the three years of sampling enable the identification of vessels that could be used to help improve their performance (e.g. Fig. 5.5), as well as longitudinal trends in industry performance (e.g. Section 5.6.4). Issues associated with the use of passenger surveys as a potential compliance monitoring tool are discussed below.

5.7.2 The importance of stakeholder workshops

The summary of stakeholder workshop processes and outcomes presented above (Section 5.3) outlines a collaborative approach to management, which was effective in implementing changes to management protocols (i.e. Code of Practice amendments) in relatively short time frames with high levels of stakeholder support. These achievements during the three years over which this study was conducted however are largely attributable to processes that occurred over several years preceding the study, during earlier stages of the industry's development. Continuity of involvement of key personnel, including industry representatives, managers and members of the Minke Whale Project research team also played a critical role in the development of this collaboration.

Since 1996, the collaboration between researchers and SWW tourism operators provided a basis for the development of the Code of Practice (Arnold & Birtles, 1999), with ongoing refinement of the Code occurring since its formal adoption by the SWW industry in 2002 (Birtles et al., 2008). Workshops addressing the management of the GBR SWW activity, involving SWW tourism operators, managers and researchers, commenced in 1999 and whilst varying in format and frequency, continued on an annual basis until end-2008. Funding has not been available to conduct monitoring or workshops since the 2009 season, however the Whale Sighting Sheets and other data are still being collected by the Minke Whale Project (drawing on donations made by passengers) to continue the long-term monitoring.

Stakeholder representation at the workshops

Attendance at workshops and hence stakeholder involvement in management discussions was largely limited to three local stakeholder groups (industry, Marine Park managers and minke whale researchers) with limited attendance by representatives of other organisations. Attendance by these three groups at the workshops was generally very good (Table 5.1). The relatively small workshop size (between 20 and 37 people) and the participants' familiarity with each other and with the management issues was conducive to rapid progress in the workshop discussions and the adoption of new management protocols. Occasional attendance however by representatives of the Commonwealth Department of the Environment and Water

(now DSEWPC; Department of Sustainability, Environment, Water, Population and Conservation), the Whale and Dolphin Conservation Society (WDCS) and the International Fund for Animal Welfare (IFAW) provided the 'local' participants with extremely valuable feedback from a broader context, both within Australia and internationally. Whilst this feedback was largely positive, their concerns about potential impacts associated with whale watching tourism (and swim-with programs in particular) highlighted that developments in the GBR SWW activity were of ongoing interest and are scrutinised by their organisations. Such an interest was also noted by the NGO representatives that participated in the stakeholder Key Informant Survey. This broader perspective and 'international gaze' is considered beneficial to the development and management of the SWW activity, and places additional pressure on local stakeholders to ensure that the GBR SWW activity is managed sustainably. Genot (1995) noted that NGOs in particular have an important role to play in the planning and oversight of nature and wildlife tourism, with their expertise in addressing key environmental issues and with their representation of the wider community's conservation interests.

Collaborative management and social learning

In addition to the workshops' role in the ongoing refinement of the Code of Practice, the opportunity for stakeholders to meet and openly discuss management problems and issues in a constructive forum has provided further benefits which have enhanced their capacity to respond to emerging threats. 'Social learning' within such a forum is considered an important objective and a key component of a collaborative management framework. Schusler, Decker & Pfeffer (2003, p.311) define social learning in the context of natural resource co-management as "*learning that occurs when people engage one another, sharing diverse perspectives and experiences to develop a common framework of understanding and basis for joint action.*" The development of collaborative relationships, understandings of different perspectives and increasing trust and confidence among different stakeholders are outcomes of social learning and are important milestones for co-management (Schusler et al., 2003). The achievement of these milestones in the development of the GBR SWW activity is evident in many of the statements provided by key informant survey respondents above (Section 5.4).

5.7.3 An adaptive management approach

Many of the processes that occurred within the Dwarf Minke Whale Tourism Monitoring Program are consistent with a passive adaptive management approach (described by Walters & Holling, 1990; Lee, 1999), in which stakeholders participate in the fine-tuning management protocols in response to research findings and emerging management issues (e.g. the adoption of the Vessel Approach Distances and Departure Protocol; Section 5.3.2.1). These processes evolved through the Dwarf Minke Whale Tourism Monitoring Program and from the preceding collaboration between the industry, managers and researchers, without a formal policy mandate from the GBRMPA to implement or trial an adaptive management model. While it is apparent that the formal implementation of such a model would require significant political will and investment of resources on the part of the management agencies (as expressed by management KIS respondents), such efforts may be necessary to ensure that positive collaborative processes are sustained, in particular as key actors change over time. Ryan (2002) cautions that at any particular stage of a tourism industry's development, cohorts of stakeholders may only be temporary alliances and may be issue-dependent.

Beaumont and Dredge (2010) evaluated the pros and cons of different styles of local tourism governance networks, noting that effective governance can be achieved in various power-sharing arrangements. There were however clear parameters that they associated with good governance, which include:

- Leadership and vision
- Engaged communities, positive cultures and constructive communication
- Accountability and transparency
- Clarity of roles, responsibilities and operational processes
- Knowledge development and social learning, and
- Inclusiveness, equity and acceptance of diversity (Beaumont & Dredge, 2010).

Many of these parameters were apparent in the management processes documented in this study. Regardless of the formal management policy framework (if one is to be adopted in future), the stakeholders of the GBR SWW activity should recognise and

strive to achieve these parameters as key requirements of a sustainably managed industry.

5.7.4 Funding for management and monitoring

Securing funding to sustain key management processes (e.g. stakeholder workshops to review management issues, monitoring and reporting of results) may be the most challenging task. Since the completion of the GBRMPA's six-year Dwarf Minke Whale Tourism Monitoring Program (DMWTMP; completed in June 2009), no further funding has yet become available (at the time of writing) to continue monitoring of the SWW activity or conduct stakeholder workshops. A reduction of inbound tourism to Australia (and Far North Queensland in particular) attributed to the 2008/09 Global Financial Crisis (Tourism Queensland, 2009) was also reported to have impacted the GBRMPA's operational budget, the major source of revenue for which is the Environmental Management Charge paid by all tourists on commercial Reef tours (Senate Standing Committee on Environment, Communications and the Arts, 2008).

The in-kind and fundraising contributions by some SWW-endorsed operators to dwarf minke whale research have been outstanding and increased each year through the DMWTMP. In 2008, the estimated value of in-kind places on vessels for Minke Whale Project researchers was >$100,000 (based on advertised trip prices; representing 236 researcher days at sea spread over eight vessels). Passenger donations from the 2008 season were also sufficient to cover most of the operational costs of field research in 2009, albeit for a severely reduced field program (representing 74 researcher days at sea spread over four vessels), and similarly, donations in 2009 contributed towards these costs in 2010 (51 researcher days at sea on three vessels).

Whilst the passenger questionnaire results indicated that 64% of respondents were willing to contribute an additional fee for research and monitoring of the SWW interactions (with a median suggestion of $50; Section 5.6.11), not all operators may support the introduction of additional compulsory fees (which they either pass on to

customers or absorb), particularly when they have already contributed so much in-kind. Additional sources of revenue should therefore be explored by the stakeholders, along with cost-effective options to address key management objectives.

5.7.5 Value and effectiveness of the Code of Practice

The effectiveness of tourism industry codes of conduct are regarded with mixed views, with some critics suggesting their use can represent 'green washing' by operators claiming to be environmentally responsible (e.g. Honey, 1999), along with concerns about their lack of enforceability (Duprey et al., 2008; Cole, 2007). Among those studies that found codes of conduct to be a valuable tool for managing wildlife and nature-based tourism (including whale watching), several key criteria to their successful implementation were identified. These include: (i) industry involvement in development and 'ownership' of guidelines, (ii) enforceable regulations to accompany voluntary codes, (iii) logical reasoning, specificity and clarity of protocols, (iv) an ongoing promotion, communication and education program targeting both operators and tourists, and (v) ongoing compliance monitoring and reviewing of results with industry stakeholders (Duprey et al, 2008; Cole, 2007; Sirakaya & Uysal, 1997; Sirakaya, 1997; Genot, 1995).

Results from passenger questionnaires and feedback from crew interview respondents indicate that the Code of Practice is an effective tool for the management of minke whale encounters by SWW-endorsed vessels. Industry stakeholders contributed to the ongoing refinement of the Code during the six-year Dwarf Minke Whale Monitoring Program and implemented new protocols via the stakeholder workshops.

5.7.6 The use of interpretation and awareness of the Code of Practice

The introduction of an interpretive DVD (Appendix 3) in 2007 contributed positively to the promotion of the Code of Practice, with 63% of live-aboard passengers reporting that they had seen it (Fig 5.3) and 22% of the total passenger sample indicating that watching the DVD(s) (either the 2007 interpretive DVD 'Meet the

Minkes' and/or the 2002 documentary "Mystery of the Minkes") was their most important source of information about minke whales on their Reef trip (Fig 5.4). The use of the new DVD on the SWW-day-boats however appears to have been limited, as only 8% of these respondents reported having seen it (Fig. 5.3).

The proportion of passengers that were aware of the Code of Practice overall was high (81%) however there were clear differences between the vessels, most obvious when comparing live-aboards and day-boats (Fig. 5.5), the latter having a much higher proportion of passengers (46% c.f. 13% for live-aboards) unfamiliar with the Code. The descriptions provided by day-boat crew (Section 5.5.3) of difficulties associated with preparing passengers for in-water interactions (that occur with low probability as reported in Chapter 3; also reported in Mangott, 2004) highlight that there is still a need to develop appropriate briefing guidelines for rapidly preparing passengers in the event of unpredictable and infrequent in-water interactions.

Interpretation has a critical role to play in informing SWW participants and vessel crew of appropriate in-water behaviour and contributes to their understanding and appreciation of the experience. Shackley (1996) notes that wildlife tourists generally do not wish to cause harm to the wildlife they view, however many will be ignorant of the effects of their interactions until they are provided appropriate interpretation. Mason (2005) argues that a better understanding of the visitor experience is also needed to facilitate improved visitor behaviour and reduce negative visitor impacts. Combining this understanding of the visitor experience with clearly stated management goals or themes for interpretive tools is considered to be the most effective means of achieving the desired outcome (i.e. visitor compliance, satisfaction and appreciation of the experience; Ham, 1992).

The significant correlations between passenger satisfaction with the minke whale experience, their rating of the quality of information received about minke whales and their rating of the crew's management of minke whale encounters (Section 5.6.7) is particularly interesting however the fact that similar trends are evident in comparisons between the vessels (Fig 5.6) suggests that other factors associated with the different vessels might have influenced this result. It is likely that various other aspects associated with each vessel have contributed to their passengers' satisfaction and

perceptions of management, however the importance of interpretation and its effects on tourist behaviour and satisfaction should not be under-valued (Sirakaya, 1997; Moscardo, 1996). The elements that passengers attributed to 'good management' of their minke whale encounters (Table 5.3) and to whether or not they felt sufficiently prepared for their minke whale encounter(s) (Table 5.6) highlight the importance of pre-swim interpretation, primarily delivered by the crew through briefings. The vessel crew played the most important role in delivering the appropriate information to their passengers (Fig. 5.4), which is their most effective means of managing encounters. Researchers also contributed substantially to the delivery of interpretation when on-board, and the additional (and more in-depth) information they provided is also likely to have contributed to passengers' satisfaction.

5.7.7 Compliance and monitoring of SWW-endorsed vessels

Study Three also investigated the value and potential use of passenger questionnaires for monitoring compliance of SWW operators. Whilst overall they indicate good compliance with the Code of Practice (with 65% of respondents giving a rating of 10/10 for the crew's management of their minke encounters), a small proportion of respondents indicated that they had observed other passengers or crew swimming towards whales (Tables 5.3, 5.4 & 5.5). The questionnaire results also identify significant differences between vessels for their management of encounters and quality of interpretation (Fig. 5.6). The highly skewed distribution of these rating scales suggests a degree of positivity bias (e.g. as found in tourism satisfaction studies; Pearce, 2006), however the significant differences found between vessels shows that there is room for improved performance, and such results can be brought to the attention of individual operators to assist their improvement.

The identification of operator names associated with such results may be an effective incentive for compliance. However as concerns were expressed by industry KIS respondents (Section 5.4.3) about the potential malicious use of such information by other operators (i.e. to gain a commercial advantage), the forum and manner in which this is done should explored further in a stakeholder workshop. Sirakaya (1997) notes the importance of ecotourism operators receiving feedback on their compliance with

voluntary guidelines. Thus far, de-identified preliminary results of these questions have been reported each year at the post-season stakeholder workshops, and responses from industry have been positive towards this approach. If operators were to become identifiable from passenger survey data, an appropriate process for dealing with findings of non-compliance or poor performance will need to be adopted and be supported by all stakeholders.

To ensure high standards of compliance are maintained (and encourage high standards of interpretation), the use of positive incentives (e.g. a reward system) may be more effective than sanctions for low standards or non-compliance. In a related study of ecotourism operators' compliance with voluntary guidelines, Sirakaya and Uysal (1997) found that sanctions and deterrents were not significant predictors of conformance behaviour (while the use of education and interpretive materials, and operators' familiarity with the protocols were). Rewards for operators needn't be expensive (e.g. certificates and chocolates presented to operators and crew at post-season workshop were observed to become an object of 'friendly competition' during the workshops and likely contributed to increasing data returns from industry each season). The ability for operators to promote their achievement of such awards in the marketing of their business (e.g. "Highest standard SWW-endorsed operator 2010"; based on passengers' mean ratings of management and information quality) provides an additional incentive mechanism that the author considers would be welcomed by this industry. Sirakaya (1997) notes that most ecotourism operators respond well to such approaches and Genot (1995) argues that tourists are increasingly demanding of environmentally responsible products and services.

Direct observations of compliance

It was not within the scope of this study to report on field observations of compliance, however such observations by the author are consistent with findings of the passenger survey. While studies elsewhere of cetacean tourism have been effective at quantifying the extent of non-compliance by operators (e.g. Duprey et al, 2008; Whitt & Read, 2006; Scarpaci, Nugegoda & Corkeron, 2004) the reliance on access to 'platforms of opportunity' (via in-kind contributions from the tour operators) to visit the remote areas in which the SWW interactions occur in this case makes similar studies difficult (for ethical reasons and the potential for observer bias). The cost of

operating an independent research/compliance vessel in these areas would also be very high.

Investigations of serious compliance breaches may require the management agency to place an undercover agent on-board a suspect vessel. This approach is currently among the GBRMPA's compliance and enforcement options, however reports on the frequency and effectiveness of such operations are not publicly available. The costs associated with this approach are also likely to be high, and such enforcement action must first be triggered by the GBRMPA's incident reporting mechanism (as reported in Section 5.3.2.2).

5.7.8 Compliance and monitoring of non-SWW-endorsed vessels

The extent of awareness of the Code of Practice and appropriate behaviours for interacting with dwarf minke whales among non-SWW-endorsed tourism operators and other Reef users is not known. Based on researcher observations, the occurrence of incidental minke whale encounters by non-SWW-endorsed vessels in the Ribbon Reefs (the primary operational area of the SWW-endorsed live-aboards) appears to have been at a relatively low level, however the scale of such interactions south of this area (in particular between Port Douglas and Cairns where there is a much higher density of tourism vessels) is unknown.

The reluctance expressed by industry KIS respondents to submit formal reports of SWW activities involving non-endorsed vessels may continue to be a barrier to triggering a management response. The SWW industry's recent resolution to adopt a policy of compulsory reporting of incidents (with the subsequent inclusion of this requirement in the Code of Practice), and the single report submitted to the GBRMPA in 2008 however appear to be steps in the right direction towards addressing this issue. This incident report of SWW activities being conducted by a non-SWW-endorsed vessel (reported in Section 5.3.2.7) resulted in a warning letter sent to the alleged offender and the matter was not pursued further by the GBRMPA 'due to insufficient evidence', despite workshop discussions indicating that some evidence had been overlooked.

Due to the limited management enforcement presence in the offshore remote areas where the SWW activities occur, the industry's reporting of compliance incidents will become increasingly important in future seasons should the number of non-SWW-endorsed vessels visiting these areas increase. GBRMPA's feedback to operators on the processes and outcomes associated with such reports (with confidentiality considerations taken into account) will also be important. Such feedback benefits the industry and other stakeholders by improving their understanding and confidence in compliance enforcement processes. Conversely, a lack of such feedback (or lack of transparency) may erode stakeholders' confidence in these processes.

5.7.9 Crew training for encounter management and monitoring

The high-turnover of crew on several SWW-endorsed vessels makes training a significant issue. Is additional crew training required to ensure that they manage minke whale encounters appropriately? Opinions on this issue among crew interview respondents were mixed. Some considered it unnecessary, stating that they were currently doing a good enough job without such additional training, while others felt that extra training accompanied by a formal recognition (e.g. certification) would be desirable for many crew and would benefit their operation (Section 5.5.6).

Crew attendance at pre-season workshops (and additional specific training workshops for day-boat crew) and the level of researcher involvement in trips (particularly aboard live-aboard vessels) during the Dwarf Minke Whale Tourism Monitoring Program probably helped to raise crews' awareness of the Code of Practice, monitoring data collection and the biology and behaviour of minke whales. Since no workshops were held in either 2009 or 2010 and researchers' presence on trips has decreased, standards of encounter management and delivery of interpretation could potentially have declined. While the processes during the six-year Monitoring Program were successful in achieving high standards of management and interpretation on SWW-endorsed vessels, any future changes to the management processes must take into consideration the importance of the crew's role in managing SWW interactions and their information and training needs to fulfil this role.

A future requirement of SWW-endorsed operators (e.g. via an amendment to the Code of Practice or via a permit condition) to have at least one appropriately trained and certified member of crew on board all dedicated minke whale watching itineraries would greatly benefit the tourist experience and help to ensure good management of SWW interactions. This person could be responsible for conducting pre-SWW briefings, supervising in-water interactions and recording data for monitoring. The details of such a requirement however will need to be explored in a stakeholder workshop(s) before being trialled.

5.7.10 Monitoring for potential impacts and risk management

Overall crew and passengers did not perceive the current SWW activity to have a significant negative impact on the whales. The most frequently mentioned reason for this perception among passengers was the initiation and maintenance of encounters by the whales themselves (Tables 5.7 & 5.8). Whilst such perceptions appear favourable for the industry, the real effects of the SWW interactions on the behaviour of the whales remains unknown and a significant proportion of passengers still expressed some concern(s) about the sustainability of this kind of tourism (Table 5.8).

The recent study by Mangott (2010) showed that individual whales became desensitised and approached significantly closer over repeated encounters. Mangott (2010) also developed a risk assessment matrix based on the probabilities of a range of behaviours and their distance from swimmers, concluding that while the overall risk of harm to whales and humans was low, the level of risk increased with the closeness of approaches.

While no incidents have yet been documented of harm occurring to human participants in these interactions, the entanglement incident reported in 2007 (in which a whale became entangled briefly in a surface rope that was lying slack in the water; Section 5.3.2) raises concerns of an increased risk associated with the whales' desensitisation to SWW interactions. There is no doubt that these whales (weighing several tonnes) are capable of causing serious injury or even death to a human

swimmer if he/she was in the wrong place at the wrong time (e.g. attached to a rope close to an entangled, panicking whale). Continued monitoring of whales' behaviour during SWW interactions is required, and further research on the behaviour of whales is needed to determine any longer-term behavioural changes and associated risks, within and beyond the GBR Marine Park (e.g. increased risk of vessel strike or being harpooned by whaling vessels due to 'boat-friendly' behaviour). Such concerns were also expressed by a small proportion of SWW participants in the passenger questionnaires (Table 5.8).

SWW operators and crew can (and should) contribute to such monitoring data collection and crew will need to carefully supervise interactions, especially those involving extremely 'friendly' whales that are making very close approaches to swimmers or objects (e.g. the rope). Recognition of early warning signals (e.g. the occurrence of particular behaviours and/or the identification of particular individual whales known to exhibit such behaviours) should be included in future crew training (as recommended by Mangott, 2010).

5.7.11 SWW permits and industry scale

Management tools such as permits are an important component of planning mechanisms that can shape and control the development of an industry for its long-term sustainability (Sterner, 2003). Higham et al. (2009) argue strongly for the implementation of permitting/licensing systems by management agencies in the early stages of a whale watching industry's development, with the agency retaining the right to revoke such permits if/when impacts on the targeted whale population(s) are detected. The SWW-endorsements (attached to Marine Parks tourism permits) for managing the GBR SWW activity were generally perceived by key informant stakeholder respondents to be a valuable tool for management of the activity. In addition to limiting the scale of dedicated SWW activities, the obligation of SWW-endorsement holders to (i) follow the Code of Practice and (ii) contribute to whale sightings data collection for monitoring are further benefits of this management tool.

Key Informant Survey respondents' perceptions of whether the current scale of the industry was appropriate (i.e. the number of operators with SWW-endorsements) were explored in relation to ecological, social, economic and management considerations (Section 5.4.5). Several industry respondents considered that an increase in the number of SWW-endorsed operators would have undesirable consequences for their business (in terms of increased competition) and for their passengers' experience (e.g. perceived crowding around some Reef sites). Responses from managers indicated that social, economic and management considerations were necessary in determining an appropriate scale for such an activity, in the absence of a proven biological impact that would determine a carrying capacity. However, it appeared unlikely that economic criteria could form a basis for restricting industry scale due to free market considerations. Managers also perceived that the quality of the SWW experience for tourists was more dependent on the standards of individual operators than the presence of other vessels nearby. Passenger questionnaire results however indicated that a significant proportion of respondents (12%; Table 5.8) were concerned about the potential industry growth and an increase in the number of vessels conducting the activity (and potential associated impacts on the whales).

As highlighted in Chapter 3, the use of the minke whale 'encounter hotspot' Lighthouse Bommie was determined to be at or near maximum capacity during the 2008 minke season. Physical limitations of Reef site and mooring use are therefore clearly important considerations when evaluating industry scale and site access. Access to the mooring at Lighthouse Bommie (and numerous other moorings along the Ribbon Reefs) is managed by the Cod Hole and Ribbon Reefs Operators Association (CHARROA), however non-CHARROA vessels have been observed using this site (without CHARROA approval) during the minke season and have been requested to vacate the mooring (via radio) by CHARROA vessels when arriving at the site (personal observation). Not all CHARROA members however hold a SWW-endorsement, but are entitled to book and use the Lighthouse Bommie mooring during the minke whale season. While only one such live-aboard operator currently exists, the potential for new live-aboard dive operations to join CHARROA and access sites in this area presents a difficult compliance and enforcement issue.

KIS respondents' views were also mixed on the management implications (i.e. industry compliance and enforcement) associated with the scale of the SWW industry. What is clear however, is that current non-SWW-endorsed vessels (in particular, those that operate in the Ribbon Reefs during the minke season) are experiencing regular incidental (and potentially deliberate in some cases) in-water interactions. As one KIS respondent noted, "*the trouble is the whales don't know which boats have the permits.*" Whilst these vessels must comply with regulations (e.g. stipulating that swimmers must not enter the water when closer than 100m to a whale), they are not obliged to adhere to voluntary protocols in the Code of Practice, nor are they required to contribute to monitoring of SWW interactions. Crew from these vessels were also not invited to the pre-season workshops and it is likely that they would be much less informed about the Code of Practice (although it is freely available on the GBRMPA website) and other minke whale encounter management issues, which would affect their management of encounters. It would seem desirable that an education program to target such operations would help to improve their management of incidental minke whale encounters and encourage their participation in monitoring data collection. The extent of incidental SWW activities involving these vessels might then be able to be evaluated.

As suggested by one KIS respondent, defining the criteria for receiving/holding a SWW-endorsement appears to be a more sensible option than deciding an arbitrary number to limit the scale of the SWW industry. Such criteria should be decided with the input of all key stakeholders in a workshop forum to ensure transparency and balanced input. Such an approach however must be balanced with precaution to minimise any potential cumulative impacts of the SWW activity with the whales, which are still unknown. Given the difficulties in determining a carrying capacity for the activity, the application of a Limits of Acceptable Change process (Stankey et al., 1985; Cole & Stankey, 1997) is strongly recommended, with monitoring implemented and stakeholder-agreed management response options prepared, to mitigate any observed deterioration of resource values or impacts on the whales. The implementation of such approaches within adaptive and collaborative management frameworks, in particular to assess the longer-term impacts of tourism on cetaceans, are increasingly recognised as a necessary management approach to achieve sustainability (Higham et al., 2009).

Among the mitigation options available to managers, the ability for permits/endorsements to be withdrawn from operators (to reduce the scale of the activity) should be retained, accompanied by a clear process and triggering mechanism. The comment made by one KIS respondent about the social impacts associated with the revocation of a commercial marine mammal watching permit in Monkey Mia (Shark Bay, Western Australia; Section 5.4.5), is a cautionary tale that should be heeded by stakeholders of the GBR SWW activity. In the Western Australian case, a causal link between dolphin watching tours and the decline in the local bottlenose dolphin population was established (Bejder et al., 2006), which led to a ministerial decision to reduce the industry scale from two permitted operators to one (Higham & Bejder, 2008).

5.7.12 Summary

This study explores a range of key management issues associated with the GBR SWW activity at a pivotal time in its management and development. By drawing on a range of perspectives from key stakeholders, experienced industry personnel and SWW participants themselves, it has attempted to present a balanced appraisal of these management issues and implications for future management of the activity. The additional evaluation of management processes and outcomes from three years of stakeholder workshops has also revealed a highly successful approach to management of the activity over the Dwarf Minke Whale Tourism Monitoring Program (2003-2008).

At the time of writing, the GBRMPA is conducting a review of the GBR SWW activity and changes to the current management structure may be made in 2011. One of the central issues of this review, as indicated by Key Informant Stakeholder interview respondents, is the scale of the industry. The processes involved in this review were outlined briefly at the 2008 Post-Season Workshop however many uncertainties remain about the extent and forum for stakeholder involvement, and the potential outcomes of these processes. Some of the recommendations arising from this study (outlined in Chapter 7; Section 7.4.2) were incorporated into a Final Report

to the GBRMPA on the Dwarf Minke Whale Tourism Monitoring Program (Birtles et al., 2010) and it is hoped that the findings of this study will assist managers and other stakeholders in their review of the SWW activity and its long-term management. It is also hoped that the example provided by the GBR SWW activity will assist the management of wildlife tourism elsewhere.

Chapter 6: Developing sustainability objectives and indicators

6.1 Introduction

As outlined in Chapter One (Section 1.4), assessments of sustainable development require monitoring of key indicators that are matched to clearly defined objectives that reflect the values and long-term aspirations of all key stakeholders. Sustainability objectives therefore provide an operational definition of sustainability for a destination, organisation or industry, by setting a series of targets towards which progress can be measured.

In 2002 a workshop (entitled "Management of Swim-With-Dwarf Minke Whale Activities in the northern Great Barrier Reef") involving 33 stakeholders (including swim-with-minke whales tourism operators, tourism industry representatives, State and Commonwealth government management agency staff and researchers) discussed key management issues associated with the GBR SWW activity, reviewed the Code of Practice and identified potential indicators for monitoring the SWW industry. The primary objective for swim-with-dwarf minke whales tourism in the GBR, established at this workshop, was "*to achieve ecologically sustainable swim-with-minke whale activities within the GBRWHA*" (Minke Whale Project, 2002, p.1). Two sub-objectives were also proposed:

> *1. To maintain the dwarf minke whale population in the GBRWHA, and*
> *2. To allow sustainable tourism interaction with dwarf minke whales in the GBRWHA.*

The difficulties in measuring these objectives were explicitly recognised, and an interim 'surrogate' objective of minimising the impacts of the SWW activities on the whales was identified (Minke Whale Project, 2002). Potential biological or ecological sustainability indicators that arose from the 2002 workshop discussions included monitoring of:

- Industry effort,
- The cohort of dwarf minke whales involved in interactions,
- The potential for cumulative effects,
- Changes in whales' behaviour, and
- The effects of noise from vessels (Birtles et al., 2002c)

Potential indicators to measure the effectiveness of encounter management and compliance with the Code of Practice and EPBC Regulations also arose from the 2002 workshop. By ensuring a consistent compliance, the management protocols themselves could be evaluated for any potential short or longer-term impacts on the whales (Birtles et al., 2002c). Proposed management performance indicators included:

- The occurrence of pre-swim briefings of passengers given by crew;
- Feedback from passengers that they felt adequately prepared for their encounter(s) with the whales;
- People not swimming towards or attempting to touch the whales;
- Whale cow-calf pairs not pursued by the vessel or swimmers;
- Active management of the encounter by crew including monitoring of whale and swimmer behaviour; and
- No 'negative' whale behaviours observed (e.g. evasive actions or 'avoidance' of the vessel or swimmers; Birtles et al., 2002c).

The above objectives and proposed performance indicators from the 2002 workshop formed the basis for this study, which sought to develop a comprehensive framework for evaluating the sustainability of the GBR SWW activity that encompasses the needs, values and aspirations of all key stakeholders within a suite of 'Quadruple-Bottom-Line' sustainability objectives that will assist the selection and evaluation of indicators for long-term monitoring.

Quadruple-Bottom-Line objectives and indicators

Quadruple-Bottom-Line (QBL) sustainability reporting includes recognition of the inter-dependence of economic, ecological, social and institutional/governance (expressed in this case as management) elements in complex social-ecological systems (Valentin & Spangenberg, 2000). Whilst the 'Triple-Bottom-Line' reporting

framework is widely accepted and continues to be promoted, there has been a growing recognition of a fourth dimension of sustainability which includes a requirement for institutional/governance conditions to be met in order for sustainable development to be truly achievable (Valentin & Spangenberg, 2000). Such institutional and governance requirements are often embedded within the social category of Triple-Bottom-Line reporting, for example within the Global Reporting Initiative Sustainability Reporting Guidelines (United Nations Environment Program, 2002; 2006) however the categorisation of such requirements within a QBL reporting framework is becoming increasingly accepted (Spangenberg, 2004).

As a range of management criteria were considered necessary to be incorporated into the sustainability objectives for the GBR SWW activity, a QBL framework was adopted for this study. Objectives were thus developed under ecological, social, economic and managerial categories.

Development process

Several authors outline a process of developing, screening and evaluating sustainability indicators (e.g. Holling, 1978; Bell & Morse, 1999, WTO, 2004), however there are very few methodological accounts of their development in tourism. Miller and Twining-Ward (2005) suggest this is likely to be due to the early stages of the use and development of sustainability indicators in tourism and the complexity of the development process.

A key step in the early stages of developing a sustainability monitoring program is to establish a clear set of objectives that are recognised by the stakeholders as desirable, achievable and sustainable (Miller & Twining-Ward, 2005). Miller and Twining-Ward (2005) state a need to first synthesise the existing knowledge and identify the knowledge gaps. Initial analyses and scoping are likely to be performed by a researcher or project facilitator, usually based on the literature. For local-level projects however, they suggest that the process of scoping is likely to be less reliant on secondary information and more so on stakeholder and community input, guided by broader scale concerns. The relevant information is then presented to the stakeholders in one or more facilitated workshops to analyse and prioritise the key issues (WTO, 2004; Miller & Twining-Ward, 2005).

Stakeholder participation

One of the most important components in the development of sustainability objectives and indicators is that the stakeholders are engaged and collaborate to ensure their values and aspirations are incorporated (Grimble & Wellard, 1997; Bell & Morse, 1999; 2003; Miller & Twining-Ward, 2005). Integrating knowledge from multiple perspectives and engaging stakeholders in the management and monitoring process increases the likelihood of successful implementation of the program, as well as the likelihood of identifying impacts on which to target future management actions (Riley et al., 2003). Identifying and bringing together the appropriate stakeholders at an early stage to set and agree on the sustainability objectives is therefore a critical first step (Bell & Morse, 1999; Miller & Twining-Ward, 2005). In the process of developing, implementing and reviewing indicators, even the level of stakeholder participation itself is suggested as a sustainability indicator (Bell & Morse, 1999).

Industry involvement in research and monitoring

Due to the remote location of the majority of SWW interactions in the GBR, the use of dedicated vessels for research and monitoring of the whales and the SWW activities would require substantial funding. Ostrom (1990) suggests that the day-to-day users of a natural resource often have a greater knowledge of its condition than do the resource managers, and consequently often regard themselves as the stewards of the resource. Thus information gathered and provided by these users can account for much of the information needed for development and evaluation of sustainability indicators that can be gathered at a reasonable cost (Ostrom, 1990; Riley et al., 2003). The involvement of SWW operators in monitoring SWW activities is therefore highly desirable, however the ability of the crew on these vessels to collect monitoring data that is sufficiently robust requires evaluation before such data can be used to draw conclusions about any observed trends.

6.1.1 Study Four objectives

This chapter documents and reflects on a process used to develop QBL sustainability objectives for the GBR SWW activity and evaluates the quality of industry-generated monitoring data (collected over 2006-2008) that is expected to contribute to a number of ecological sustainability indicators. Outcomes of this study include a comprehensive suite of QBL sustainability objectives matched to a range of potential sustainability indicators (reported in results below and in Appendix 1).

It should be noted that the resulting sustainability objectives are not the sole intellectual property of the author, as they evolved through a participatory process involving numerous stakeholders and incorporate their diverse values, goals and aspirations for a sustainable swimming-with-whales tourism industry. It was intended throughout the process of developing the sustainability objectives that the stakeholders developed a sense of shared ownership of the resulting list.

Many of the proposed sustainability indicators are yet to be evaluated and prioritised in a similar participatory process. They are presented below as 'potential indicators' for the purpose of identifying data requirements, including existing sources and gaps to be addressed. It is intended that stakeholders will further develop and refine these sustainability indicators as part of an implementation process.

Specific objectives of Study Four were:

1. Using a participatory process involving key stakeholders, develop Quadruple-Bottom-Line sustainability objectives for the GBR swimming-with-minke whales tourism activity.
2. Critically evaluate the process by which the sustainability objectives were developed, including the level stakeholder participation.
3. Outline potential indicators to measure progress towards the sustainability objectives.
4. Evaluate the quality of industry-generated monitoring data for addressing potential sustainability indicators.

6.2 Methods

6.2.1 Developing sustainability objectives

Principles of Participatory Action Research (outlined in Chapter 2) were employed to engage key stakeholders (including tourism operators, government management agency staff, cetacean scientists and representatives of wildlife conservation NGOs) in an iterative, three-step process to develop species, location and industry-specific sustainability objectives:

(i) A suite of QBL draft objectives were initially developed based on relevant literature and with input from Minke Whale Project researchers, encompassing ecological, social, economic and management goals.

(ii) Sixteen stakeholder key informants were then interviewed to refine the objectives and explore issues relating to their implementation.

(iii) The objectives were subsequently reviewed and fine-tuned in a series of facilitated stakeholder workshops.

Stakeholder key informant interviews

Feedback on the draft list of sustainability objectives (SOs) was sought from 16 stakeholder key informants via semi-structured interviews (Key Informant Survey methods and respondents are outlined in Chapter 4). The list of SOs, along with a flyer explaining the aims and methods of the study, was distributed to interviewees several days in advance of their scheduled interview to allow time for preparation of comments. The handout contained prompts and space for respondents to annotate each draft SO, with instructions requesting interviewees to give consideration to its appropriateness and whether or not they thought it would be useful as a sustainability objective for the GBR swim-with-minke whales tourism industry (attached as Appendix 19).

A similar handout was used during the interviews (attached as Appendix 20). In this case, alongside each proposed SO a rating scale was used to gauge respondents' level of support for the objective (ranging from 1 = "do not support" to 5 = "very strong support; *NB. A 'do not know' option was also provided*). Additional questions at the

bottom of each category prompted respondents to consider if any objectives were missing and if the wording of any proposed SOs could be improved. During the interviews, respondents wrote their rating score for each draft objective on the handout and commented aloud whilst the digital voice recorder ran continuously. Handouts were retrieved at the end of interviews to collate the rating scores and any written comments in addition to those captured by the digital recorder. Eleven of the 16 respondents had sufficient time available to work through the list in this manner during their interview and provided rating scores for all SOs. The remaining five respondents provided verbal and written comments on the objectives.

Following the transcription of interviews, all feedback for each SO was collated and analysed (results presented below). The majority of respondents were generally supportive of most proposed SOs, thus the analysis concentrated largely on any criticisms or suggestions to improve the draft objectives. This feedback was used to refine the draft SOs, which were then presented to stakeholders along with outcomes of the interviews for their feedback and further refinement at stakeholder workshops.

Facilitated stakeholder workshops

The revised SOs were presented to participants at four stakeholder workshops held between November 2007 and December 2008 (workshop agendas included as Appendix 5). Time was set aside in the agenda of each workshop for the review of the SOs, ranging from approximately 35 to 105 minutes per workshop. Each of these sessions was facilitated by the author. The same process was followed in each session, whereby after reviewing the original draft wording and a summary of key issues for each objective (including comments from the stakeholder key informant survey), the wording was discussed and edited in real-time using a laptop and data projector. Workshop participants were encouraged to freely express any criticisms about the phrasing and/or intent of each SO during the fine-tuning process until all present were satisfied with the wording. Once a consensus on the wording of each SO had been reached, a vote was held (via a show of hands, or in most cases a room full of nodding heads with no-one disagreeing) to indicate participants' willingness to accept the objective as a sustainability objective for the GBR swim-with-minke whales tourism activity.

Due to time constraints, whenever the discussion of an SO became bogged down and a consensus could not be reached quickly, it was 'parked' and the workshop moved on to the next one. Unresolved SOs from each workshop were revised as necessary afterwards based on participants' feedback and were presented again for review and discussion at the next workshop.

Representation by key stakeholder groups was generally very good for each workshop, ranging between 20 and 37 participants (a summary of workshop attendance is provided in Chapter 5; Section 5.3). Outcomes of each workshop (including finalised and adopted SOs) were documented and reported back to stakeholders via workshop minutes. A summary of key discussion points and outcomes from each of the four stakeholder workshops is presented in the results below (Section 6.3).

6.2.2 Development of potential sustainability indicators

A range of potential indicators to address each SO were developed with input from MWP researchers. Those indicators that draw on industry-generated data (including Whale Sighting Sheets, Vessel Movement Logs and passenger questionnaires) are presented and evaluated in the results below. These potential QBL indicators are also presented in Appendix 1, along with key questions requiring further research, tools and/or methods for monitoring each indicator and the stakeholder group/agency likely to be responsible for facilitating or providing support for such monitoring.

A process for selecting and implementing sustainability indicators is proposed in the discussion of this chapter (Section 6.5).

6.2.3 Evaluation of industry-generated monitoring data for potential sustainability indicators

Many of the potential sustainability indicators that draw upon data from existing sources (e.g. Whale Sighting Sheets, Vessel Movement Logs and passenger

questionnaires) are included among analyses presented in preceding chapters (3, 4 and 5). Further analyses were conducted to evaluate the quality and reliability of industry-generated monitoring data, including the Whale Sighting Sheets and Vessel Movement Logs. These analyses included an assessment of Whale Sighting Sheet completion rates (i.e. key fields with missing data) and a comparison of records (e.g. time recordings, GPS position) made by researchers and crew for the same dive site visits. Results of these analyses are presented below in Section 6.4.

6.3 Results: development of sustainability objectives

6.3.1 Development process: feedback from stakeholder key informants

A summary of the background and experience of the stakeholder key informant survey (KIS) respondents is provided in Chapter 4 (Section 4.4). KIS Respondents provided feedback on a first draft list of QBL sustainability objectives (presented below, Tables 6.1 – 6.4) which led to their refinement. The refined draft objectives were then subject to further fine-tuning before their adoption, in stakeholder workshops.

Overall impressions of the draft sustainability objectives

Reactions to the draft sustainability objectives (Tables 6.1 – 6.4 below) among the interview respondents were very positive. One respondent highlighted a need to identify and draw attention to the ecological knowledge gaps, which would guide future research into dwarf minke whale ecology and habitat use within the GBR. Example responses included (*NB. R1-16 refers to individual respondents; MC refers to the interviewer*):

- "I know you've got to have it all put down and you've got to look at all different stakeholders and then work through it, but a lot of this stuff is like common sense." (R2)
- "My first impression was very comprehensive and that you've obviously given it a great deal of thought… There weren't any that I thought were inappropriate or not very useful." (R11)
- "I think they're entirely appropriate, what I think is missing is any attempt to make a meaningful ecological perspective on things… Whether it's, bathymetry… ecology or

whatever it might be that renders some areas particularly important for the minkes, that seems to me to be something that's missing." (R15)

Feedback on specific draft objectives

A summary of mean ratings and criticisms/suggestions to improve each draft SO is presented below for each Quadruple-Bottom-Line category.

Ecological objectives

A high level of support was recorded for all draft ecological SOs, however issues were identified and improvements suggested for all but one of them. A summary of key criticisms and suggestions to improve each draft objective, along with mean ratings of KIS respondents' support is presented below (Table 6.1). General comments indicated that such ecological objectives reflected stakeholders' values about the whales, however one respondent identified a need to develop more specific and measurable objectives that focussed on the SWW activity. The difficulties associated with measuring progress towards broad ecological objectives that focus on the population of dwarf minke whales and their habitat were noted, highlighting a need for additional objectives or sub-objectives to be developed that could be addressed directly by stakeholders of the GBR SWW activity. Respondents however affirmed the value of those SOs that were broad in scope (e.g. 1.1a and 1.1b in Table 6.1 below) which provided overarching (or philosophical) objectives to guide management of the SWW activity. Example responses include:

- "I've been on the affirmative on all of these... If there's any proof coming in that interactions are having a harmful effect then we've got to consider modifying them." (R4)
- "It looks like most of them are pretty obvious, that you'd want to support these... [*If*] any one of those things goes wrong and it's bad for the whales, then anything that's bad for the whales is bad for the tourism and everything else." (R10)
- "The difficulty for you is that if you set an objective like that, then the objective is only useful if you can actually measure it… I agree with that objective, but that next step… I would scrutinise all of them to say, can you measure that? If you can't measure it, it's not a useful objective. It may be a broad aim, a philosophical aim, but it's not a measurable, you know you can't actually see if you're achieving your objectives." (R14)

Changes to the draft objectives were subsequently made based on KIS respondents' feedback (outcomes/actions for each objective are included below in Table 6.1).

Table 6.1: Summary of key informant survey respondents' mean rating scores (n=11) for their support for specific draft ecological sustainability objectives and summary of associated key criticisms/discussion points (n=16)

Original draft sustainability objective	Mean rating (out of 5)	Summary of key criticisms & discussion points	Outcome
1.1 The GBR dwarf minke whale population:			
(a) is maintained (i.e. the population is not decreased).	**4.6**	• Populations are generally not static, emphasis should shift to 'not altering it from its natural trajectory' • Population structure (i.e. demography) is also important. • This objective is too broad and is beyond the scope of the GBR SWW activity.	-Revised wording & focus. -New specific sub-objectives created.
(b) is not displaced from its normal habitat (e.g. feeding, breeding grounds, migratory paths) as a result of interactions with humans.	**4.6**	• This SI is desirable from a moral standpoint, but difficult to measure & attribute to the SWW activity.	- Wording fine tuned. -New specific sub-objective created.
1.2 Individuals and groups of dwarf minke whales:			
(a) are not physically harmed as a result of interactions with humans.	**4.6**	• All generally supportive; objective is clear and can be measured/monitored.	-Wording fine-tuned in workshop.
(b) control the nature and extent of interactions with vessels and swimmers.	**4.7**	• All generally supportive; objective is clear and can be measured/monitored. • Raises question about potential impacts of very long encounters, even if controlled by the whales.	-Wording fine-tuned in workshop.
(c) do not have their behaviour negatively impacted as a result of interactions with humans.	**4.5**	• Behavioural responses are inevitable, difficult to determine if impact is significant. • Need to establish behavioural and energy budgets to measure this.	-Revised wording & focus. -New specific sub-objective created
(d) do not have their key activities (such as feeding, breeding, nursing, resting, socialising) interfered with as a result of interactions with humans.	**4.5**	• Suggestion to change wording to "negatively impacted" – the term 'interfered with' is unclear. • Difficult to determine 'key' activities in practice & difficult to measure this.	-Revised wording & focus.
(e) are not at a greater risk of being hunted (e.g. by whaling vessels) as a result of habituation to vessels from human interactions in the GBR.	**4.4**	• There are other risks associated with habituation that may be more relevant (e.g. vessel strike, entanglement). • Prevention of habituation should be an objective.	-Revised wording & focus.
1.3 Dwarf minke whales' habitat:			
(a) is not degraded by human activities.	**4.5**	• Outside the GBR is beyond the scope of the SWW activity. • Habitat is already being degraded by human activities. • Should be more focussed on the SWW activity.	-Revised wording & focus. -New specific sub-objective created.
(b) continues to support the GBR dwarf minke whale population.	**4.6**	• Similar comments to those for 1.3a. • Extent of the whales' habitat is not known.	-Changed focus & new objective created.

Social objectives

The draft social objectives received a similarly high level of support from the KIS respondents, however there were fewer recommendations to change or revise them and no additional objectives were suggested. Further comments were made by four respondents about the importance of the tourism industry's role in advocating conservation of the whales and the Reef to tourists via interpretation. Example responses include:

- "I think using the specific advocacy for the Reef and about whales… those two things are quite useful things in those social objectives." (R14)
- "Probably it would be a good thing … to use the tourism as a means of educating people about cetaceans in general and in particular in view of whaling and how it relates to the experience that they're having." (R15)

A summary of issues and recommendations for each draft social objective, along with mean ratings of stakeholders' support and outcomes/actions based on their feedback is provided below (Table 6.2).

Table 6.2: Summary of key informant survey respondents' mean rating scores (n=11) for their support for specific draft social sustainability objectives and summary of associated key criticisms/discussion points (n=16)

Original draft sustainability objective	Mean rating (out of 5)	Summary of key criticisms & discussion points	Outcome
2.1 Swim-with-dwarf minke whales tourism operators in the GBR:			
(a) provide a consistently high-quality experience for international and domestic tourists.	**4.5**	• Suggest change wording to 'all participants' • 'High quality experience' must be defined.	-Wording revised & definition provided.
(b) promote further understanding and appreciation of dwarf minke whales to their clients using high quality interpretation.	**4.5**	• All generally supportive; objective is clear and can be measured/monitored. • 'High quality interpretation' also needs to be defined.	- Wording fine tuned & definition provided.
(c) foster broader conservation awareness and a commitment to sustainability among their crew and passengers.	**4.6**	• All generally supportive.	- Wording fine tuned in workshop.
(d) contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research.	**4.7**	• Financial constraints of tourism operators will limit the extent to which they can do this.	-Unchanged.
(e) achieve and maintain the support of the local community, such that it values the whales and the industry appropriately.	**4.3**	• First half of sentence is sufficient – cannot achieve community support without their valuing this in the first place. • The term 'appropriately' is vague.	-Wording revised.
2.2 Swim-with-dwarf minke whales participants:			
(a) are aware of the relevant EPBC Regulations and protocols in the Australian National Guidelines for Whale and Dolphin Watching 2005 (and subsequent revisions) and the Code of Practice for Dwarf Minke Whale Interactions before they encounter dwarf minke whales.	**4.6**	• Terminology is too complex – needs to be simplified.	-Wording revised.
(b) are sufficiently prepared for their swimming-with-dwarf minke whales experience, with realistic expectations of in-water interactions.	**4.7**	• All generally supportive.	- Wording fine tuned in workshop.
(c) follow the Code of Practice.	**4.5**	• All generally supportive.	- Wording fine tuned in workshop.
(d) are not at risk of death, injury or disease by swimming with dwarf minke whales.	**4.5**	• Can't say people are not at risk – need to re-word: suggest 'minimise risk' or 'managed risk'. • Crew are responsible for managing risk to swimmers.	-Wording revised. -Objective moved to focus on operators.
(e) contribute to research and monitoring of dwarf minke whales and potential impacts of their interactions.	**4.4**	• All generally supportive.	- Wording fine tuned in workshop.
(e) have an outstanding experience interacting with the whales.	**4.4**	• Need to clarify/define 'outstanding'. • This objective should be combined with 2.1a.	- Wording fine tuned & definition provided.

Economic objectives

Expressions of support for specific draft economic sustainability objectives were markedly lower than those for other categories, however overall they were generally supported. KIS respondents' feedback indicated some flaws in the wording and focus of some objectives (e.g. 3, 3a & 3c; Table 6.3). For draft SO 3(c) ("*Swim-with-dwarf minke whales permitted operators in the GBR have appropriate environmental offsets factored into their cost-benefit analyses*") in particular, three respondents found this objective unclear and they were unable to provide a rating of their support, selecting the 'don't know' option. Additional comments suggesting that the economic objectives should be considered of lesser importance than ecological ones were made by two respondents, however the inclusion of the economic category was generally acknowledged as important for sustainability. Example responses include:

Comments about the primacy of ecological over economic objectives:

- "Nothing can be more important than the sustainability of the habitat and the whales, so the economic benefits must come second to all that." (R5)
- "You almost need to link that statement in 3 [*the economic category*] to, 'subject to achieving the ecological objectives', so that the ecological objectives have primacy." (R14)

Generally supportive of economic sustainability objectives:

- "I think that management agencies are a few years behind in that aspect of recognising that economics plays a part and it's just as important… for sustainability… [*The operators*] need to be able to run a business that's profitable if they're going to have some sense of ownership about being best practice, or going above and beyond the minimum levels of requirement. That there has to be some sort of economic basis to that because you can't pull money out of nowhere to provide better interpretation or to upgrade your boat so it's a green boat or to do that kind of stuff." (R13)

Table 6.3: Summary of key informant survey respondents' mean rating scores (n=11) for their support for specific draft economic sustainability objectives and summary of associated key criticisms/discussion points (n=16)

Draft sustainability objective	**Mean rating** (out of 5)	**Summary of key criticisms & discussion points**	**Outcome**
Primary objective:			
3. Swim-with-dwarf minke whales tourism in the GBR returns an adequate profit to the industry.	**4.2**	• Operators' profitability is not dependent on the whales (due to seasonality). • Relevance questioned. • Suggest change of emphasis to ensuring a sustainable industry in the community.	-Wording revised & focus shifted.
Sub-objectives: "Swim-with-dwarf minke whales permitted operators in the GBR":			
(a) have sufficient access to the resource and share the resource equitably.	**4.5** *(one respondent selected 'don't know')*	• Focus is more management (allocation process) rather than economic. • 'Sufficient access' should not be a right if there are impacts on the whales.	-Objective removed; new management objective created.
(b) contribute to the maintenance of the resource on which they depend.	**4.6** *(one respondent selected 'don't know')*	• Definitions required for 'resource' and extent of contribution.	- Wording fine tuned.
(c) have appropriate environmental offsets factored into their cost-benefit analyses.	**4.1** *(three respondents selected 'don't know')*	• Meaning unclear to some respondents. • Objective assumes that operators are already causing impacts; offsets should be done after impacts are reduced to minimum. • Education of tourists should be considered an offset to impacts. • Credibility of offsetting schemes is presently questionable.	-Focus of objective revised. -Not yet resolved in workshops
(d) provide an adequate economic return to the local community (e.g. through local sourcing, employment).	**4.2**	• 'Adequate contribution' must be defined. • Some operators will be able to contribute more than others.	-Wording fine-tuned & definition given.

Management objectives

A very high level of support was shown for the draft management objectives overall however there were numerous suggestions to improve them, in particular fine-tuning of the wording to ensure clarity (see summary of criticisms below in Table 6.4). Two respondents indicated a dislike for the term 'World's Best Practice' however due to the very high level of support it achieved (this objective scored the highest mean rating; Table 6.4), in particular from industry respondents, the objective was amended and the term retained. Example responses include:

Dislike for the term 'World's Best Practice'

- "World's Best Practice, I mean that's thrown around all over the place and can be pretty meaningless." (R15)

Comments about stakeholder collaboration and level of involvement

- "You're never going to have everyone that [*you*] want to be there… but I think if you can have the larger proportion really happy and wanting to be involved, then you're probably on a winner." (R12)
- "The best way of managing such an industry is gathering all the stakeholders together… that's the absolute number one priority as far as I'm concerned." (R16)

Table 6.4: Summary of key informant survey respondents' mean rating scores (n=11) for their support for specific draft management sustainability objectives and summary of associated key criticisms/discussion points (n=16)

Draft sustainability objective	Mean rating (out of 5)	Summary of key criticisms & discussion points	Outcome
4.1 Management of the GBR swim-with dwarf minke whales tourism industry:			
(a) is World's Best Practice and establishes a leading model for whale watching and wildlife tourism management in Australia and internationally.	**4.8**	• Simplify wording: recognition of WBP requires being a leading model. • There must be benchmarks for comparison. • Concern about encouraging development of other SWW programs which may be inappropriate.	-Wording revised.
(b) is genuinely collaborative and participatory, involving all stakeholders.	**4.6**	• Simplify wording: 'genuinely' is unnecessary. • Not all stakeholders can participate all the time; emphasis should be on a participatory process.	-Wording revised.
(c) contributes to capacity building and knowledge sharing.	**4.7**	• Suggest adding 'between all stakeholders'.	- Wording fine tuned.
(d) is transparent in all decision making processes.	**4.6**	• All generally supportive.	-Unchanged
(e) is informed and guided by the use of the highest quality scientific research.	**4.7**	• Suggest adding words 'is informed by and responsive to…' so that management responds directly to science.	- Wording fine tuned.
(f) wherever a lack of scientific certainty exists, applies the Precautionary Principle to proactively prevent potential negative impacts on the resource.	**4.5** *(one respondent selected 'don't know')*	• Clarification of definition required. • Need to simplify and focus on the burden of proof, i.e. 'prove that there won't be an impact before you start doing it'.	-Wording revised & definition provided.
(g) is able to adapt and respond promptly to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale).	**4.5** *(one respondent selected 'don't know')*	• Suggest simplification of wording. • 'Promptly' may be inappropriate in some cases where more time/information is required.	-Wording revised.
4.2 The GBR swim-with dwarf minke whales tourism industry:			
(a) demonstrates a consistently high level of compliance with EPBC Regulations, the Australian National Guidelines for Whale and Dolphin Watching 2005 (and subsequent revisions) and the Code of Practice for Dwarf Minke Whale Interactions.	**4.7** *(one respondent selected 'don't know')*	• Operators should comply with all relevant management requirements, not just whale watching ones.	-Wording revised & simplified.

6.3.2 Development process: fine-tuning and adoption of sustainability objectives in stakeholder workshops

After being revised based on the feedback from the stakeholder KIS respondents, the SOs were presented to participants at four stakeholder workshops (held over 2007-2008) for fine-tuning and adoption as sustainability objectives for the GBR SWW activity. A summary of this process and outcomes from each stakeholder workshop is presented below.

Post-Season Workshop, November 2007

Towards the end of this workshop following a review of the 2007 season's preliminary findings and discussion of management issues, 45 minutes were allocated to reviewing SOs. Workshop participants were introduced to the concept and purpose of the SOs and were updated briefly on the process by which they were being developed. SOs that were deemed to be the simplest and most likely to be supported were introduced first, with more complex SOs introduced after the workshop participants had become accustomed to the SO review and adoption process. A summary of feedback from the KIS survey for each draft SO was also presented alongside the revised objectives. This workshop was successful in reviewing six social SOs, with minor amendments made to their wording in real-time. All six objectives were adopted with unanimous support from the workshop participants.

Code of Practice and SO Workshop, April 2008

After reviewing and adopting changes to the Code of Practice, the latter half of this workshop (approximately 1 ¾ hours) was devoted to the review of proposed SOs. A brief update was given on the SOs that had been adopted at the previous workshop before commencing the review. As per the previous workshop, SOs that were deemed to be the simplest were reviewed first.

Prior to the review of the proposed ecological SOs, the following caveats (identified from the KIS survey) associated with some of these objectives were acknowledged: (i) that some objectives would be very difficult to address with indicators due to their broad scope (e.g. the assessment of risks and threats to dwarf minke whales outside the GBRMP), and (ii) that further research on dwarf minke whale population structure

and external threats will be required, but still might not be able provide a clear explanation of some observed trends. Despite these caveats, the objectives were still considered to be desirable as broader, long-term goals for the industry and stakeholders. To assist progress towards these broader goals, several new sub-objectives that were specific to the SWW activity had been developed and were introduced to workshop participants for their review.

In total, 32 SOs were reviewed during the workshop with 23 being formally adopted with unanimous support. These outcomes and key discussion points for the nine unresolved SOs were recorded and summarised in the workshop minutes. For most of the SOs that were unresolved, workshop participants had indicated that the wording was not sufficiently clear. These SOs were revised based on this feedback and reviewed at the subsequent workshops.

Pre-Season Workshop, May 2008

Six proposed SOs were reviewed during this workshop, of which five were resolved and formally adopted with unanimous support. Additional implications of an ecological SO that had been adopted at the previous workshop (1.8a; "*Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way*") were discussed in further detail, including highlighting of some potential indicators to address it. Such indicators included: (i) operators supporting research to evaluate the local-scale impacts of their operation on the marine environment and implementing procedures to reduce such impacts to an ecologically sustainable level, (ii) operators conducting an audit of their net ecological footprint (EF) and taking steps to achieve an appropriate EF benchmark, and (iii) an increasing proportion of SWW participants contributing to an accredited offsetting scheme to offset the carbon emissions and EF of their holiday. After discussing these implications the workshop participants agreed unanimously to retain the SO without further modification.

Post-Season Workshop, December 2008

At the final workshop during this study, seven remaining proposed SOs were reviewed and five were adopted with unanimous support from the workshop participants. The two unresolved SOs, both from the economic category, were:

3(d) "Swimming-with-whales endorsed tourism operators in the GBR incorporate natural capital valuations (e.g. dive site 'health' conditions, species diversity & abundance) into their cost-benefit analyses." It was noted that the SWW operators were unlikely to have the resources to conduct their own valuations of natural capital (i.e. biological and ecological surveys) and that such research and monitoring must be considered as a high priority for the GBRMPA. It was also emphasised that environmental damages must not be considered to be compensated by benefits from manufactured capital (e.g. income). The full range of implications associated with this proposed objective could not be explored in the time available at this workshop and it was therefore flagged for further discussion at a future workshop.

3(e) "Swimming-with-whales endorsed tourism operators in the GBR become carbon neutral by _____." This proposed SO was developed and added to the list after the stakeholder key informant survey in response to recent scientific literature (e.g. Veron, 2008) that predicted severe effects on the GBR (and coral reefs worldwide) resulting from increasing atmospheric CO_2. The timeline for achieving this proposed objective was left open intentionally for workshop discussion. Industry representatives at the workshop indicated that they were generally supportive of such an initiative however many details and implications of this SO could not be resolved in the limited time available. Key concerns included the processes by which SWW operators could become carbon neutral, the legitimacy of offsetting programs and possible direct benefits to the GBR region. Management agency participants indicated that they were supporting new programs to assist the GBR tourism industry move towards such targets.

By the conclusion of the 2008 Post-Season Workshop, a total of 39 sustainability objectives (presented in Tables 6.5 – 6.8 below) had been formally adopted with unanimous support from workshop participants, with the abovementioned two unresolved economic SOs pending further discussion by stakeholders in future workshops.

6.3.3 Outcomes: adopted sustainability objectives for the GBR SWW activity

Presented below (Tables 6.5 – 6.8) are 39 sustainability objectives (eight of which are sub-objectives) that resulted from the development process outlined above, arranged into their respective Quadruple-Bottom-Line categories (ecological, social, economic and management). These 39 SOs were accepted with unanimous support from participants at the stakeholder workshops. Brief descriptions are provided to explain the relevance and key issues associated with each objective.

Table 6.5: Stakeholder-adopted ecological sustainability objectives

Sustainability objective	Relevance and key issues
1.1 The GBR dwarf minke whale population size and structure are not impacted by human influences.	Measuring progress towards this objective is a challenging research task that is not currently being addressed. This objective however reflects a shared vision for the conservation of dwarf minke whales. Two sub-objectives are provided below, which focus on (a) the GBR swimming-with-whales (SWW) activity and (b) the stakeholders of this industry, to assist their progress towards the achievement of this broad objective.
***Sub-objective*:** 1.1 (a) The interacting GBR dwarf minke whale population size and structure are not changed by the swimming-with-whales activity.	Changes in size and structure of the interacting population are detectable by monitoring for trends in indicators such as: (i) the number of interacting whales in the GBR, (ii) gender ratios of interacting whales and (iii) age/size class ratios of interacting whales. However, determining the cause of any observed trends will be very difficult.
***Sub-objective*:** 1.1 (b) Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat.	This objective recognises that the GBRMP is important habitat for dwarf minke whales and that stakeholders must promote and achieve support for the conservation of the GBR and the broader marine environment.
1.2 The GBR dwarf minke whale population is not displaced from its key habitats (e.g. feeding, breeding grounds, migratory paths) as a result of human influences.	Measuring progress towards this objective is a challenging research task that is not currently being addressed. This objective however reflects a shared vision for the conservation of dwarf minke whales. A sub-objective is provided below which focuses on the GBR SWW activity.
***Sub-objective*:** 1.2 (a) Dwarf minke whales are not displaced from the areas where they are commonly seen in the GBR as a result of interactions with vessels and swimmers.	Displacement of interacting dwarf minke whales from the areas they commonly use in the GBR (e.g. Lighthouse Bommie) is detectable by monitoring interaction rates at sites where dwarf minke whales are regularly encountered. However, determining the cause of any observed changes is very difficult.
1.3 Dwarf minke whales are not physically harmed as a result of their interactions with vessels and swimmers.	Mangott (2010) outlines a risk assessment matrix to evaluate and assist the management of risks to whales and humans during SWW activities.
1.4 Dwarf minke whales initiate and voluntarily maintain all their interactions with vessels and swimmers.	It is illegal for vessels to approach closer than 100m to a whale, and swimmers must not move towards a whale when closer than 30m.
1.5 Dwarf minke whales are not impeded from following their life-sustaining behaviour patterns (e.g. feeding, resting, nursing, socialising and reproducing) as a result of human influences.	Research is needed to establish the extent of habitat for the GBR population of dwarf minke whales. A sub-objective is provided below which focuses on the GBR SWW activity.
***Sub-objective*:** 1.5 (a) The energy and behavioural budgets of dwarf minke whales are not significantly altered as a result of the swimming-with-whales activity.	It is possible to monitor for short-term behavioural changes, however we do not yet know the energy and behavioural budgets for dwarf minke whales and more behavioural research is required to establish these.
1.6 Dwarf minke whales do not show signs of disturbance as a result of repeated interactions with vessels and swimmers.	It is difficult to determine whether whales are disturbed by the presence of vessels or swimmers. A list of behaviours is provided in the Code of Practice which may indicate possible disturbance.
1.7 Dwarf minke whales are not habituated as a result of the swimming-with-whales activity.	There are a range of potential risks to the whales that may be increased if they become habituated to interactions with humans (e.g. entanglement, vessel strike, hunting).
1.8 The habitat of the GBR dwarf minke whale population is conserved in perpetuity.	Measuring progress towards this objective is a challenging research task that is very broad in scope. This objective reflects a shared vision for the conservation of the GBR and the marine environment. A sub-objective is provided below which focuses on the GBR SWW activity.
***Sub-objective*:** 1.8 (a) Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way.	The evaluation of ecological sustainability requires full-cost accounting of the ecological footprint (EF) for the business. EF calculations account for the consumption of energy, foodstuffs, raw materials and water, and the production of wastes (including carbon dioxide from the burning of fossil fuels), transport-related impacts and the use of productive land associated with buildings, roads and other infrastructure. It is important to recognize that a large proportion of the net EF associated with tourism in the GBRMP will be associated with long-haul air travel by international tourists (i.e. primarily carbon dioxide and other emissions from aircraft). SWW-endorsed operators can significantly reduce the net EF of their business in the short-term by encouraging their clients to contribute to a guaranteed and accredited (e.g. by the Australian Greenhouse Office) offsetting scheme.

Table 6.6: Stakeholder-adopted social sustainability objectives

Sustainability objective	Relevance and key issues
2.1 (a) Swimming-with-whales endorsed tourism operators in the GBR provide a consistently high-quality experience for all participants.	The following elements were recognised by stakeholders as contributing to a "high quality experience": • Participants' expectations being met or exceeded and a high rating of satisfaction with the experience. • Use of high quality interpretation (defined under 2.1b below). • Good management of whale interactions by crew. • Good briefings and passenger preparedness for swimming-with-whales. • Participants understanding & following the Code of Practice. • Participants' personal/intrinsic values of the whales being upheld.
2.1 (b) Swimming-with-whales endorsed tourism operators in the GBR use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR.	High quality interpretation is defined here as: • Factually correct and incorporates current/latest knowledge (e.g. latest research findings) • Has a clear and relevant theme/message • Accessible and understandable (e.g. language) • Interesting, engaging, stimulating and thought-provoking • May include use of multimedia • Enhances knowledge, encourages "mindfulness", influences attitudes and behaviour.
2.1 (c) Swimming-with-whales endorsed tourism operators in the GBR implement risk management procedures to minimise the risk of harm to participants.	Although there have been no reports of injury to swimming-with-dwarf minke whale participants, some dwarf minke whale behaviours have been identified (in the Code of Practice) that may pose a risk to humans and/or the whales, if they occur in close proximity to swimmers or objects in the water. Mangott (2010) outlines a risk assessment matrix to evaluate and assist the management of risks to whales and humans during SWW activities.
2.1 (d) Swimming-with-whales endorsed tourism operators in the GBR foster a greater awareness of sustainability and the conservation of whales and other marine life among their crew and passengers.	The ecological sustainability of the Great Barrier Reef ecosystem and broader marine environment are under increasing pressure from human-related threats. SWW-endorsed operators (and the wider GBR tourism industry) have an opportunity and obligation to raise their clients' awareness of such issues to increase public support for measures to protect and conserve the marine environment.
2.1 (e) Swimming-with-whales endorsed tourism operators in the GBR contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research.	SWW operators can support research in many ways, including: • by providing in-kind vessel berths/spaces for researchers on SWW trips. • by facilitating collection of data for research.
2.1 (f) Swimming-with-whales endorsed tourism operators in the GBR achieve and maintain the support of the local community, such that it values the whales and the industry, for its sustainable use of the Reef and interactions with the whales.	SWW-endorsed operators (and the wider GBR tourism industry) have an opportunity to raise public awareness for issues relevant to the protection and conservation of dmw, the GBR and the broader marine environment. By conducting their activities in a sustainable manner, SWW operators provide an example to the local community and wider public of sustainable use of the Reef and whales.
2.2 (a) Swimming-with-whales participants are familiar with the Code of Practice before they encounter dwarf minke whales.	Adherence to the Code of Practice is a permit condition of SWW-endorsed operators. The Code of Practice received a major update in 2008 to improve its ease of use by crew and passengers.
2.2 (b) Swimming-with-whales participants are prepared for their encounter, with realistic expectations of minke interactions.	Briefings of SWW participants prior to an encounter with whales should include the following details: • weather conditions, • the likelihood and average duration of in-water interactions (seasonally dependent), • numbers of whales, closeness of approaches, particular whale behaviours (e.g. exuberant displays) • adherence to relevant protocols in the Code of Practice, with explanations.
2.2 (c) Swimming-with-whales participants comply with the Code of Practice.	Management of passengers in the water during an interaction is the responsibility of vessel crew.
2.2 (d) Swimming-with-whales participants contribute to research and monitoring of dwarf minke whales.	SWW participants can contribute to research and monitoring of dwarf minke whales in several ways, including: • completing a passenger questionnaire. • recording behavioural observations in an Interaction Behaviour Diary • donating copies of underwater photographs/video footage of whales to the photo-ID study • donating money to support research and monitoring of the SWW activity.
2.2 (e) Swimming-with-whales participants have an outstanding minke experience.	Elements contributing to a 'high quality' SWW experience are outline above in 2.1 (a). The former objective focuses on SWW operators providing the experience. This objective focuses on the outcomes, as experienced by the SWW participants.
2.3 (a) Researchers studying dwarf minke whales in the GBR communicate relevant findings to all stakeholders in an ongoing collaborative learning process.	Over the period 2003-2008, the GBRMPA funded bi-annual workshops for industry, researchers and managers, at which members of the MWP research team presented updates on the latest findings from each season. These workshops provided a valuable forum for the communication of research findings and discussion of management issues between stakeholders. Funding will be required to ensure the continuity of such workshops.

Table 6.7: Stakeholder-adopted economic sustainability objectives

Sustainability objective	Relevance and key issues
3. Swimming-with-dwarf minke whales tourism in the GBR is an economically sustainable industry.	Businesses must be economically viable to ensure continuity of operation and an ongoing commitment to the maintenance and stewardship of the resource. Sub-objectives are provided below which focus on components associated with this broad objective.
***Sub-objective*:** 3 (a) Swimming-with-whales endorsed tourism operators in the GBR are resilient to short-term market fluctuations and adaptable to long-term market trends.	Live-aboard dive tourism operations typically have high operating costs and depend on a relatively small market segment that can be highly price-sensitive. Many destinations worldwide are in direct competition for this market. The GBR dwarf minke whale phenomenon however is a unique drawcard. Predictable sightings of dwarf minke whales are limited to a short season (approx. 6-8 weeks per year). SWW operators are multi-species operations and depend upon a range of dive sites and marine wildlife species to attract their clients.
***Sub-objective*:** 3 (b) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the conservation of the resource on which they depend.	Stakeholders must collectively agree on what constitutes an 'adequate' contribution. Such contributions can include: • Providing financial and/or in-kind support to research and monitoring of dwarf minke whales, other marine species and the marine environment. • Contributing to the Great Barrier Reef Environmental Management Charge (EMC).
***Sub-objective*:** 3 (c) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the local community.	Stakeholders must collectively agree on what constitutes an 'adequate' contribution. Such contributions can include: • Employing local residents. • Using local suppliers and services. • Encouraging clients (tourists) to utilise other local businesses.

Table 6.8: Stakeholder-adopted management sustainability objectives

Sustainability objective	Relevance and key issues
4.1 (a) Management of the GBR swimming-with-dwarf minke whales tourism industry is widely acknowledged as World's Best Practice.	Management of the GBR SWW activity has an opportunity and a responsibility set a world-leading example for the sustainable management of marine wildlife tourism. Whilst the GBR SWW activity has several unique characteristics, the collaborative and adaptive management approach can provide lessons benefitting the management of other Australian and international wildlife tourism.
4.1 (b) Management of the GBR swimming-with-dwarf minke whales tourism industry involves all stakeholders in a collaborative and participatory process.	Due to the geographical remoteness of the SWW activity and the infrequency of an enforcement presence, active industry involvement in the management of this activity is essential. Collaboration involving a wide range of key stakeholders (e.g. including researchers, managers, industry, and wildlife conservation NGOs) ensures that all values of the whales are represented and management actions have a higher probability of achieving their objectives.
4.1 (c) Management of the GBR swimming-with-dwarf minke whales tourism industry contributes to capacity building and knowledge sharing between all stakeholders.	Capacity building in the context of managing the GBR SWW tourism industry will include: • Ongoing stakeholder learning about the resource. • Investment in research, education and training. • Strengthening industry resilience and ability to adapt to change. • Precautionary rather than reactive management decisions.
4.1 (d) Management of the GBR swimming-with-dwarf minke whales tourism industry is transparent in all decision making processes.	Commercial in-confidence may apply to certain information for some decisions (e.g. permit assessments by the GBRMPA). In such cases the process and policy framework for assessments must be clear to all stakeholders.
4.1 (e) Management of the GBR swimming-with-dwarf minke whales tourism industry is informed by and responsive to relevant findings from scientific research.	Management decisions must be based on the best available scientific evidence. Given the lack of knowledge of dwarf minke whale biology, ecology and behaviour, comparisons may be drawn from relevant studies of other cetaceans and marine mammals.
4.1 (f) Management of the GBR swimming-with-dwarf minke whales tourism industry applies the Precautionary Principle.	The accepted definition of the Precautionary Principle is that provided by National Environment Protection Council Act 1994: *Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:* *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and* *(ii) an assessment of the risk-weighted consequences of various options.*
4.1 (g) Management of the GBR swimming-with-dwarf minke whales tourism industry adapts and responds to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale).	Management issues, current and potential threats and opportunities should be reviewed by stakeholders on a regular basis.
4.1 (h) Management of the GBR swimming-with-dwarf minke whales tourism industry utilises appropriate planning processes (e.g. the Limits of Acceptable Change process) to ensure efficient and equitable use of the resource at a sustainable scale.	The Limits of Acceptable Change (LAC) process (Stankey et al., 1985) was developed as a toolkit for parks & recreation managers to deal with the issue of recreational carrying capacity. The LAC process requires managers and stakeholders to define minimally acceptable changes to the resource (i.e. impacts) in order to achieve a compromise between (i) protection of the resource, (ii) protection of visitor experiences and values, and (iii) meeting the goals of resource users. A limit is placed on the level of impact/change to the resource that is acceptable. Impacts and trends are monitored, and when a predetermined level of adverse change is detected, management actions are implemented to mitigate and prevent further deterioration to the resource.
4.1 (i) Management of the GBR swimming-with-dwarf minke whales tourism industry operates within an adaptive management framework.	Adaptive management treats management policies as experiments. Adaptive management requires: • Collaboration involving all key stakeholders. • Development of objectives and indicators for monitoring. • Ongoing research and monitoring to understand cause-effect relationships. • Regular stakeholder workshops to review indicators and objectives, and implement management actions. • Reversibility of management decisions (if found to produce undesirable outcomes). • Ongoing stakeholder learning about the resource. • Transparency of information, decision processes and outcomes.
4.2 (a) Swimming-with-whales endorsed tourism operators in the GBR comply with all relevant management requirements.	Demonstration of consistent high compliance with management protocols by operators sets an example to passengers and other marine tourism operations in the GBR and elsewhere.

6.3.4 Potential sustainability indicators

A range of potential sustainability indicators to measure progress towards the QBL sustainability objectives were developed with input from Minke Whale Project researchers. These potential indicators are outlined below (Table 6.9). Those indicators that draw on existing industry-generated data presented in the preceding chapters (including the Whale Sighting Sheets, Vessel Movement Logs and passenger questionnaires) are shown in bold. An evaluation of the quality of whale sightings and vessel effort data provided by vessel crew is presented below (Section 6.4). The potential indicators that draw on these industry-generated data are evaluated using screening criteria adapted from Bell and Morse (2003) and others (as outlined in Chapter 1, Section 1.4.7) in the discussion that follows (Section 6.5).

Table 6.9: Quadruple-Bottom-Line sustainability objectives and potential sustainability indicators for the Great Barrier Reef swimming-with-whales activity (*NB. Indicators that draw on existing industry-generated data are shown in bold*)

Sustainability objective	**Potential indicators** *to measure progress towards this objective.*
Ecological objectives	
1.1 The GBR dwarf minke whale population size and structure are not impacted by human influences.	i. Research is initiated to determine the characteristics of the GBR dwarf minke whale population.
Sub-objective: 1.1 (a) The interacting GBR dwarf minke whale population size and structure are not changed by the swimming-with-whales activity.	i. Numbers of interacting whales recorded each season from standardised observations on dedicated research platforms do not decrease. ii. The proportion of re-sighted animals (both within and between seasons) does not change significantly over time. iii. The demography of interacting whales (i.e. gender ratio, age/size class ratios) does not change significantly over time.
Sub-objective: 1.1 (b) Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat.	i. SWW-endorsed operators use high quality interpretation to promote the conservation values of dwarf minke whales and the GBRMP to their clients. ii. Stakeholders of the GBR SWW industry lobby government for the conservation of dwarf minke whales and their broader habitat (within and outside the GBRMP).
1.2 The GBR dwarf minke whale population is not displaced from its key habitats (e.g. feeding, breeding grounds, migratory paths) as a result of human influences.	i. Research is initiated to address these knowledge gaps.
Sub-objective: 1.2 (a) Dwarf minke whales are not displaced from the areas where they are commonly seen in the GBR as a result of interactions with vessels and swimmers.	**i. Encounter rates (for the SWW tourism industry) at Reef sites do not change significantly over time.** **ii. The proportion of total whale encounter time to total vessel effort at Reef sites does not change significantly over time.**
1.3 Dwarf minke whales are not physically harmed as a result of their interactions with vessels and swimmers.	i. Incidents resulting in physical harm to whales do not occur or are extremely rare.
1.4 Dwarf minke whales initiate and voluntarily maintain all their interactions with vessels and swimmers.	**i. No significant increase in the proportion of encounters for which vessels were under power at the time of first sighting.** ii. Incidents involving breaches of EPBC and/or GBRMP Regulations do not occur or are extremely rare.
1.5 Dwarf minke whales are not impeded from following their life-sustaining behaviour patterns (e.g. feeding, resting, nursing, socialising and reproducing) as a result of human influences.	i. Research is initiated to address these knowledge gaps.
Sub-objective: 1.5 (a) The energy and behavioural budgets of dwarf minke whales are not significantly altered as a result of the swimming-with-whales activity.	i. Research is initiated to address these knowledge gaps.
1.6 Dwarf minke whales do not show signs of disturbance as a result of repeated interactions with vessels and swimmers.	i. Dwarf minke whales do not display 'potential disturbance behaviours' with increasing frequency over repeated interactions.
1.7 Dwarf minke whales are not habituated as a result of the swimming-with-whales activity.	i. Research is initiated to address these knowledge gaps.
1.8 The habitat of the GBR dwarf minke whale population is conserved in perpetuity.	*NB. A wide range of indicators are required for monitoring the state of the GBR and the broader marine environment.* *Australian institutions involved in such research and monitoring include (but are not limited to) the GBRMPA, the Australian Institute of Marine Science, the CSIRO, and several universities.*
Sub-objective: 1.8 (a) Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way.	i. SWW-endorsed operators support research and monitoring to evaluate impacts of their activities on the marine environment and implement procedures to reduce such impacts to an ecologically sustainable level. ii. SWW-endorsed operators conduct an audit of their net EF and take steps to reduce, and where necessary, contribute to a guaranteed and accredited offsetting scheme, to achieve an appropriate EF benchmark. **iii. An increasing proportion of SWW-participants contribute to a guaranteed and accredited offsetting scheme to offset the carbon emissions and EF of their journey away from home.** iv. SWW-endorsed vessels adhere to Best Practice environmental standards of operation. v. Divers and snorkellers adhere to Best Practice diving/snorkelling standards.

Table 6.9 (cont.): Quadruple-Bottom-Line sustainability objectives and potential sustainability indicators for the Great Barrier Reef swimming-with-whales activity (*NB. Indicators that draw on existing industry-generated data are shown in bold*)

Sustainability objective	**Potential indicators** *to measure progress towards this objective.*
Social objectives	
2.1 (a) Swimming-with-whales endorsed tourism operators in the GBR provide a consistently high-quality experience for all participants.	**i. Passenger mean rating of satisfaction with the SWW experience meets or exceeds a minimum standard (agreed by stakeholders).** **ii. Passengers' expectations of the SWW experience are met or exceeded (e.g. with regard to likelihood of encounters, no. of whales, closeness, behaviours seen, length of encounter).** iii. No reported incidences of inappropriate advertising.
2.1 (b) Swimming-with-whales endorsed tourism operators in the GBR use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR.	**i. Passengers received adequate SWW briefings and other interpretive material on their trip.** ii. Appropriately trained crew and/or guides are present on SWW trips and participate in SWW briefings and delivery of other interpretation. **iii. Passenger mean ratings of the quality of information provided about dwarf minke whales on their trip meets or exceeds a minimum standard (agreed by stakeholders).**
2.1 (c) Swimming-with-whales endorsed tourism operators in the GBR implement risk management procedures to minimise the risk of harm to participants.	i. Incidents resulting in physical harm to SWW participants do not occur or are extremely rare.
2.1 (d) Swimming-with-whales endorsed tourism operators in the GBR foster a greater awareness of sustainability and the conservation of whales and other marine life among their crew and passengers.	i. Post-experience surveys of SWW participants show an increased awareness and appreciation of whales and marine life. ii. Appropriately trained crew and/or guides are present on SWW trips and participate in SWW briefings and delivery of other interpretation.
2.1 (e) Swimming-with-whales endorsed tourism operators in the GBR contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research.	**i. SWW operators submit Whale Sighting Sheets (WSS) for every encounter with dwarf minke whales.** ii. SWW operators provide in-kind spaces on SWW trips for researchers. iii. Crew on SWW vessels facilitate collection of data for research (e.g. including passenger questionnaires, images/video for photo-ID).
2.1 (f) Swimming-with-whales endorsed tourism operators in the GBR achieve and maintain the support of the local community, such that it values the whales and the industry, for its sustainable use of the Reef and interactions with the whales.	i. Media articles/stories featuring SWW operators contain positive messages about the sustainable use of the Reef and/or interactions with the whales. **ii. Passengers' perceive the activities of SWW operators to be ecologically sustainable.** iii. SWW operators are accredited by a nationally/internationally recognised body for their ecologically sustainable operation (e.g. NEAP, Green Globe).
2.2 (a) Swimming-with-whales participants are familiar with the Code of Practice before they encounter dwarf minke whales.	**i. Passengers received adequate SWW briefings outlining relevant protocols in the Code of Practice before their first SWW encounters.**
2.2 (b) Swimming-with-whales participants are prepared for their encounter, with realistic expectations of minke interactions.	**i. Passenger survey responses indicate that SWW participants felt sufficiently prepared for their SWW encounter (minimum standard to be agreed by stakeholders).** **ii. Passengers' expectations of the SWW experience are met or exceeded (e.g. with regard to likelihood of encounters, no. of whales, closeness, behaviours seen, length of encounter).**
2.2 (c) Swimming-with-whales participants comply with the Code of Practice.	**i. No reported breaches of compliance with the Code of Practice (including responses in passenger questionnaires).**
2.2 (d) Swimming-with-whales participants contribute to research and monitoring of dwarf minke whales.	**i. SWW participants provide data for research and monitoring (e.g. including passenger questionnaires, behaviour diaries, images/video for photo-ID).** ii. SWW participants contribute financially to dwarf minke whale research and monitoring.
2.2 (e) Swimming-with-whales participants have an outstanding minke experience.	**i. Passengers' mean rating of satisfaction with the SWW experience is consistently high (meeting stakeholder-agreed minimum standard).** **ii. Passengers' expectations of the SWW experience are met or exceeded.**
2.3 (a) Researchers studying dwarf minke whales in the GBR communicate relevant findings to all stakeholders in an ongoing collaborative learning process.	i. Regular occurrence of workshops involving reporting of research results to all key stakeholders. ii. Research reports, publications and other outputs are made accessible to all stakeholders.
Economic objectives	
3. Swimming-with-dwarf minke whales tourism in the GBR is an economically sustainable industry.	Operators will have their own financial and operational indicators to monitor the performance of their business. *Potential additional indicators to be developed.*
Sub-objective: 3 (a) Swimming-with-whales endorsed tourism operators in the GBR are resilient to short-term market fluctuations and adaptable to long-term market trends.	Operators will have their own financial and operational indicators to monitor the performance of their business. *Potential additional indicators to be developed.*

Table 6.9 (cont.): Quadruple-Bottom-Line sustainability objectives and potential sustainability indicators for the Great Barrier Reef swimming-with-whales activity (*NB. Indicators that draw on existing industry-generated data are shown in bold*)

Sustainability objective	**Potential indicators** *to measure progress towards this objective.*
Sub-objective: 3 (b) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the conservation of the resource on which they depend.	**i. SWW operators contribute financially to dwarf minke whale research and other GBR research projects.** ii. SWW operators provide in-kind vessel spaces to researchers to allow them to collect scientific research/ monitoring data.
Sub-objective: 3 (c) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the local community.	i. SWW operators employ local residents. ii. SWW operators utilise local suppliers and services. iii. SWW participants utilise other local businesses.
Management objectives	
4.1 (a) Management of the GBR swimming-with-dwarf minke whales tourism industry is widely acknowledged as World's Best Practice.	i. Management of the GBR SWW exceeds benchmarks set by other whalewatching and marine tourism in Australia and worldwide. **ii. Positive feedback from SWW participants, researchers, managers and representatives of NGOs with experience of management issues associated with other whalewatching and marine wildlife tourism industries.**
4.1 (b) Management of the GBR swimming-with-dwarf minke whales tourism industry involves all stakeholders in a collaborative and participatory process.	i. Regular occurrence of SWW management workshops to which all key stakeholders are invited. ii. All key stakeholder groups are consulted in management decisions affecting the SWW industry. iii. All key stakeholder groups are satisfied with all management processes and decisions affecting the SWW activity.
4.1 (c) Management of the GBR swimming-with-dwarf minke whales tourism industry contributes to capacity building and knowledge sharing between all stakeholders.	i. Discussions of key management issues involving all key stakeholders occur regularly. ii. Stakeholder support for and investment in research to strengthen industry resilience and adaptability to changes in the social-ecological system.
4.1 (d) Management of the GBR swimming-with-dwarf minke whales tourism industry is transparent in all decision making processes.	i. All key stakeholder groups are satisfied with all management processes and decisions affecting the SWW activity.
4.1 (e) Management of the GBR swimming-with-dwarf minke whales tourism industry is informed by and responsive to relevant findings from scientific research.	i. Management review and decision making processes show clear references to relevant findings from scientific research.
4.1 (f) Management of the GBR swimming-with-dwarf minke whales tourism industry applies the Precautionary Principle.	i. Risk assessments are conducted in management review and decision-making processes wherever the possibility of degradation to the resource exists. ii. An appropriate level of monitoring is implemented following the introduction of any significant changes in the management of the SWW activity.
4.1 (g) Management of the GBR swimming-with-dwarf minke whales tourism industry adapts and responds to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale).	i. Occurrence of SWW stakeholder workshops to proactively review and plan for emerging issues, threats and opportunities affecting the SWW industry. ii. Stakeholder support for and investment in research to strengthen industry resilience and adaptability to changes in the social-ecological system.
4.1 (h) Management of the GBR swimming-with-dwarf minke whales tourism industry utilises appropriate planning processes (e.g. the Limits of Acceptable Change process) to ensure efficient and equitable use of the resource at a sustainable scale.	i. All key stakeholders are consulted in a transparent process when reviewing potential changes to the scale and distribution of the SWW activity. ii. Monitoring is implemented that is able to detect adverse changes in the resource. iii. Management actions are prescribed for responding to unacceptable changes.
4.1 (i) Management of the GBR swimming-with-dwarf minke whales tourism industry operates within an adaptive management framework.	As above for 4.1(b) – (h).
4.2 (a) Swimming-with-whales endorsed tourism operators in the GBR comply with all relevant management requirements.	**i. Incidents involving breaches of compliance with relevant management protocols do not occur or are extremely rare (includes formal incident reports and passenger questionnaire responses).**

6.4 Results: quality of industry-generated monitoring data for sustainability indicators

The following results provide an assessment of the quality of industry-generated monitoring data that contribute to some of the potential ecological sustainability indicators proposed in Table 6.5. Data from two instruments were evaluated: the Whale Sighting Sheet (WSS; completed under obligation as a GBR Marine Parks permit requirement) and the Vessel Movement Log (VML; completed voluntarily for the study presented in Chapter 3).

6.4.1 Completion rates for questions on the Whale Sighting Sheets

An analysis of the completeness of the received WSS was made and the frequency of missing data for key questions in the WSS is reported below (Table 6.10). Key data fields in the WSS (Appendix 4) included: (i) the date, (ii) the time of first sighting of whale(s), (iii) the location at the beginning of the encounter, (iv) the time of last sighting of a whale for the encounter, (v) the vessel name, (vi) the vessel status when whale(s) first sighted (i.e. steaming, drifting, moored or anchored), (vii) the number of whales observed during the encounter and (viii) the name of the person completing the WSS (*NB. identifying the recorder was deemed important in case a follow-up contact for additional information was required*). Overall the completion rates for Whale Sighting Sheets over 2006 to 2008 were high with very few cases of missing data in these key fields. No trends were apparent over the three seasons.

Table 6.10: Whale Sighting Sheet completion rates for key questions, 2006-2008 (n=854)

Question	Proportion of WSS on which the question was completed (%)		
	2006 (n=257)	**2007** (n=271)	**2008** (n=326)
Date	100	100	100
Time of initial sighting	100	99.6 (1 missing)	99.7 (1 missing)
Location at start of encounter	100	97.4 (7 missing)	99.1 (3 missing)
Time of last sighting	100	99.6 (1 missing)	98.2 (6 missing)
Vessel name	100	100	100
Vessel status when whale first sighted (e.g. anchored, moored, drifting or steaming)	96.5 (9 missing)	99.6 (1 missing)	99.7 (1 missing)
Number of whales	98.8 (3 missing)	98.9 (3 missing)	98.5 (5 missing)
Recorder name	95.7 (11 missing)	98.5 (4 missing)	98.8 (4 missing)

6.4.2 Comparison of whale sightings data collected by crew and researchers

Of the total WSS sample (2006-2008; n=854), 783 Sighting Sheets were completed by vessel crew and 71 were completed by researchers from the Minke Whale Project (either PhD students, supervisors or trained volunteers). As outlined in Chapter 3 (Section 3.2.2), in 2008 a number of duplicate WSS for the same encounter were received (for n=18 encounters; with a WSS completed by both a researcher and a crew member independently).

The 18 duplicate WSS completed by vessel crew came from three different vessels and were completed by four different people (2 Skippers and two Trip Directors). The 18 researcher duplicate WSS were completed by eight different research team members (7 volunteer researchers + the author). A comparison between the corresponding crew and researcher WSS was made, highlighting some discrepancies between the key data fields (summarised below in Table 6.11).

Table 6.11: Comparison of researcher and crew recordings of key data fields for 18 pairs of duplicate Whale Sighting Sheets received in 2008

Variable	Number of cases with discrepancy between researcher and crew records	Extent of difference
Location of first sighting	All site names consistent. GPS coordinates varied for 12/18 encounters.	Mean GPS difference between two points = 181.5m apart. (Range = 31-570m apart; n=12)
Time of first sighting	13/18	Mean difference = 15.5 minutes (Range = 1-55 mins; n=13)
Time of last sighting	14/18	Mean difference = 19.6 minutes (Range = 1-110 mins; n=14)
Approx. distance from vessel when first sighted	10/16 *Missing data in 2 cases from researchers*	Mean difference = 60 metres (Range = 5-280m; n=10)
Number of whales	7/18	Mean difference = 1.9 whales (Range = 1-3; n=7)
Closest approach distance by whale (to vessel)	10/18	Mean difference = 8.5 metres (Range = 4-15m; n=10)

6.4.3 Comparison of vessel effort data collected by crew and researchers

A comparison of site arrival and departure times between Vessel Movement Log (VML) and Researcher Log Sheet (RLS) records was made, where both data sheets were completed independently on the same day and vessel. A total of 180 vessel days were available for comparison (62 from 2006, 50 from 2007 and 68 from 2008), representing all SWW-endorsed operators except *Floreat Reef Charter* and *Eye to Eye Marine Encounters* (see Appendix 7 for the distribution among vessels). From these 180 vessel days, 456 site visits were recorded with duplicate/comparable logs. An additional 35 site visits were found on either a VML (n=27) or RLS (n=8) for which no record was made in the corresponding data sheet. Thus in 27 cases, the vessel crew member failed to log a site visit that was recorded by the researcher/volunteer, and in eight cases the researcher/volunteer failed to record the site visit.

In 28 cases, the arrival time at the site was not recorded (27 of which were VML records) and in 45 cases the site departure time was not recorded (44 of which were VML records). Among these, there were nine site visits for which neither the site arrival time nor the site departure time were recorded (all VML). From the remaining records, a total of 428 site arrival time pairs and 409 site departure time pairs (837 in

total when combined) from the VML and RLS could be compared. For 37.6% (315/837) of the total time pairs, the time recorded was identical (difference = 0 minutes). Discrepancies that were found for the remaining 522 time pairs ranged between one minute and 205 minutes in one extreme case (frequency distribution of time discrepancies shown below in Figure 6.1). The median time difference between these VML and RLS time records was two minutes (mean = 9.25 minutes; ±SE 0.786).

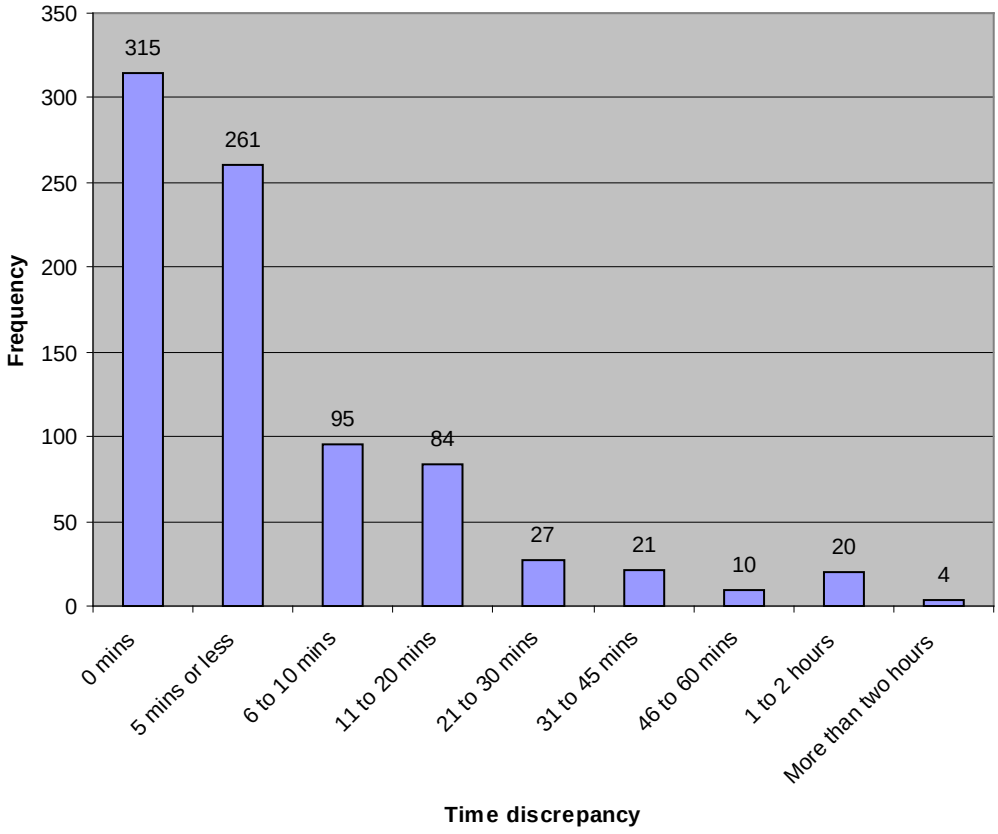


Figure 6.1 **Frequency distribution of time discrepancy between researcher and crew recordings of site arrival and departure times** (n=522 pairs of corresponding time records)

A comparison of the locations that were visited (records of site names and/or GPS coordinates) was also conducted and whilst many spelling errors of site names (also noting that different site names for some Reef sites are used by different operators) and abbreviations of the GPS coordinates were found (or were not recorded for many

of the better-known sites; i.e. were deemed unnecessary), no significant discrepancies were revealed between the VML and RLS records.

6.4.4 Rounding tendency in time recordings

It was expected that many of the smaller discrepancies above (Table 6.11; Figure 6.1) could be attributed to individual watch/clock variations and/or 'rounding off' of the time (e.g. to the nearest five or ten minutes) on the part of the crew member (or researcher) completing the data sheet. To investigate this possibility, a simple analysis of the frequency of the last digit of time recordings was conducted for the WSS, as well as for the vessel effort data completed by both crew and researchers.

From the total WSS sample (n=854), the two variables 'time of first sighting' and 'time of last sighting' yielded 1699 individual time recordings. Time recordings ending in '0' and '5' were found to be heavily over-represented in the sample and accounted for 60.9% (1034/1699) of the total time records (see Figure 6.2).

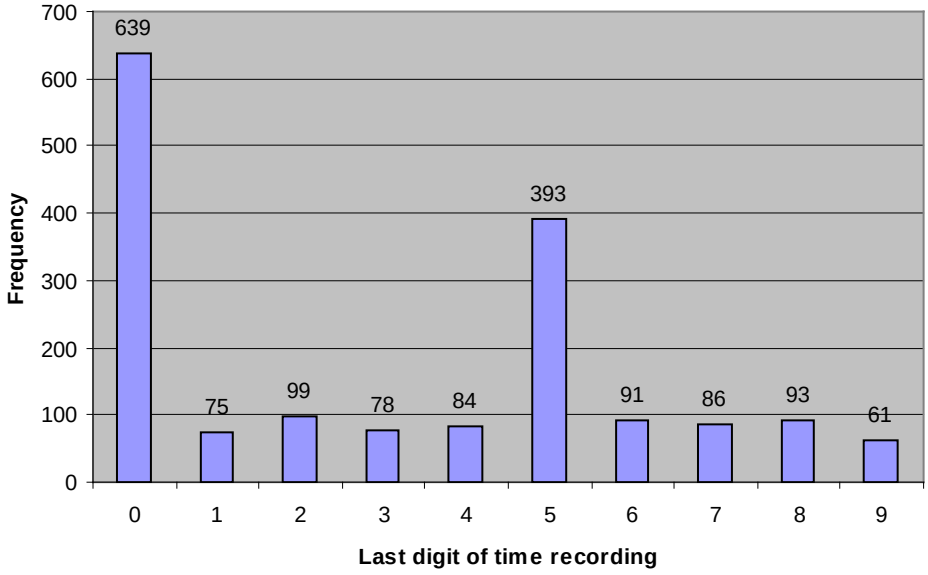


Figure 6.2: **Frequency distribution of the last digit in time recordings (time of first sighting and time of last sighting) on Whale Sighting Sheets, 2006-2008** (n=1699 individual time recordings)

A similar analysis was made for both the Vessel Movement Logs and Researcher Log Sheets which allowed a direct comparison between the two. In the VML data, time recordings ending in zero or five were heavily over-represented, accounting for 91% (476/522) of these records. For the RLS data, time recordings ending in these digits were over-represented to a lesser extent and accounted for 41% (215/522) of these records. Frequency distributions of this analysis for the VML and RLS are shown below (Figure 6.3).

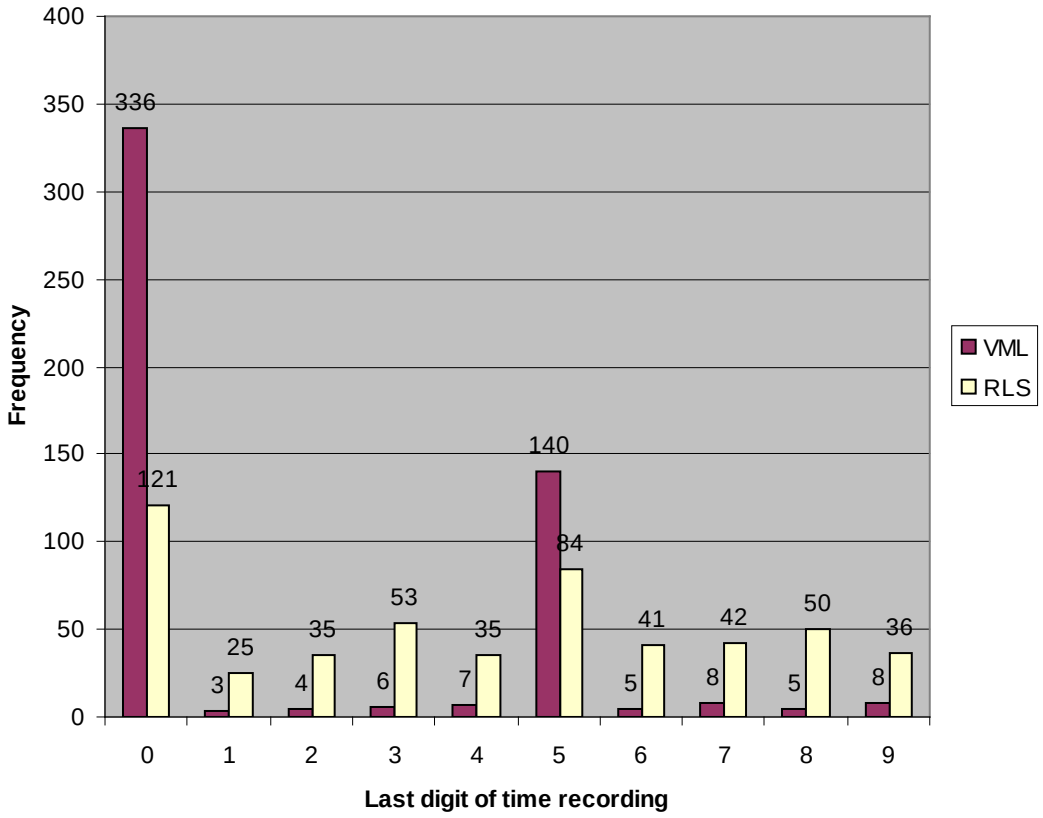


Figure 6.3: **Frequency distribution of the last digit of time recordings on the Vessel Movement Log and Researcher Log Sheet for 522 comparable cases with differing site arrival/departure times**

6.5 Discussion

Key findings and outcomes of this study include:

1. The successful engagement of key stakeholders in the development of a suite of QBL sustainability objectives for the GBR SWW activity (presented in Tables 6.5 – 6.8 and in Appendix 1).
2. A high level of support among stakeholders for the 39 sustainability objectives that were formally adopted in stakeholder workshops.
3. Identification of potential sustainability indicators to address the above objectives (Table 6.9 and Appendix 1).
4. An assessment of the quality of industry-generated monitoring data for potential ecological sustainability indicators.

6.5.1 Reflections on the sustainability objectives development process

This study succeeded in engaging key stakeholders in a participatory process to develop sustainability objectives for the GBR SWW activity. A high level of support was shown by the stakeholder key informants for the draft sustainability objectives and their feedback on specific draft objectives led to numerous refinements. Further fine-tuning of the sustainability objectives occurred during stakeholder workshops leading to all present agreeing unanimously to 'adopting' 39 objectives from the 41 that were proposed.

Key factors that are attributed to the success of this study include:

- ***A relatively small permitted industry and stable group of stakeholders***: Direct feedback on the SOs was gathered via interviews with owners and/or managers from seven of the nine SWW-endorsement holders (and from representatives of all nine SWW operations via the stakeholder workshops). The ability for representatives of all SWW operators to participate in the SO development process might not have been possible (or at least would have

been more logistically challenging) had there been a larger group of SWW-endorsed operators. Senior representatives of relevant wildlife conservation NGOs and a leading scientist from an Australian marine mammal research organisation also provided valuable input to shape the SOs, and whilst their attendance at stakeholder workshops was limited (primarily due to their location) they were informed of the outcomes of each workshop via the circulated minutes. Representatives of the GBRMPA attended all four workshops that dealt with sustainability objectives and representatives from Queensland Parks and Wildlife (Marine Parks) were able to attend three of these (as reported in Chapter 5, Section 5.3). Considering that many of the stakeholders (and key informant survey respondents) were busy people with limited time available for additional activities (i.e. lengthy interviews and workshops) the overall high level of participation shown is considered to be exceptional and indicative of a high level of interest in the management of the SWW activity.

- ***The shared values among different stakeholder groups and awareness of benefits of the SWW activity***: As reported in Chapter 4, a wide range of values associated with dwarf minke whales and the GBR SWW activity were elicited from the stakeholder KIS respondents, among which was a common empathy for the animals and their wellbeing, emotional elements associated with the SWW experience (among those who had swum with the whales) and a desire to achieve and promote a sustainable whale watching industry. The recognition of these values and of a range of benefits associated with the SWW activity for the different stakeholder groups (e.g. profit for industry, community engagement and education for managers, research opportunities for scientists and increased public awareness for wildlife conservation NGOs) are likely drivers of their interest and involvement in management processes, including the development of the SOs. Such values and benefits are attributed by Roggenbuck and Driver (1999) to be drivers in processes that lead to the inscription of national parks and preserves in the USA and elsewhere.

- ***The commitment from the GBRMPA to the six-year Dwarf Minke Whale Tourism Monitoring Program***: Funding for all workshops was provided by the GBRMPA under the six-year DMWTMP and at least two GBRMPA representatives attended every workshop during this period. Without this support for the workshops it is unlikely that this study would have achieved its objectives. It is also considered likely that without these workshops, industry contributions to research and monitoring data collection would not have been as substantial as they were.

- ***The existence of permits and operators' obligatory contribution to monitoring***: While the delineation of SWW-endorsed and non-SWW-endorsed operators via GBRMPA's Marine Parks permits makes identification of SWW operators relatively simple, the permit condition requiring their reporting of all minke whale encounters (via Whale Sighting Sheets; WSS) is likely to trigger their interest in monitoring results and hence the use of such data in management decisions. Each season's WSS results (and emerging trends) were reported to stakeholders by the MWP research team at post-season workshops (2003-2008) and were received with great interest by industry participants.

- ***The long-standing collaboration between Minke Whale Project researchers and SWW operators***: Minke Whale Project researchers had collaborated with many of the same SWW operators since dwarf minke whale research began in 1996. In addition, the author's personal involvement in previous studies involving several of the same SWW operators (e.g. Curnock, 1998; Birtles et al., 2002b; Valentine et al., 2004) undoubtedly also contributed to a growing confidence and trust in the research by the industry over this period which benefitted the sustainability objective development process.

- ***The use of a participatory (PAR) approach to the development of SOs***: The sustainability objective development process was driven primarily by the author and the outcomes shaped substantially by researcher involvement. The Participatory Action Research (PAR) approach (outlined in Chapter 2, Section

2.2.4) was shown to be an appropriate and very effective method for developing the objectives and for achieving strong support for them among the stakeholders. One of the underlying aims of the PAR approach is to facilitate the development of social capital in communities (Arnold & Fernandez-Gimenez, 2007). Social capital is defined as "the institutions, relationships, attitudes, and values that govern interactions among people and contribute to economic and social development'' (Grootaert & van Bastelaer, 2002, p.2). This SO development process is deemed to have contributed to the enhancement of social capital among these stakeholders through the documentation of shared values and objectives to achieve a sustainable SWW industry.

6.5.2 Critique of sustainability objectives

Sustainability objectives and indicators, once developed and implemented, should not be considered permanent, rather they should be periodically reviewed to ensure that they remain relevant and appropriate, address any changes in the socio-ecological system over time, and encompass the evolving values and roles of the stakeholders (Walters & Holling, 1990; Ramirez, 1999). The sustainability objectives that resulted from the process documented in this study may indeed include gaps and shortcomings that were not realised by the author or the stakeholders that contributed to their current form. Nonetheless these objectives represent a substantial advancement in the articulation of stakeholders' values, aspirations and long-term goals for the GBR SWW activity that will assist its sustainable management and monitoring. Key principles and concepts of sustainable development are incorporated into these objectives, which are reviewed in their respective categories below.

Ecological Objectives

Key principles among the ecological objectives include the protection and conservation of dwarf minke whales at the species, population and individual animal level (SOs 1.1, 1.2, 1.3, 1.5 & 1.7; Table 6.5) and the conservation of their habitat (SO 1.8; i.e. the Great Barrier Reef ecosystem and broader marine environment). These objectives are consistent with Australian cetacean policy (e.g. the Australian

National Guidelines for Whale and Dolphin Watching 2005; Commonwealth Department of the Environment and Heritage, 2005, and the Operational Policy on Whale and Dolphin Conservation in the Great Barrier Reef Marine Park; GBRMPA, 2007), which provides for the protection of individual whales including consideration for impacts on the behaviour of animals (e.g. potential disruption of migration, feeding, breeding and potential habituation to human encounters). Due to the unknown effects of cumulative interactions on the behaviour of individual whales, the GBR SWW sustainability objectives include additional objectives invoking the Precautionary Principle (SOs 1.4, 1.6; Table 6.5).

The broad, population-level objectives, in particular 1.1 ("*The GBR dwarf minke whale population size and structure are not impacted by human influences*") and 1.2 ("*The GBR dwarf minke whale population is not displaced from its key habitats (e.g. feeding, breeding grounds, migratory paths) as a result of human influences*") were criticized by one stakeholder KIS respondent for their broad scope, the difficulties associated with measuring them and with attributing any observed changes to the GBR SWW activity. These valid criticisms prompted the development of several sub-objectives that are more specifically focused on the SWW activity and its stakeholders (i.e. SOs 1.1a, 1.1b, 1.2a, 1.5a and 1.8a; Table 6.5). The broader objectives were retained however due to their strong level of support from remaining stakeholders and their overarching (or philosophical) goals to protect and conserve the GBR dwarf minke whale population.

Sub-objectives 1.1b ("*Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat*") and 1.8a ("*Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way*") provide more specific goals directed at stakeholders and SWW operators, however the latter sub-objective is again very broad in scope and introduces additional challenges for operators as well as uncertainties about sustainable levels of impact from tourism vessels on the Reef itself.

Social objectives

Underlying principles among sustainability objectives in the social category include upholding participants' values and expectations of the SWW experience (with a specific outcome of achieving high visitor satisfaction; e.g. 2.1a & 2.2e; Table 6.6), educating and promoting awareness of conservation values among SWW participants (2.1b, 2.1d) and the wider community (2.1f), participation in research and monitoring to assess sustainability by operators and SWW participants (2.1e & 2.2d respectively), compliance with management protocols (2.2a, b & c), participant safety (2.1c) and information sharing/social learning (2.3a; Table 6.6). Some duplication of objectives in this category is evident (e.g. 2.1a: "*Swimming-with-whales endorsed tourism operators in the GBR provide a consistently high-quality experience for all participants*" and 2.2e: "*Swimming-with-whales participants have an outstanding minke whale experience*"), however the focus on tourism operators *providing* and SWW participants *receiving* the experience prompts the development of indicators that focus on both the process and the outcome.

The 'peak' nature of the SWW experience (as described in Chapter 4) is recognised implicitly in sustainability objectives 2.1a and 2.2e (Table 6.6). The opportunity to enhance participants' awareness of marine and environmental conservation and sustainability in conjunction with such peak wildlife experiences (espoused by Orams, 1995; Birtles et al., 2001a; Townsend, 2003; among others) is encapsulated in two objectives directed at SWW operators (2.1b: "*Swimming-with-whales endorsed tourism operators in the GBR use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR,*" and 2.1d "*Swimming-with-whales endorsed tourism operators in the GBR foster a greater awareness of sustainability and the conservation of whales and other marine life among their crew and passengers*"; Table 6.6). Several of the stakeholder key informant survey respondents indicated that providing high quality interpretation with this aim should indeed be an obligation for SWW-endorsed operators.

Sustainability objectives in the social category relating to SWW participants' compliance with the Code of Practice (2.2a: "*Swimming-with-whales participants are familiar with the Code of Practice before they encounter dwarf minke whales*" and

2.2c: "*Swimming-with-whales participants comply with the Code of Practice*"; Table 6.6) could have been placed in the management category, however retaining all SOs directed at the SWW participants in this single category was deemed appropriate for the convenience of end-users. Indeed many of the QBL sustainability objectives could be considered applicable to more than one category and there is some clear overlap between some objectives in different categories (e.g. 2.1d as above and 1.1b: "*Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat*"). Such overlaps are not considered a weakness of the SOs, rather they reinforce key goals to the different user groups identified (i.e. the SWW participants, the operators, managers and other stakeholders) and placement in their respective categories provides additional context to guide users' actions.

Economic objectives

Whilst this category remains incomplete at the time of writing due to insufficient discussion among stakeholders of issues associated with two proposed objectives (3d: "*Swimming-with-whales endorsed tourism operators in the GBR incorporate natural capital valuations (e.g. dive site 'health' conditions, species diversity & abundance) into their cost-benefit analyses*" and 3e: "*Swimming-with-whales endorsed tourism operators in the GBR become carbon neutral by:* _____"; neither currently approved by stakeholders), key elements among adopted SOs include economic resilience and adaptability of operators to market changes (3a) and their financial contribution to maintenance of the resource (3b) and the local community (3c; Table 6.7). The latter two sub-objectives stem from ecotourism principles (Commonwealth Dept. of Tourism, 1994) whilst implicit in sub-objective 3a is the longevity of individual operators/businesses that contribute to a sustainable industry.

It is important to recognise that the SWW industry is a relatively small component of tourism goods and service providers in the Far North Queensland region and is highly dependent on a myriad of other industry sectors that contribute to the region as a tourism destination. This region is however largely dependent on long-haul travellers and more than 60% of SWW tourists are from overseas (Chapter 4; Fig. 4.1). The SWW operators and the wider GBR tourism industry is therefore vulnerable to worldwide events affecting tourism and long-haul travel, as evidenced by the closure

of *Undersea Explorer* in 2009, reportedly a consequence of the global economic downturn (Port Douglas & Mossman Gazette, 2009).

Unique aspects of the GBR SWW experience however can make a positive contribution to sustaining the longevity of the Cairns/Port Douglas region as a tourism destination. Hassan (2000) states that the unique and value-adding aspects of destinations can contribute to a long-term advantage and appeal to target market segments, however such components must be integrated with destination planning and development. A global perspective is also required to maintain destination competitiveness in a heavily segmented international nature-based tourism marketplace (Hassan, 2000). Individual SWW operators may consider each other as competitors, however it will be essential for them to look beyond such rivalry to develop a coordinated approach to contribute to sustained destination development.

A recent study by Stoeckl et al. (2010a) found that passengers on the live-aboard SWW-endorsed vessels (including SWW participants during the minke whale season) spent an additional four to five days in the Cairns/Port Douglas region before and/or after their Reef trip and spent on average almost $2000 AUD in the area. These operators were found to contribute at least $16m (and potentially up to $27m, depending on the multiplier used) annually to the local economy, indicating that they do indeed contribute substantially to the local community (as per sustainability objective 3c). Further market studies and the engagement of the SWW industry with key destination stakeholders may facilitate integration of the GBR SWW activity in strategic planning and benefit the sustainable development of the destination. Hassan (2000) however cautions that any environmental degradation to the destination's natural attributes is likely to adversely affect future demand for the destination.

Management objectives

Key concepts among sustainability objectives in the management category include stakeholder participation and collaboration (4.1b), transparency (4.1d), capacity building and knowledge sharing (4.1c), adaptability (4.1g & 4.1i), guidance from scientific research (4.1e) and the application of the Precautionary Principle when dealing with uncertainty (4.1f; Table 6.8). Objective 4.1h ("*Management of the GBR swimming-with-dwarf minke whales tourism industry utilises appropriate planning*

processes (e.g. the Limits of Acceptable Change process) to ensure efficient and equitable use of the resource at a sustainable scale") recognises the difficulties associated with determining the carrying capacity of the SWW activity and proposes the Limits of Acceptable Change (LAC) process (Cole & Stankey, 1997) as an appropriate tool for reviewing the scale and distribution of the industry.

The LAC process engages stakeholders to define minimally acceptable conditions or standards for the resource, and utilizes monitoring to determine if/when such conditions occur. If monitoring reveals that standards are not being met, pre-planned management actions are taken (e.g. reduce the scale of the industry). The LAC process therefore offers a compromise between the protection of the resource, upholding visitor values and experiences and meeting the needs/goals of resource users (Cole & Stankey, 1997). The issue of potential industry growth was shown to be a key concern among industry key informant survey participants (Chapter 5; Section 5.4.5) and the GBRMPA has indicated it will review the SWW activity in 2010 (following completion of the six-year Dwarf Minke Whale Tourism Monitoring Program; *NB. the outcomes of this review are still unknown at end-2010*) which could result in changes to the current cap on the number of SWW-endorsed operators. As representatives from the GBRMPA were party to the adoption of this sustainability objective, the process by which they review the SWW activity should clearly take this objective into account.

Objective 4.1a ("*Management of the GBR swimming-with-dwarf minke whales tourism industry is widely acknowledged as World's Best Practice*") reflects a desire among stakeholders that the SWW activity continue to be recognised as a leading model for sustainable management of a marine wildlife tourism industry. While positive feedback in this regard was received from management agency staff and representatives of conservation NGOs at stakeholder workshops in 2007 and 2008 (Chapter 5, Section 5.3.2) and via the stakeholder key informant survey (Chapter 5, Section 5.4.1), the activity must continue to be scrutinized and benchmarked to ensure such standards are maintained. Ongoing monitoring of the activity, industry compliance (addressed in objective 4.2a) and stakeholders' combined efforts to achieve the remaining SOs will be the most likely process to achieve such recognition.

6.5.3 Framework for sustainability indicators

A simplified graphical representation of the relationship between sustainability objectives and indicators is shown below (Fig. 6.4). At the top level is the overarching goal, in this case to achieve a sustainable SWW tourism industry. Specific sustainability objectives are then developed underneath in their respective QBL categories (via the process documented above), under which a suite of sustainability indicators are implemented to address each objective. In the process of selecting indicators it is likely that more than one will be required for individual objectives, and some indicators may even contribute to more than one objective (Miller & Twining Ward, 2005; e.g. as shown in Tables 6.9).

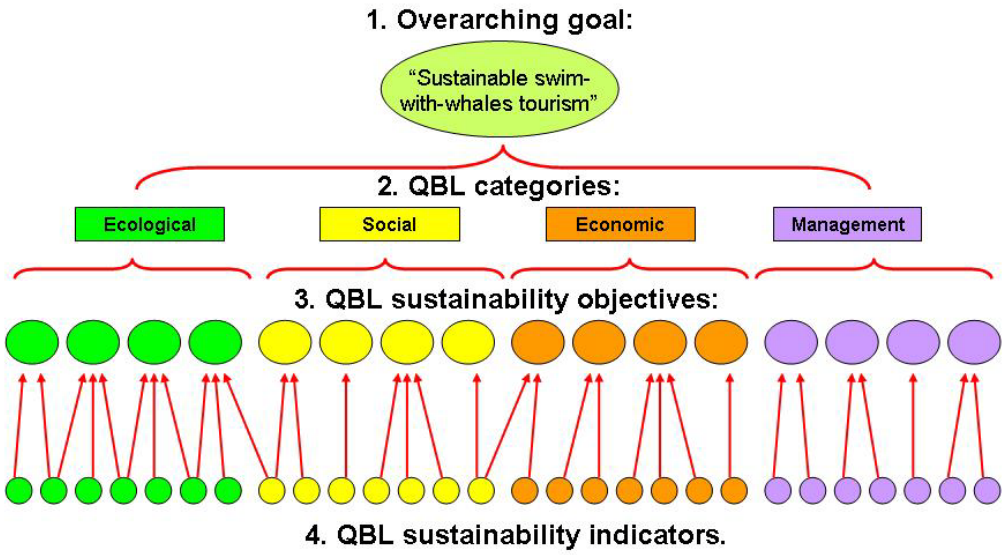


Figure 6.4: Quadruple-Bottom-Line sustainability indicator framework

The information requirements for the proposed sustainability indicators include both qualitative and quantitative data. Many of the indicators proposed to address ecological objectives are consistent with Pressure-State-Response (PSR; developed by the OECD, 1993) monitoring frameworks commonly used in State of the Environment reporting (e.g. Australian State of the Environment Committee, 2006)

and outline: (i) research needed to establish key pressures (i.e. sources of anthropogenic impacts) on the whales and their habitat, (ii) quantitative data needs for monitoring the state of the SWW activity and interacting dwarf minke whales, and (iii) responses or actions for stakeholders to address shortcomings and/or improve social capacity to achieve the broader objectives. The typologies of social, management and economic sustainability indicators vary in their consistency with the PSR framework. A number of proposed management indicators in particular focus on the implementation and adherence to processes and their resulting outcomes, while in the economic category, it is likely that some indicators will require more traditional performance-based evaluations. Process and outcome indicators are often applied in Integrated Coastal Management to evaluate the effectiveness of management policies and are deemed particularly appropriate for use at local scales (Bowen & Riley, 2003). While indicator typologies such as the process-outcome and PSR models provide useful conceptual frameworks for developing and categorising sustainability indicators, it is apparent that multiple models can be applicable in QBL sustainability assessment frameworks such as this.

6.5.4 Sustainability indicators drawing on industry-generated data from existing monitoring tools

The proposed sustainability indicators shown in Table 6.9 represent only a first step in a process of screening, selection and implementation (as outlined in Chapter 1, Section 1.4.4), however many of the identified potential social indicators as well as some managerial and ecological indicators have already been evaluated with results presented in Chapters 3, 4 and 5. Data collection tools for these potential indicators include several instruments that enable industry and SWW participants to contribute to sustainability monitoring, including passenger questionnaires (Appendix 13), Whale Sighting Sheets (Appendix 4) and vessel effort data provided by Vessel Movement Logs (Appendix 9) and/or automated GPS loggers. Outcomes of analyses of these monitoring instruments are discussed below as part of a screening process for their potential use as sustainability indicators.

Whale Sighting Sheets and vessel effort data

Whilst dedicated research programs are required to address the numerous biological and ecological knowledge gaps for the GBR dwarf minke whale population (as outlined in Table 6.5), the Whale Sighting Sheets provide a valuable snapshot each season of the extent of minke whale encounters involving the SWW-endorsed vessels. Additionally, year-to-year comparisons of Whale Sighting Sheet data have so far shown trends in the SWW activity (e.g. increasing encounters and total interaction time) that have been correlated with a change in industry effort (as outlined in Chapter 3). Vessel effort data were shown to be necessary to standardize the whale sightings data for determining whale encounter rates at key sites in the GBR (Chapter 3).

The use of encounter rates and the proportion of total whale encounter time to vessel effort for the SWW industry at Reef sites are proposed as potential indicators to address sustainability objective 1.2(a): "*Dwarf minke whales are not displaced from the areas where they are commonly seen in the GBR as a result of interactions with vessels and swimmers*" (Table 6.9). Over the three years analysed (2006-08) no significant changes in the proportion of total whale encounter time to total vessel effort for any Reef site were detected (Chapter 3, Section 3.3.5.1), however a declining (or increasing) trend in this proportion at Reef sites should be detectable if sufficient effort data continue to be collected from the SWW-endorsed vessels. Determining the cause of any observed trend however poses a considerable challenge and the most appropriate response to such a finding (in the absence of other contextual information) may be the instigation of new research to address the issue.

Additional vessel status and location data provided by the Whale Sighting Sheet (e.g. including Q.15: "*Vessel status when whale(s) first sighted*"; Appendix 4) provides a useful indicator to address sustainability objective 1.4 ("*Dwarf minke whales initiate and voluntarily maintain all their interactions with vessels and swimmers*"; Table 6.9). As reported in Chapter 3 (Section 3.3.2), for the majority (77%) of encounters, vessels were not moving under power when whales were first sighted, and nearly three-quarters of encounters (74.4%) involved vessels that were moored at a Reef site or at anchor in the GBR lagoon. Whether the whales initiated and voluntarily maintained their interactions for encounters in which vessels were in open water

however may not be so easily determined from the Whale Sighting Sheets alone, without reports of observations by passengers, crew and/or researchers. Additional contextual information provided in all data sheets (open-ended descriptive fields in particular) can also help to shed light on anomalous data and/or reports of incidents.

Passenger questionnaires

Questions from the passenger questionnaire that contribute to potential sustainability indicators are listed and evaluated below (Table 6.12) using screening criteria adapted from those proposed by Bell and Morse (2003; outlined in Chapter 1, Section 1.4.7) and others (e.g. Guy & Kibert, 1998). Relevance to the adopted sustainability objectives, the desired trend or results, clarity (of results and their relevance) and sensitivity to change are key considerations included in this evaluation.

Table 6.12: Screening of potential sustainability indicators in the passenger questionnaire

Sustainability objective(s) addressed (*from Appendix 1*)	**Question Number & current phrasing** (*from Appendix 13*)	**Desired trend or results**	**Clarity and ability to detect change**	**Issues / comments**
Ecological category				
1.3 Dwarf minke whales are not physically harmed as a result of their interactions with vessels and swimmers.	**Q.34**: "Did you observe anything during your trip that might have caused a negative impact on the whale(s)?"	Responses indicate no incidences of harm to whales.	Qualitative analysis required; significant incidents should be identifiable.	Analyses show that affirmative responses are more indicative of compliance infringements than of impacts on whales (Section 5.6.8).
1.6 Dwarf minke whales do not show signs of disturbance as a result of repeated interactions with vessels and swimmers.	**Q. 34**: as above.	Responses indicate no observations of disturbance of whales.	As above.	Signs of disturbance are unclear, difficult to detect.
1.8 (a) SWW-endorsed tourism operators in the GBR operate in an ecologically sustainable way.	**Q.13**: "Have you taken any steps to reduce or offset the ecological footprint or carbon emissions of your trip to the GBR?"	An increasing proportion of respondents provide an affirmative response.	Yes/No response provides simple % indicator; changes easy to measure from year-to-year.	Analysis of open-ended responses reveal that the question is misunderstood by some respondents (Section 5.6.9).
Social category				
2.1 (a) SWW-endorsed tourism operators in the GBR provide a consistently high-quality experience for all participants.	**Q.23**: "How would you rate your satisfaction with your minke whale experience on this trip?"	A stakeholder-agreed minimum standard is met by all SWW operators.	Mean rating scores provide simple indicators; changes easy to measure from year to year.	Benchmarking/ comparisons with other wildlife tourism are possible.
	Q.24: "Overall, how well did your minke whale experience meet your expectations?"	As for Q.23 above.	As for Q.23 above.	Open-ended responses can identify reasons for unrealistic expectations.
2.1(b) SWW-endorsed tourism operators in the GBR use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR.	**Q.26**: "Overall, how well would you rate the quality of information you received about minke whales on this trip?"	As for Q.23 above.	As for Q.23 above.	Requires further detail to identify reasons for low/high rating scores (e.g. Q.27)
	Q.27: "What sources of information about minke whales did you receive/have access to on this trip?"	As for Q.23 above.	Tick boxes provide simple indication of information sources that were available.	Identifies means by which passengers received info about minke whales.
2.1(f) SWW-endorsed tourism operators in the GBR achieve and maintain the support of the local community, such that it values the whales and the industry, for its sustainable use of the Reef and interactions with the whales.	**Q.35**: "Do you have any concerns about the sustainability of this kind of tourism?"	Responses indicate overall passenger perception of a sustainable SWW activity.	Yes/No response provides simple % indicator; qualitative analysis required to identify reasons for responses.	Analyses show that affirmative responses can often be conditional (i.e. "Yes, if…"; Section 5.6.8).
2.2(a) SWW participants are familiar with the Code of Practice before they encounter dwarf minke whales.	**Q.31**: "Are you familiar with the Code of Practice for dwarf minke whale interactions in the GBRWHA?"	As for Q.23 above.	Yes/No response provides simple % indicator; changes easy to measure from year to year.	
2.2(b) SWW participants are prepared for their encounter, with realistic expectations of minke interactions.	**Q.33**: "Do you feel you were adequately prepared for your encounter(s) with minke whales?"	A stakeholder-agreed minimum standard is met by all SWW operators.	Yes/No response provides simple % indicator; changes easy to measure from year to year.	Open-ended responses can help identify reasons for negative responses.
	Q.24: as above.	As for Q.23 above.	As for Q.23 above.	As for Q.24 above.
2.2 (c) SWW participants comply with the Code of Practice.	**Q. 32**: "Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew?"	As for Q.23 above.	As for Q.23 above.	Open-ended responses can help identify reasons for low rating scores.
	Q.25: "Was there anything that impacted negatively on your minke whale experience?"	Responses indicate compliance infringements are rare.	Qualitative analysis required; significant incidents should be identifiable.	Analysis of open-ended responses reveal a small proportion indicate compliance infringements (Section 5.6.1).
2.2 (e) SWW participants have an outstanding minke experience.	**Q.23** and **Q.24**: as above.	As for Q.23 above.	As for Q.23 above.	As for Q.23 and Q.24 above.
Economic category				
3 (c) SWW-endorsed tourism operators in the GBR contribute adequately to the local community.	**Q.47**: "While in the Cairns/Port Douglas region what is the approximate amount that you have spent (or will spend) per day…?"	SWW participants contribute to the local economy.	Economic analyses required; long-term trend analyses possible.	Benchmarking and further comparisons with other industry sectors are possible.
Management category				
4.1 (a) Management of the GBR SWW industry is widely acknowledged as World's Best Practice.	**Q.32**: as above.	As for Q.32 above.	As for Q.32 above.	As for Q.32 above.
4.2(a) SWW-endorsed tourism operators in the GBR comply with all relevant management requirements.	**Q.32**: as above.	As for Q.32 above.	As for Q.32 above.	As for Q.32 above.

The above table demonstrates the viability of passenger surveys to provide a variety of sustainability indicators addressing social and managerial SOs for the GBR SWW activity. The large sample collected from SWW-endorsed live-aboard vessels (Chapter 4, Section 4.3.1) was achieved with a high level of support from these operators, with the survey collection carried out largely by the vessel crew. The collection of passenger surveys on SWW-endorsed day-boats however required more facilitation from research volunteers. The busy itineraries and difficulties communicating messages to the large number of passengers on these vessels noted by Mangott (2004; 2005) and in Chapter 5 (Section 5.5.2) are likely to restrict the crew's ability to explain and distribute such surveys to passengers on return voyages from the Reef. Improved participation by day-boat crew however may be able to be achieved with ongoing facilitation, including additional industry workshops and/or crew training held in Port Douglas at the start of each season. Funding will be required to enable such workshops.

6.5.5 Quality of industry-generated sightings and effort data

Comparisons between crew and researcher records for the same minke whale encounters have shown some discrepancies in the details (e.g. Table 6.11 above), including an inherent bias among vessel crew to 'round' time recordings to the nearest five or ten minutes (Figures 6.2 & 6.3). With regard to recording details of minke whale encounters, such differences are likely attributable to the multiple tasks required of vessel crew in operating the vessel and facilitating passenger activities. Whilst dedicated researchers' primary role on board is to record details of minke whale encounters as accurately as possible in real-time, it is understandable that the multitasking required of vessel crew results in delayed recordings of observations and hence some approximations of times, the location (i.e. GPS coordinates), distances and numbers of whales.

In comparing researcher and vessel crew recordings of vessels' arrival and departure times at Reef sites (Figure 6.1), for more than 80% of these recordings the time discrepancy was ten minutes or less, and for more than 93% of time recordings the discrepancy was 30 minutes or less. Error rates within such a range are generally

considered acceptable for use in monitoring via platforms of opportunity (e.g. Hauser et al., 2006), however the quality of the data should re-evaluated periodically. Education and training of industry personnel for such data collection is also desirable to minimise errors and biases.

The number of whales per encounter is often more difficult to estimate, especially so with larger group sizes and in rough weather, due to the whales' high mobility and short time spent on the surface. A single observer, either in the water or placed on the top deck of the vessel, has a limited field of view and is unlikely to be able to track the movements of several whales at once. For encounters involving large pods, such uncertainty can only be reduced via post-hoc photo-identification of individual animals (Birtles et al., 2002a; Arnold et al., 2005a; Sobtzick, 2011). Researcher protocols require counts of the maximum number of whales visible at one time to be regarded as the minimum possible number of whales present (*NB. the highest number that the author has ever observed at one time was 13 whales, from in-water*). The use of these and crew estimates provided in the Whale Sighting Sheets will therefore have only limited analytical power, however clustered analyses may be useful. To address this issue, Mangott (2010) used clustered groups of (i) one to three whales, (ii) three to six whales, and (iii) more than six whales.

It is clear that without the crew's involvement in the collection of Whale Sighting Sheets and vessel effort data, sampling conducted by dedicated researchers alone would very likely be insufficient to monitor the full extent of the SWW industry. It is desirable however that efforts are made to ensure crew are aware of the value of these data and the importance of complete and accurate recording of key information. The occurrence of pre-season training/information workshops are considered a highly effective means of promoting such messages. The rewards provided to operators (certificates and chocolates) for their contributions to data collection at post-season workshops during the Dwarf Minke Whale Tourism Monitoring Program (outlined in Chapter 5) are similarly regarded as highly effective in facilitating Whale Sighting Sheet and other industry data returns.

6.5.6 Implementation challenges

Several challenges and key steps remain in the implementation of a sustainability indicator monitoring program for the GBR SWW activity. As outlined in Chapter One, potential indicators must be screened and evaluated on the basis of their importance to end-users, associated costs and expected benefits (Bell & Morse, 1999; Miller & Twining-Ward, 2005). Ideally all key stakeholders should be involved in this process in a transparent workshop, to ensure the most useful, relevant and practical indicators are selected for trial implementation. Consideration must also be given to the sampling design for quantitative indicators, which must have adequate statistical capacity to detect a significant change in system variables (Field, O'Connor, Tyre & Possingham, 2007). Field et al. (2007) recommend that the sampling design of monitoring programs should be experimental and adaptive, and that learning and improvement should be considered important objectives of the program.

Funding

Failure to secure long-term funding is a common deficiency among ecological monitoring programs conducted by researchers, conservation NGOs and government agencies in Australia (Field et al., 2007). Monitoring must be sufficiently long-term to allow the detection of trends or changes over and above natural fluctuations in the system. Field et al. (2007) suggest that such changes would be detectable in few ecological variables in periods of less than five years, and recommend a minimum target of ten years for most ecological monitoring programs. Whilst during the six-year Dwarf Minke Whale Tourism Monitoring Program a clear trend of increasing encounters with dwarf minke whales was detected (Chapter 3, Section 3.4.1), the cumulative effects of this growing activity on individual whales and the GBR population are as yet undetermined. The indicator screening process must therefore include an assessment of all costs and potential funding sources, and an ongoing commitment must be made by the SWW industry, the management agencies and other stakeholder groups to ensure that funding is available, and potentially to share the financial responsibility.

Economic sustainability of SWW operators

It is clear that in order to maintain support for and contribute to sustainability monitoring, SWW operators must be able to maintain a financially viable business year-round. The economic vulnerability and resilience of the SWW industry is therefore a critical concern for the long-term sustainability of the SWW activity. As noted in Chapter 4 (Section 4.5.2.3) the closure of two SWW operations prior to the 2009 minke whale season was at least in part attributed to the 2008/09 Global Financial Crisis. SWW operators and many other Great Barrier Reef tourism businesses will continue to be vulnerable to international visitor market fluctuations. The existing and any new operators commencing SWW activities need to be well prepared to endure such periods of low visitation in future. Research into the economic resilience and financial risks of Reef tourism businesses would be beneficial, assisting longer-term planning by operators and the sustainable management of the industry.

Management framework

The management framework within which sustainability indicators are implemented can have a significant effect on the success and outcomes of the monitoring program. Adaptability and collaboration between stakeholders are regarded as highly desirable attributes, without which indicator monitoring programs run the risk of failure (Holling, 1978; Walters & Holling, 1990; Johnson, 1999). The involvement of stakeholders in agreeing to limits or thresholds for indicators along with deciding management options to address undesirable trends, and their ongoing involvement in reviewing results and fine-tuning indicators where necessary can foster stakeholders' commitment to the process and benefit the long-term success of the program (Holling, 1978; Lee, 1999; Miller & Twining-Ward, 2005). Based on the successful stakeholder collaboration that has developed through the Dwarf Minke Whale Tourism Monitoring Program and the high level of stakeholder support for the development of the current sustainability objectives, the implementation of an adaptive management framework (e.g. Holling, 1978; Walters & Holling, 1990) is considered an ideal approach to facilitate the evaluation of the long-term sustainability of the GBR SWW activity. An adaptive management model to suit the characteristics of this industry and its stakeholders is proposed in Chapter Seven.

Chapter 7: Discussion and conclusions

7.1 Achievement of thesis objectives

The four studies presented in this thesis (Chapters 3-6) achieved their objectives (as set out in Chapter 1, Section 1.8) in the following way:

1. A detailed description was made of the nature and extent of the GBR SWW tourism activity, including an examination of patterns and trends in the spatial and temporal occurrence of dwarf minke whale encounters and industry 'effort' (Chapter 3). This study provided the first account of effort by the GBR SWW industry, which, when compared with sightings data, enabled the calculation of standardised minke whale encounter rates and proportions of total encounter time to total vessel effort for >50 Reef sites that are visited most frequently by the SWW-endorsed operators.

2. The nature of the SWW experience was evaluated and a range of social values associated with the whales and the SWW activity (held by SWW participants and key stakeholders) were identified (Chapter 4). An understanding of these values and benefits attributed to the SWW activity can assist stakeholders in the future planning and management of the SWW activity (e.g. in determining limits of acceptable change).

3. Key issues for the management of the SWW activity were identified and evaluated, including practical on-the-water management challenges and the broader processes and outcomes involving stakeholders back on land (Chapter 5). Using passenger surveys, significant differences were found between vessels (in particular, differences between management of the SWW activity by live-aboard and day-trip vessels), highlighting the crucial role played by interpretation in the management of SWW interactions. The collaborative approach involving stakeholders reviewing research findings and management issues in bi-annual workshops over the six-year monitoring period 2003-2008

shares characteristics with a passive adaptive management process (e.g. as outlined by Walters & Hilborn, 1978 and Walters & Holling, 1990), involving monitoring without experimental testing of system parameters. A high level of participation and confidence was shown by key stakeholder groups in this participatory process.

4. Data collection instruments were evaluated for their contribution to monitoring of potential sustainability indicators, including Whale Sighting Sheets, Vessel Movement Logs and passenger questionnaires (Chapter 6). The quality of industry-generated data (from Whale Sighting Sheets and Vessel Movement Logs) was evaluated and deemed to be of acceptable quality for monitoring of the SWW activity, however ongoing extension work with crew on SWW-endorsed vessels will be required to maintain such standards. Passenger questionnaires were found to be a useful tool for monitoring industry compliance with management protocols, however issues relating to the ongoing collection and treatment of these data must first be addressed by managers and SWW-endorsed operators (i.e. data confidentiality, management responses to incidents and trends of concern).

5. A comprehensive suite of Quadruple-Bottom-Line sustainability objectives for the GBR SWW activity were developed via a participatory process involving key stakeholders (reported in Chapter 6). A total of 39 objectives were adopted unanimously by participants at a series of facilitated stakeholder workshops held over 2007-2008 (Chapter 6, Tables 6.1-6.4; also shown in Appendix 1). Feedback from interviews with stakeholder key informants indicated a high level of support overall for the sustainability objectives and for the process by which they were developed. The resulting objectives encompass the range of stakeholder values associated with the whales and the SWW activity, providing a framework for sustainability monitoring and future management.

6. A range of potential sustainability indicators were proposed (Chapter 6, Tables 6.1-6.4; also shown in Appendix 1) to address the QBL sustainability objectives. Those indicators that draw upon industry-generated whale

sightings and vessel effort data as well as passenger questionnaires were evaluated against a range of screening criteria (Chapter 6; Section 6.5.4). Information gaps were identified that will require dedicated research to be addressed.

7. A range of management recommendations were made (Chapter 5), based on findings from passenger surveys, interviews with crew and stakeholder key informants, and from analyses of the minutes from stakeholder workshops. Findings and recommendations from Chapter 5 were drawn upon to develop an industry-specific adaptive management model to assist stakeholders of the GBR SWW activity with the implementation of sustainability indicators for long-term monitoring and management. The proposed adaptive management model is presented below (Section 7.3), following discussion of the outcomes and implications arising from the four studies.

A multidisciplinary approach and a range of methods were employed to address the above objectives. An overarching theoretical framework for this thesis however is the recently identified field known as 'sustainability science' (i.e. Kates et al., 2001; Swart et al., 2004; Clark, 2007). Fundamental characteristics of sustainability science (as outlined by Kauffman, 2009) that are reflected in this thesis include (i) a transdisciplinary approach, (ii) integrated analyses, and (iii) an aim towards practical implementation and action.

Methodological tools employed in the four studies include statistical analyses of quantitative data (Studies 1, 2 and 3), phenomenological analyses (as outlined by Moustakas, 1994) and the 'grounded theory' approach (Strauss & Corbin, 1998; Charmaz, 2006) to treatment of qualitative data (i.e. interviews, open-ended questionnaire responses and analyses of stakeholder workshops; Studies 2, 3 and 4), as well as principles of Participatory Action Research (Argyris & Schön, 1989; Greenwood et al., 1993) to engage stakeholders in the development of sustainability objectives (Study 4). These tools were considered the most appropriate for addressing the research objectives and resulted in successful outcomes.

7.2 Outcomes and implications arising from the four studies

7.2.1 Dwarf minke whale encounters and industry effort

Study One identified a trend of increasing minke whale encounters over the three study years (with coverage expanded to six years by the inclusion of the full Dwarf Minke Whale Tourism Monitoring Program, 2003-2008) that was attributed to SWW-endorsed operators (live-aboards in particular) increasing their 'effort' by spending a greater proportion of their itineraries at 'hotspot' sites with high encounter rates and high proportions of total encounter time to vessel effort (e.g. Lighthouse Bommie). This resulted in a near-doubling (a 90.6% increase) of the number of reported minke whale encounters, and of the total time that the vessels spent interacting with minke whales (an 89.5% increase) over the six year period.

The potential impact of this increase in the total encounter time on the whales is unknown, however the growth trend itself is cause for some concern and the potential for increased cumulative interaction times for individual whales (and thus the increased potential for changes in their behaviour associated with more/longer interactions) clearly requires further research and ongoing monitoring.

Industry effort and growth

The actual searching effort by the SWW-endorsed operators (with the exception of the primary research vessel *Undersea Explorer*) appears to be very minimal, with few searches for dwarf minke whales conducted by the SWW-endorsed vessels in open water. This suggests a latent capacity at the existing scale of the SWW activity (i.e. capped at nine SWW-endorsements), which could be realised if more 'effort' were made by existing SWW-endorsed operators to conduct such searches. The motivation for operators to increase their effort to conduct searches in open water will likely be influenced by the extent to which they can access sites with high encounter rates (e.g. Lighthouse Bommie and surrounding sites), however it will also be dependent upon market demand for the SWW experience.

Examination of the proportion of passengers on SWW-endorsed vessels whose 'primary reason for taking this dive trip to the GBR' was seeing and/or swimming with minke whales (Chapter 4, Section 4.3.4) found an increase in this proportion over the three years, suggesting that visitor demand for the GBR SWW experience grew over this period. Such growth however was tempered in 2009 with two of the SWW-endorsed live-aboard operators closing down; one citing a loss of business due to the global financial crisis (Port Douglas & Mossman Gazette, 2009).

There is clearly potential for further growth in demand for the GBR SWW activity. The extent to which such demand is able to be met in the future will be potentially determined by the outcomes of the GBRMPA's 2010 review of the activity (still pending at the time of writing), which could result in a change to the current cap of nine SWW-endorsements (as documented in the 2008 post-season workshop minutes; summarised in Chapter 5, Section 5.3.2). The potential for an increase in the number of SWW-endorsed operators targeting Lighthouse Bommie and the surrounding area raises concerns not only for the increased potential for cumulative impacts on the whales but also for impacts on the visitor experience associated with crowding of vessels in this area.

The importance of monitoring industry effort

Monitoring of minke whale encounter rates and the proportion of whale encounter time to vessel effort at Reef sites used by the SWW-endorsed operators can assist in detecting potential changes or trends in the relative abundance of dwarf minke whales at these sites. Determining the cause of any such changes (or specifically attributing any trends to the SWW activity) will however be problematic, requiring careful investigation of a wide range of potential contributing factors, both within and outside the GBRMP. It is clear however that ongoing monitoring of the SWW activity must incorporate vessel effort data to enable spatial and temporal comparisons of encounter rates and proportions of encounter time to vessel effort at Reef sites and provide a context for any observed changes in the distribution and frequency of reported minke whale encounters.

Responding to trends without α =<0.05 statistical significance

Results of this study showed increasing industry effort at key Reef sites over the study period, however the increasing mean duration of visits to these sites was not statistically significant (Lighthouse Bommie and Challenger Bay; Table 3.11). The use of the conventional α-level of 0.05 in supporting environmental management decisions has been challenged by number of recent studies that have found such decisions to be sub-optimal (e.g. Mapstone, 1995; Pollock, Nichols, Simons, Farnsworth, Bailey & Sauer, 2002; Field, Tyre & Possingham, 2005). The reliance on large samples and/or long-term data in wildlife monitoring to establish such high levels of certainty can cause substantial delays in the implementation of management actions that are often less effective in providing protection for the wildlife concerned and become more costly to implement (Gerber, DeMaster & Kareiva, 1999; Field, Tyre, Jonzen, Rhodes & Possingham, 2004; Field et al., 2005). Field et al. (2004) propose a decision framework for evaluating and minimising the relative costs of making Type I (detected change is false) and Type II (actual change is undetected) errors. The expected economic loss associated with either error is weighed against the probabilities of (i) the occurrence of a deleterious change and (ii) that the monitoring data will correctly identify that the change has occurred. Implementing such a decision framework may therefore be more appropriate than relying on findings of α =<0.05 significance when evaluating sustainability indicators derived from such industry-generated effort and whale sightings data.

7.2.2 Social values of dwarf minke whales and the swimming-with-whales experience

Sustainable management of human-marine wildlife interactions requires not only a detailed understanding of the biological and ecological characteristics of the target species and the associated impacts of the tourism activities, but also knowledge of the experiential characteristics for the tourists. Studies of the experiences, perceptions, attitudes and behaviour of tourists can provide critical information for the management of tourists' encounters with wildlife (Orams, 1996; Birtles et al., 2001a; Wilson & Tisdell, 2001). It is also important that tourists and tourism operators understand the potential impacts of their interactions with wildlife and the need to

follow management protocols designed to minimise such impacts (Lawrence, Wickins & Phillips, 1997). Ultimately, in tourist-wildlife interactions it is the tourists that need to be managed to minimise negative impacts (Birtles et al., 2001a).

Study Two described the characteristics of the GBR SWW experience and provides an account of the range of social values and benefits attributed to the whales and the SWW activity, held by key stakeholders including SWW-endorsed tourism operators, Reef managers, wildlife conservation NGOs, cetacean researchers and SWW tourists. Key elements of the SWW experience, determined from SWW participants' responses in questionnaires, included:

(i) the closeness of approaches made by the whales to swimmers,
(ii) the in-water setting,
(iii) seeing multiple whales,
(iv) the long duration of encounters,
(v) the whales' inquisitive behaviour,
(vi) interactions being initiated by the whales and occurring 'on their terms',
(vii) the appearance and size of the whales, and
(viii) that SWW interactions were well managed, with high quality interpretation provided by the vessel crew to accompany the experience.

These elements combine to provide an outstanding and highly memorable wildlife tourism experience and can be characterised as a 'peak experience' for many SWW participants (e.g. as described for tourism interactions with dolphins, other whales and sharks; DeMares, 2000; Curtin, 2006; Dobson, 2007). A comparison of the mean satisfaction rating from live-aboard questionnaire respondents (9.02/10; as reported in Chapter 4; Section 4.3.6) with Pearce's (2006) benchmarking review of tourism satisfaction studies shows that despite an overall positivity bias in tourists' responses to satisfaction rating scales, this result is indeed reflective of an exceptional tourism experience (with mean scores above 8.5/10 being considered meritorious; Pearce, 2006).

Socio-cultural values of whales and dolphins vary between cultures as well as between individuals (Bowett & Hay, 2009; Curtin, 2006). Representations of cetaceans in the western media often have anthropomorphic connotations which often

influence popular perceptions (Galvin & Herzog, 1993). Whales and dolphins are typically perceived to possess qualities similar to those held by humans (e.g. intelligence, social behaviour) and are regarded as 'safe' and approachable (Curtin, 2006). Such attributes have contributed to strong emotive reactions among whale watching tourists and swim-with-dolphins participants (Amante-Helweg, 1996; Curtin, 2006; Peake, Innes & Dyer, 2009). The inquisitive and highly interactive nature of the GBR dwarf minke whales may amplify such reactions among some of the SWW participants. Verbal anecdotes shared by some participants that have swum with cetaceans in other parts of the world (e.g. humpback whales in Tonga, orcas in Norway, sperm whales in the Dominican Republic) indicate that this aspect of the GBR SWW activity is exceptional. Mangott (2010) also characterises interacting dwarf minke whales' behaviour as 'exceptionally exploratory'. The opportunity therefore to inspire a greater environmental awareness among participants is also likely to be enhanced when such experiences are accompanied by high quality interpretation.

Whilst the longer-term effects of the SWW experience on participants' attitudes and behaviour (e.g. regarding environmental conservation) were not investigated in this study, the finding of a relatively high proportion of questionnaire respondents who indicated that they had been changed in some way by their minke whale experience (Chapter 4, Section 4.3.10.3) is worthy of further investigation. Follow up studies on attitudinal and/or behavioural changes (e.g. similar to that by Ballantyne, Packer, Hughes & Dierking, 2007) among SWW participants may determine longer-term changes and benefits among SWW participants.

The demand for close encounters with marine wildlife by tourists can lead to problems. Particularly during in-water interactions, overcrowding, collisions between tourists and perceived negative reactions from the animals (e.g. as a result of other tourists' actions) can have a negative effect on the tourist experience (Davis et al., 1997; Valentine et al., 2004). It is therefore an encouraging finding that the perception of good management of the SWW activity emerged as an important contributing element to participants' satisfaction. Such a result provides an additional incentive for SWW-endorsed tourism operators to maintain high standards of compliance with management protocols, and to ensure passengers are well prepared

prior to their in-water interaction. A comparison of the mean satisfaction rating in this study with that found by Valentine et al. (2004; reporting a 9.00/10 mean satisfaction rating based on data collected over 1999-2000) shows that the 'peak' nature of the minke whale experience has not diminished since the industry-wide voluntary adoption of the Code of Practice in 2002 and their requirement to comply with the Code as a condition of their SWW-endorsement from 2003.

The stakeholder perspectives documented in Chapter Four provide a valuable account of social values and benefits of the GBR dwarf minke whales and the SWW activity, and recent studies (e.g. Stoeckl et al., 2010a; 2010b) have shown a substantial economic benefit to the regional economy from the live-aboard SWW-endorsed operators, a significant proportion of which can be attributed to tourists' desire to see and interact with dwarf minke whales during the winter months.

The presence of researchers on the tourist vessels (i.e. 'platforms of opportunity') was shown to add considerable value to the tourist experience (Chapter 4, Table 4.12). This mutually beneficial arrangement between the SWW-endorsed operators enables the collection of research and monitoring data that are of a higher quality than can be collected by untrained crew and passengers, and the communication of high quality interpretation to passengers about the whales and the SWW experience (e.g. via informal discussions and evening biology and research presentations to passengers and crew). Were the SWW-operators not so forthcoming with their in-kind support for such research, this study would not have been possible and much less would be known about the interacting population of dwarf minke whales in the GBR. The collaboration that has developed over the past 15 years has been one of incremental improvements, based on growing familiarity and trust between key individuals and the recognition of shared values and goals (i.e. a sustainably managed SWW industry). A substantial effort was also made by members of the research team to develop useful interpretive tools for the vessel crews that incorporated the most recent scientific discoveries (e.g. annual newsletters, posters and the 2007 DVD; Appendices 6, 2 and 3).

The range of values and benefits of the SWW activity to stakeholders, tourists and the local community (as described in Section 4.5.2) are very much dependent on a

widespread perception that the SWW interactions are not impacting the whales. The detection of a significant negative impact on the whales' behaviour, or the occurrence of an incident in which a whale and/or a swimmer were harmed, has the potential to rapidly change current positive perceptions of the activity and its management. Ongoing research and monitoring of dwarf minke whale behaviour and potential effects of the SWW activity should therefore be an important objective for the management agencies and the SWW operators, in order to minimise such risks. The ability to implement changes to management of the activity in a timely manner (i.e. via an adaptive management process) is also a desirable management characteristic to be maintained. Ongoing collaboration and sharing of information between tourism operators, managers, researchers and other key stakeholders is a key requirement for the effective implementation of changes to management (Johnson, 1999; Lee & Jamal, 2008).

7.2.3 Management of the swimming-with-whales activity

Study Three evaluated a range of management issues associated with the management of the GBR SWW activity, including those identified at stakeholder workshops held over 2006-2008. These workshops played a key role in fostering a collaborative and adaptive approach to the management of the SWW activity. Industry respondents in the stakeholder Key Informant Survey expressed confidence in this management process and were satisfied with the transparency and flow of information from other stakeholder groups (i.e. principally managers and researchers). These industry stakeholders and the crew survey respondents similarly expressed support for the Code of Practice and considered the protocols within it to be effective.

While tourism operators may be generally accepting and supportive of management protocols, breaches of guidelines still occur. Codes of practice usually rely on voluntary compliance and lack enforceable consequences. This compliance is achieved by people's desire to 'do the right thing', which is informed by interpretation and educational processes (Mason, 2005; Sirakaya, 1997; Orams, 1995). Cole (2007) cautions that the development of a code of conduct/practice is only the first step in a continuous process and its success in the long-term can only be achieved with

ongoing promotion of its messages. Ongoing monitoring of compliance is also regarded as necessary for successful implementation of voluntary codes, to ensure their uptake and effectiveness (Genot, 1995).

While direct observation of operator compliance was not within the scope of this study, other such studies have shown a higher likelihood of operator non-compliance where there is competition between operators and other 'performance' pressures. In a study of vessel-based dolphin watching operators in Port Stephens (NSW), Allen (2006) reported a breach of the Code of Conduct in one out of six interactions. Allen reported that these breaches were most likely to occur in competitive circumstances, when one vessel after another approached the same group of dolphins, and when recreational boats became involved in interactions. Scarpaci et al. (2003) investigated compliance with regulations by swim-with-dolphins operations in Port Phillip Bay Victoria, finding more than 30% non-compliance with approach and manoeuvring protocols and more than 60% non-compliance with time limits for encounters among operators.

Duprey et al. (2008) recommended that voluntary guidelines can be effective management tools when accompanied by mandatory regulations and reinforced with ongoing compliance monitoring, industry education and encouragement to comply. Despite the perception of good compliance among the GBR SWW operators (and their good intentions), the remote location of these interactions and the infrequent presence of Reef managers, combined with a general reluctance among the SWW-endorsed operators to report incidents involving other operators known to them (Chapter 5, Section 5.4.2), highlights a need for an independent mechanism by which industry compliance can be monitored.

The use of passenger surveys as a compliance monitoring tool for the SWW-endorsed operators was investigated (Sections 5.4.3 & 5.6) and several potential sustainability indicators for monitoring the management of SWW interactions were identified in the passenger questionnaire (Chapter 6, Section 6.5.4). The implementation of such surveys for compliance monitoring (i.e. whereby non-compliant or sub-standard operators can be identified from the survey results) will require negotiation between the parties involved (i.e. managers, operators and researchers) to establish a process in

which the data are used and appropriate management steps are taken in response to findings of sub-standard performance. Mason (2005) notes that where visitor impacts become evident, it is likely that the perception of such impacts will be accompanied by a decline in the visitors' satisfaction. Indirect approaches to regulating and maximising compliance with management guidelines, such as the use of interpretation and education tools, rather than direct approaches such as enforcement, have been widely recognised as being more effective and less expensive methods of controlling tourists and operators' behaviour and minimising impacts on wildlife (Orams, 1995; Moscardo, 1998; 1999; Birtles et al., 2001a). These management tools can also enhance the visitor experience and foster a sense of responsibility towards the resource (Vander Stoep & Gramann, 1987).

The training of vessel crew and the requirement for trained/accredited guides to be present on SWW tours would greatly benefit the management of the SWW activity and the overall experience for SWW participants. Benefits of introducing such a requirement (potentially as a permit condition) would include consistent and high standards of interpretation delivery, in-water interaction management and monitoring data collection. Ryan (2002) argues that it is timely for sustainable tourism management planning to shift its focus from preservation of the status quo towards *sustained value creation* for host communities, tourism industries and for the tourists themselves. While the detailed training and accreditation requirements (including costs) would clearly need to be resolved with the input of all key stakeholders, such a program would add value to the SWW tourist experience and potentially raise the overall profile of the industry. Similar guide training and accreditation programs have been shown to be successful elsewhere (e.g. the Savannah Guides program in northern Australia; Black, 2007), however so far no such programs have been introduced for tour guides in the Great Barrier Reef. The iconic and peak nature of the swimming-with-dwarf minke whales experience and the industry's current small scale present an ideal opportunity for a trial implementation of an accredited guide scheme that may in future be broadened to encompass other specialised wildlife tourism activities in the GBR World Heritage Area.

SWW endorsements and permit conditions

The use of permits (or SWW-endorsements attached to Marine Parks tourism permits) was regarded by all stakeholders as an effective mechanism for managing the GBR SWW activity. The endorsements represent the only current regulatory tool by which the scale of the industry is limited, and the two permit conditions (to comply with the Code of Practice and to report all encounters with dwarf minke whales) make it obligatory for operators to contribute to monitoring and adhere to otherwise voluntary management protocols. The Code of Practice (Birtles et al., 2008) recommends that all non-regulatory (minor) compliance infringements be reported to the Minke Whale Project research team, so that they can be discussed and addressed in a subsequent post-season stakeholder workshop. The management consequences for a SWW-endorsed operator failing to comply with the non-regulatory protocols however have not yet been clearly articulated by the GBRMPA. While peer pressure can be an appropriate and effective means of encouraging better compliance (Duprey et al., 2008), other enforcement options (e.g. the suspension or revocation of the SWW-endorsement) are required for serious (i.e. regulatory) compliance infringements.

The number of endorsements issued by the GBRMPA is likely to be a key consideration in their 2010 review of the SWW activity. As reported in Chapter 3, there is currently substantial latent capacity within the existing nine SWW endorsements, and the long-term cumulative effects of the SWW interactions at the current scale are still unknown. A precautionary approach and the adoption of an appropriate assessment process (e.g. the Limits of Acceptable Change) are therefore recommended in this and future reviews of the scale of this activity.

The possibility of the GBRMPA banning the SWW activity altogether is considered an unlikely outcome of their 2010 review. In-water interactions would still occur at many popular Reef dive tourism sites due to the inquisitive behaviour of the whales, creating an untenable management compliance scenario. Likewise, the possible removal of the permits/endorsements for operators to conduct SWW activities (thereby allowing any and all GBR tourism operators to conduct whale-swims) is also undesirable and removes the mechanism by which operators are obliged to comply with non-regulatory protocols in the Code of Practice. The use of permits/endorsements has been shown to be very effective in the management of the

SWW activity so far. Alder (1993) notes that GBRMP managers and users have recognised the value and benefits of Marine Parks Permits, which help to protect shared resources, provide a means of addressing operational and management problems and help to resolve conflicts.

Management of non-endorsed SWW interactions

The extent and the management of non-endorsed SWW interactions remains a key concern that has not been adequately addressed. While anecdotal reports from vessel crew have indicated that non-SWW-endorsed tourism operators in the Offshore Port Douglas and Offshore Cairns Sectors of the GBRMP encounter dwarf minke whales each season (and photographs from such encounters are often published on the company websites), very few Whale Sighting Sheets documenting these encounters were received over the six-year monitoring period. Some attempts to encourage wider tourism industry participation in the reporting of dwarf minke whale encounters were made by members of the Minke Whale Project research team (the author included) however no resources were available to support this task. Improved efforts to raise industry awareness of management guidelines and the whale sightings network, through educational materials (e.g. brochures) and industry information sessions/workshops (open to all Reef tourism operators) would help to address this issue.

Concerns expressed by vessel crew (Chapter 5, Section 5.5.2) that non-endorsed vessels are engaging in SWW activities and may not be adhering to regulations should be taken seriously by all stakeholders, however it is of ongoing importance that operators submit formal Incident Report Forms to trigger a management response. This issue was discussed in stakeholder workshops, leading to an amendment to the Code of Practice requiring SWW operators to submit reports of all such incidents. This issue should however continue to be monitored and discussed in stakeholder workshops, with further actions taken if deemed necessary.

7.2.4 Developing sustainability objectives and indicators

The fourth and final study was successful in facilitating the collaborative development of a comprehensive suite of Quadruple-Bottom-Line sustainability objectives (Chapter 6, Tables 6.1-6.4; Appendix 1), which will guide and assist the screening and implementation of sustainability indicators to monitor the GBR SWW activity. A range of potential indicators that draw upon existing data generated by the industry (including Whale Sighting Sheets, vessel effort data and passenger questionnaires) were evaluated against screening criteria recommended by Bell and Morse (2003) and others (e.g. Guy & Kibert, 1998; Chapter 6, Section 6.5.4). Further screening and evaluation of potential indicators by all stakeholders in a workshop however is necessary before they can be implemented.

Sustainability objectives development process

Bell & Morse (1999) categorise different approaches to developing sustainability indicators into two methodological paradigms: reductionist (i.e. 'top-down' or expert-led approaches) and participatory (i.e. 'bottom-up', incorporating a diversity of community and/or resource user perspectives). Fraser, Dougill, Mabee, Reed and McAlpine (2006) argue that 'top-down' approaches to sustainability monitoring, driven by development 'experts' and environmental managers, typically fail. Reed, Fraser, Morse and Dougill (2005, p.1) suggest that "*only through active community involvement can indicators facilitate progress toward sustainable development goals. To engage communities effectively in the application of indicators, these communities must be actively involved in developing, and even in proposing, indicators.*"

The process undertaken through this study incorporated aspects of both of Bell and Morse's reductionist and participatory paradigms, adhering to principles of Participatory Action Research (PAR; McTaggart, 1991), whereby stakeholder input and approval was solicited via key informant interviews and in workshops, with the process ultimately facilitated and driven by the author. Following a PAR process was considered to have contributed substantially to the successful adoption of the 39 sustainability objectives. 'Ownership' of the resulting sustainability objectives however rests with the stakeholders that were involved in the process, whose contributions shaped and fine-tuned the words and meaning of each objective until

their unanimous acceptance in the stakeholder workshops. Such participatory processes can empower stakeholders involved in their implementation and help to ensure that indicators are relevant to core community values (Fraser et al. 2006). Fraser et al. (2006) go further to suggest that participatory approaches to indicator development play an important educational role and can build community capacity to respond to future threats and problems. Indeed, sustainability monitoring should ideally be an ongoing learning process for all stakeholders and the process by which they are developed is just as important as their application (Reed et al., 2005, Bell & Morse, 1999; 2003).

Industry contributions to monitoring

Data generated by crew and passengers on the SWW-endorsed vessels (including Whale Sighting Sheets, Vessel Movement Logs and passenger questionnaires) contributed valuable information towards a range of proposed sustainability indicators (outlined in Chapter 6; Section 6.5.4). The industry-generated data on the extent of their minke whale encounters and vessel site use (i.e. 'effort') were also shown to be sufficiently reliable for ongoing monitoring of the SWW activity (Chapter 6, Section 6.4). The cost of continuing to collect these data is low, however ongoing efforts are required to ensure consistency in the quantity and quality of data returns, and funding will be required for analyses and reporting of results. To ensure that the quality of these data remains at an acceptable standard, periodic assessments of the data will be necessary and ongoing engagement with the SWW-endorsed operators will be required.

Industry education/crew training workshops are considered to be a highly effective means of achieving crew awareness and support for such monitoring. It is particularly important that crew are aware of: (i) the reasons the data are collected, (ii) the importance and value of their contributions, and (iii) how to record their observations accurately and in the correct format. Fraser et al. (2006) note that it is important to ensure that the data collection methods, the results of analyses and their interpretation are conceptually and practically accessible to all stakeholders to ensure their ongoing participation and support. Prompt feedback to operators and crew on their data returns (quantity as well as quality, e.g. completeness of data sheets) is also considered of great value, and it was noted at the post-season workshops over 2006-

2008 that prizes awarded to operators and individual crew (certificates and chocolates awarded on the basis of the quantity and completeness of their returned data sheets) generated a sense of friendly rivalry for such recognition and rewards and resulted in steady improvements in their contributions to data collection.

Likewise, the importance of prompt analyses of monitoring data cannot be understated. Results should be reviewed by managers and stakeholders as soon as possible, with consideration given to refining the monitoring design to address information shortfalls or sharpen its focus on key objectives. The iterative evaluation of monitoring programs based on periodic analyses can also help to improve survey efficiency and cost effectiveness of the program (Field et al., 2007). Field et al. reflect on a preponderance of ecological monitoring programs that fail to meet this objective and warn that "*the illusion of productivity created by the accumulation of essentially useless data has passed as acceptable up to date, but we expect that it will not remain unchallenged indefinitely*" (2007, p.490).

Management agency involvement

The commitment of government natural resource management agencies to participatory processes for the implementation of sustainability monitoring programs is key to their successful implementation (Holling, 1978; Johnson, 1999; Bell & Morse, 2003). Fraser et al. (2006) emphasise that indicator development and assessment processes must integrate policy support, local knowledge and scientific research to achieve success. While the management agency representatives involved in this study demonstrated strong support for the sustainability objective development process, and funding was provided by the GBRMPA to hold the stakeholder workshops as part of the six-year Dwarf Minke Whale Tourism Monitoring Program, no further funding has been made available since the Program's completion and the last workshop was held in 2008. The extent to which the GBRMPA is able to contribute operational support and funding for future sustainability monitoring is also uncertain. Dwarf minke whales however are identified as a priority species for conservation and management in the GBRMP, and the GBRMPA's *Operational Policy* on whale and dolphin conservation outlines the Authority's intent to support and encourage research and monitoring programs to improve knowledge of priority species (GBRMPA, 2007; GBRMPA, 2005).

Dwarf minke whales are still regarded as a form of *Balaenoptera acutorostrata* (i.e. an undescribed subspecies of the ordinary or northern hemisphere minke), and their conservation status is not categorised in Australia due to 'insufficient information' (Bannister, Kemper & Warneke, 1996) and is categorised internationally as 'least concern' (IUCN, 2008). At either level, such a conservation status may disadvantage research funding proposals for dwarf minke whales when being ranked against proposals to study other marine mammal species classified as critically endangered, endangered, vulnerable or near threatened. Recent studies however have suggested that due to genetic variation between the dwarf minke and other *B. acutorostrata* subspecies, their assumed sub-species status may be incorrect and is in need of further examination (Pastene, Acevedo, Goto, Zerbini, Acuna & Aguayo-Lobo, 2010).

Information gaps and research needs

Long-term studies of the SWW interactions are clearly required to determine the extent of potential cumulative impacts on the interacting whales, and ongoing industry involvement and support will greatly benefit such monitoring and research. However, many of the unanswered questions about this species' ecology and life history will require dedicated research from independent platforms. Such studies that were flagged as key research priorities in the Dwarf Minke Whale Tourism Monitoring Program Final Report to the GBRMPA (Birtles et al., 2010) included:

- Systematic surveys of the whales' distribution and abundance in the GBRMP (i.e. from dedicated research platforms including vessels and aircraft).
- Studies of the whales' activity budgets when in the GBRMP (via remote sensing and observation from dedicated platforms) and behavioural changes associated with the SWW activity.
- Migration and movement studies using satellite tags (to contribute to more complete assessments of risks and threats to dwarf minke whales both within and outside the GBRMP).
- Genetic studies of key biological and population parameters (e.g. including stock structure, potential variation and phylogeography of sub-populations).

Much can still be learned however from ongoing studies of interacting whales from tourism vessels (i.e. 'platforms of opportunity'). Recent research has determined that the interacting population of dwarf minke whales (within the operational area of the SWW-endorsed vessels) represents an open population with regular immigrations and emigrations (Sobtzick, 2011). While the size of the interacting population is not yet resolved, this and previous studies by Birtles et al. (2002) and Arnold et al. (2005) have shown that individual whales (identified from their unique natural colouration patterns) are returning to the same areas each year and are subject to repeated encounters with tourism vessels each season. Such a finding increases concerns for potential cumulative effects of these encounters on the behaviour of interacting whales. Behavioural research by Mangott (2010) has revealed short-term desensitisation of interacting dwarf minke whales to vessels and swimmers, characterised by closer approaches to swimmers made by resighted whales. The biological significance of this change in behaviour and longer-term implications for the interacting population are therefore key questions to be addressed in future studies of the SWW interactions.

7.3 Implementing sustainability indicators

The outcomes of Study Four (Chapter 6) represent a key early step in the longer-term process of evaluating the sustainability of the GBR SWW activity. As outlined in Chapter One (Section 1.4), the implementation of sustainability indicators requires the commitment of all key stakeholders to an iterative process of indicator screening, data collection, analyses, reporting and review. The selection of indicators will ultimately be limited by the available resources, thus the most cost-effective indicators will be those most likely to be implemented (Miller & Twining-Ward, 2005). Due to the costs associated with accessing the remote areas in which the majority of SWW interactions occur, data supplied by the SWW tourism operators will play a critical part in sustainability monitoring into the foreseeable future.

The management framework within which a sustainability monitoring program is implemented has a strong influence over the program's success or failure (Holling,

1978). Success (i.e. achieving progress towards all sustainability objectives) is most likely to be achieved in an adaptive management framework, in which all key stakeholders review results from the indicators in regular workshops and participate in decision-making that is responsive to findings and outcomes of the monitoring. Without such a process or mechanism to provide feedback to stakeholders (in particular, the tourism operators that contribute to monitoring data collection) and incorporate their input to decision making, the value and effectiveness of the sustainability indicators are severely compromised (Walters & Holling, 1990; Johnson, 1999).

Adaptive models for managing and monitoring the impacts of whale watching tourism are increasingly being advocated as appropriate frameworks in which to address the long-term and cumulative impacts that can emerge in targeted cetacean populations (e.g. Koski & Osborne, 2005; Higham et al., 2009). Higham et al. (2009) argue that such adaptive management models must be integrated across different scales, incorporating broad policy and regulations (at a national and international level) with site-, species- and population-specific considerations. Social science research should be given equal weighting to biological/ecological scientific evaluations and the adherence to the Limits of Acceptable Change (LAC) framework is recommended to determine appropriate boundaries for change across a range of social and environmental criteria (Higham et al., 2009). The broad applicability of the LAC process has seen it employed and advocated as an appropriate tool in marine tourism management, for example by Shafer & Inglis (2000) who used the LAC framework as a conceptual basis for evaluating management of snorkelers at Reefs sites in the Great Barrier Reef World Heritage Area, and by Roman, Dearden & Rollins (2007) to prescribe zoning for managing reef tourism within a marine protected area in Thailand.

Many aspects of the 2003-2008 Dwarf Minke Whale Tourism Monitoring Program were consistent with an adaptive approach to management of the GBR SWW activity (e.g. stakeholder workshops, monitoring, review and fine-tuning of management protocols). These aspects and the adoption of sustainability objectives by the key stakeholders provide a solid foundation upon which to build additional components of an adaptive management framework that is effective in evaluating progress towards

sustainability goals. A Swimming-with-Whales Adaptive Management Model that is specifically applicable to the GBR SWW activity is therefore proposed and outlined below.

7.3.1 A proposed Swimming-with-Whales Adaptive Management Model

The following section outlines broad criteria and key components of a proposed Swimming-with-Whales Adaptive Management Model (SWAMM) for the GBR SWW activity. Among the proposed components are several that mirror those that occurred during the 2003-2008 Dwarf Minke Whale Tourism Monitoring Program (e.g. regular stakeholder workshops, monitoring data collection and annual reporting to stakeholders). These components contributed substantially to this Program's success, are familiar to current stakeholders, and their continuation is considered essential to the proposed SWAMM. These and additional components outlined below are not intended to be overly prescriptive and many specific details and requirements will need to be discussed and agreed by the key stakeholders in a workshop (e.g. decision making protocols in the event of disagreement between stakeholders, minimum attendance requirements for management decisions).

Stakeholder participation

Representatives of the following organisations should be recognised as key stakeholders in the assessment and management of the GBR SWW activity and would be invited to participate in all processes outlined below:

- The Great Barrier Reef Marine Park Authority (representatives from Species Conservation and Tourism and Recreation have previously participated, however representatives from other departments and their Local Marine Advisory Committee may also provide valuable input).
- Queensland Parks and Wildlife (Marine Parks); Department of the Environment and Resource Management.
- The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (Coasts and Marine).
- All tourism operators holding a GBR Marine Parks Permit with an endorsement to conduct swimming-with-dwarf minke whales activities.

- The Association of Marine Park Tourism Operators (AMPTO; the peak industry body for marine tourism in the GBRMP).
- Researchers with relevant interests and expertise (including cetacean biology and marine tourism) from local academic and scientific institutions (e.g. the Minke Whale Project research group based at James Cook University, scientists from the Museum of Tropical Queensland, the Australian Institute of Marine Science).
- The Whale and Dolphin Conservation Society (Australasia).
- The International Fund for Animal Welfare (Asia-Pacific).
- The Cairns and Far North Environment Centre (CAFNEC; a local non-government environmental conservation organisation).

Additional stakeholders may be recognised and included in these processes as deemed appropriate by those mentioned above. Such additional stakeholders may include representatives of regional tourism promotional bodies (e.g. Tourism Tropical North Queensland), other local non-government wildlife conservation organisations, research scientists from other institutions and Indigenous Traditional Owner groups. Whilst historical linkages have not yet been identified between coastal and island Aboriginal tribes of northern Queensland and dwarf minke whales, such linkages may exist and opportunities to participate in these processes should be extended to relevant Traditional Owner groups.

Marine Parks Permits and SWW-endorsements

All tourism vessels conducting swimming-with-dwarf minke whales (SWW) activities must be in possession of a Great Barrier Reef Marine Parks Permit (issued by the Great Barrier Reef Marine Park Authority), with a specific endorsement to conduct this activity (in accordance with the *Great Barrier Reef Marine Park Regulations 1983*; Birtles et al., 2008). The number of these endorsements should remain capped, at a level determined by a Limits of Acceptable Change (Stankey et al., 1985) or similar process that is deemed appropriate by all key stakeholders. Following this same process, eligibility criteria and conditions of the SWW-endorsements should be established and should include minimum standards for:

- Compliance with the current Code of Practice for dwarf minke whale interactions in the GBRWHA,
- Contributions to monitoring data collection,
- Delivery of appropriate interpretation by vessel crew (with a minimum requirement for trained and/or accredited guides).

Stakeholder workshops

Stakeholder workshops provide the central forum for the evaluation of sustainability indicators, fine-tuning of management protocols and broader decision-making relevant to the GBR SWW activity. Stakeholder participants should be encouraged to speak freely and openly on all relevant topics, and the Chatham House Rule (i.e. whereby participants are "*free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed*" outside the workshop forum; Royal Institute of International Affairs, 2002) could occasionally be applied in discussions of sensitive issues. Detailed minutes of all workshops should be taken and circulated to all participants for comments/corrections before being posted online to a password-protected website, made accessible to all recognised stakeholders.

SWAMM Planning and Implementation Workshop

An initial stakeholder workshop should be held to review and implement the adaptive management model and sustainability assessment framework. Key objectives of this workshop would include:

- Review of the proposed adaptive management framework and decision-making processes, and fine-tuning of these based on stakeholder feedback.
- Consistent with a Limits of Acceptable Change process, stakeholders should address the following steps (adapted from Stankey et al., 1985):
    (i) Identification of the broad resource issues and concerns and review of the management framework for the activity (including relevant legislation, policy and the Code of Practice).
    (ii) A review and formal agreement on the resource and social conditions towards which management strives. The sustainability objectives developed in Study Four (Chapter 6) provide an ideal basis for this

step, however as new information emerges and/or changes occur in the social-ecological system, such objectives/conditions will require review and updating.

(iii) A review of the current state of the SWW activity, drawing on the best available information on the status and trends in the GBR dwarf minke whale population (e.g. Sobtzick, 2011), the tourism industry, effects of the SWW interactions on whale behaviour (e.g. Mangott, 2010) and the management of the activity (e.g. as reported in Chapter 5).

(iv) Identification and formal agreement on the minimum standards and conditions of the resource (including environmental and social conditions) that would be acceptable to stakeholders.

- Identification and review of potential sustainability indicators to measure progress towards sustainability objectives,
- Screening of indicators by stakeholders, using appropriate screening criteria (e.g. Bell and Morse, 2003; Guy and Kibert, 1998) including cost/benefit analysis and prioritisation for implementation.
- Once indicators are selected, potential desirable and undesirable results should be defined. For some indicators (e.g. those with existing baseline data) it may be possible to define benchmarks, targets, thresholds or acceptable ranges.
- Potential management responses to undesirable results from selected indicators should be reviewed and fine-tuned, based on stakeholders feedback.

In consideration of the time required for stakeholders to address all of the above objectives, a full-day workshop is recommended. Tasks may however be spread over subsequent workshops if stakeholders are unable to attend for such a duration (e.g. due to other work commitments).

Annual monitoring and assessment workshops

A pre-season workshop should be held in mid to late May each year, prior to the start of the core GBR minke whale season. Attendance by crew of the SWW-endorsed vessels (in addition to the owners/managers that represent each SWW operator) should be strongly encouraged. Objectives of these workshops should include:

- Reviewing results of sustainability indicators from the previous minke whale season(s), including any longer-term trends.
- SWW operators reporting on the previous minke whale season, including a discussion of any significant events and management issues.
- Reviewing monitoring data requirements for the upcoming season and distributing data collection instruments to SWW operators.
- Distributing new and/or updated interpretive material to SWW-endorsed operators.
- A crew training/familiarisation component could also be incorporated into this workshop or be held as a separate event (dependent on availability of crew from each SWW vessel). This component would include familiarisation with the Code of Practice and crew roles in the management of SWW interactions, collection of monitoring data and delivery of interpretation. Stakeholders should evaluate whether a mandatory requirement for trained crew to be present on SWW trips is appropriate. Such a requirement could be made obligatory in the Code of Practice.

A post-season workshop should be held each year in November or December. Objectives of these workshops should include:

- Reporting by SWW operators on the previous minke whale season, including discussion of any significant events and management issues.
- Reviewing of monitoring data returns from the June-July minke whale season (including totals from each operator and an evaluation of data quality).
- Reviewing preliminary results of sustainability indicators from the June-July minke whale season, including any longer-term trends.
- Reviewing and fine-tuning management protocols (i.e. the Code of Practice) as necessary.
- Fine-tuning of sustainability indicators as necessary and periodic reviewing of the sustainability objectives and updating these as necessary (e.g. as illustrated in Figure 7.1 below).
- Annual awards presented to SWW operators and individual crew for contributions to monitoring data returns (quantity and quality).

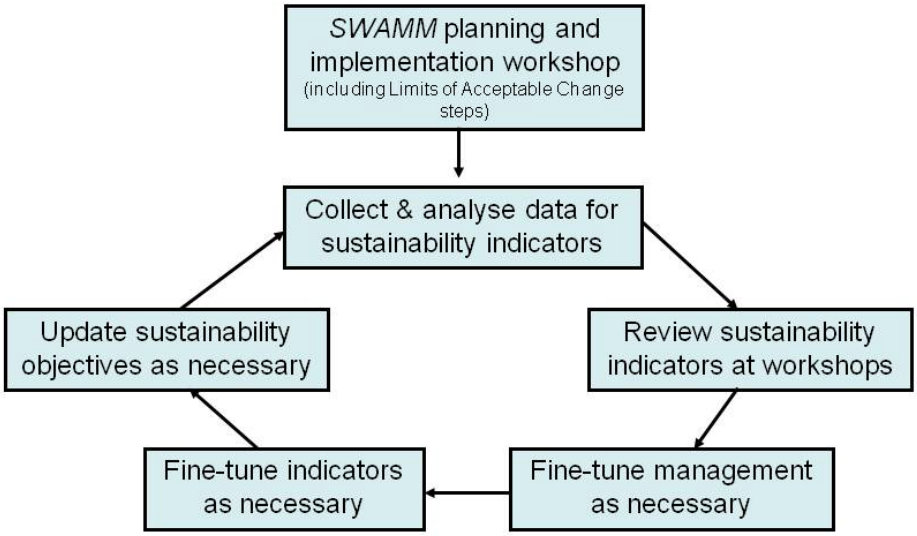


Figure 7.1: Iterative process of sustainability assessment as part of the Swimming-with-Whales Adaptive Management Model (SWAMM)

Monitoring data collection, analyses and review

Data should be collected each minke whale season for the selected sustainability indicators, by both trained crew and/or researchers when present on vessels. Mandatory reporting for SWW-endorsed operators (as a permit condition) should include a Whale Sighting Sheet completed for each encounter with dwarf minke whales and vessel 'effort' data (i.e. site use and any open-water search effort; minimum data logging requirements will need to be agreed by stakeholders in the pre-season workshop). Passenger questionnaires (for monitoring a range of sustainability indicators including operator compliance) should be distributed on all trips on which minke whales were encountered. Procedures for handling of passenger survey data and results, including the identification of operators in these results, should be reviewed and implemented at the SWAMM Planning and Implementation Workshop.

Additional voluntary monitoring and research data collection is strongly encouraged, including photo-identification data (i.e. underwater photos and video footage taken by crew and passengers) and recording of behaviours (data recording requirements to be determined). Considering the importance of such data for addressing key questions about the population characteristics (Sobtzick, 2011) and potential long-term changes in whales' behaviour (Mangott, 2010), stakeholders should consider including such

additional data collection as an obligatory requirement under the Code of Practice. This issue should be reviewed in the SWAMM Planning and Implementation Workshop when screening and prioritising sustainability indicators.

All monitoring data should be submitted to and analysed by a stakeholder-approved independent contractor. Copies of Whale Sighting Sheets and vessel effort logs should be forwarded to the GBRMPA. Data returns and summary statistics from each season should be reported to stakeholders at the post-season workshops. Summary reports on the sustainability indicators, including the assessment of longer-term trends, should be prepared and circulated annually for review by stakeholders and discussion at each pre- and/or post-season workshop. A medium-term reporting cycle should also be established (e.g. every five years) for more substantial periodic reviews of the SWW activity, including assessments of industry scale, permit criteria and conditions.

Management responses

Consistent with the Limits of Acceptable Change process, management responses to a range of potential undesirable outcomes (e.g. non-compliance with management protocols, detected impacts) should be reviewed by stakeholders and determined at the initial SWAMM Planning and Implementation Workshop. While some management responses may be able to be determined through a process of negotiation between the stakeholders, others (e.g. breaches of regulations) would be subject to the regulatory framework (i.e. the *Great Barrier Reef Marine Park Regulations 1983*) and jurisdiction of the GBRMPA. In either case, the management triggers, processes, options and/or actions should be clearly articulated for all conceivable undesirable events. The ability for the GBRMPA to suspend or revoke an operator's SWW-endorsement (e.g. for failure to meet permit conditions or for serious/repeated compliance infringements) should also be included among the available management actions.

Funding and resources

Clearly there are costs associated with running workshops, data entry, analyses and report preparation, the development of interpretive materials and training of vessel crew. The financial burden/responsibility of these tasks should not rest with any

single stakeholder organisation or group, and all stakeholders should be expected to contribute in some way to the management and assessment processes. The amount contributed by each stakeholder organisation should be discussed and agreed by all stakeholders in workshops, and may include direct financial and/or in-kind support.

Seed funding will be required from the GBRMPA and/or Commonwealth Government to cover basic costs until a long-term funding solution is achieved. Stakeholders should also explore additional revenue-raising options in workshops. Such options could include a management levy for passengers on SWW-endorsed minke whale watching tours and/or the collection of voluntary donations from passengers on SWW-endorsed vessels, however further (and more creative) ideas should be explored. SWW operators should continue to provide in-kind support for research (e.g. by providing researchers access to vessels), and in turn, researchers should contribute to the development and provision of high quality interpretation for SWW participants.

Economic resilience of the SWW industry

In light of the recent Global Financial Crisis and potential vulnerability of SWW operators to downturns in tourist numbers in the Cairns region (highlighted by the closure of two operations prior to the 2009 minke whale season), the SWW industry must be resilient to short-term market shocks and fluctuations. Implementation of the SWAMM process must include a careful review of the economic sustainability objectives and indicators (as part of the screening and implementation process for all sustainability objectives) and evaluations of financial risks faced by SWW operators.

7.4 Conclusion

This thesis has provided an evaluation of a range of mechanisms for assessing the sustainability of swimming-with-whales tourism in the Great Barrier Reef. In addition to the proposed Swimming-with-Whales Adaptive Management Model, a range of specific management recommendations arising from the four studies are presented below (Section 7.4.1). Many of these recommendations were included

among recommendations from the Minke Whale Project research team in a Final Report to the GBRMPA on the Dwarf Minke Whale Tourism Monitoring Program (Birtles et al., 2010).

The processes and outcomes of the Dwarf Minke Whale Tourism Monitoring Program and the collaborative development of sustainability objectives are encouraging indications of the stakeholders' desire and commitment to foster a sustainable SWW industry. The author therefore holds an optimistic outlook for the sustainable management of the SWW activity if such processes are continued, and if management of the activity is adaptive and responsive to scientific findings on the effects of the SWW interaction on the GBR dwarf minke whale population. Much uncertainty however surrounds the broader threats to these whales when outside the GBR, as well as threats to the Great Barrier Reef ecosystem and indeed the global marine environment from human-related impacts including marine pollution, overfishing and global climate change. The effects of predicted increasing sea surface temperatures and ocean acidification pose a major threat to reef-building corals and other marine organisms that form the basis of ocean food-web productivity (Veron, 2008; GBRMPA, 2009), while the flow-on effects of climate change to cetacean populations have only recently begun to be explored (e.g. Azzellino, Gaspari, Airoldi & Lanfredi, 2008; Gambaiani, Mayol, Isaac, & Simmonds, 2008). Considering the risks, the GBR SWW industry (and the wider GBR tourism industry) and stakeholders should be much more active in their efforts to raise public awareness and political support for reducing carbon pollution, and for implementing mitigation and resilience-building strategies.

The SWW-endorsed operators and indeed the wider tourism industry in the Far North Queensland region are heavily dependent on long-haul international visitation. As such, these tourism businesses are particularly vulnerable to a range of shocks that impact global travel, including disease epidemics, economic crises, terrorism and political instability. The closure of two SWW-endorsed live-aboard operations in 2009 reflects this vulnerability. The potential for growth in this activity in the near future however should not be underestimated. Considering the steady growth in whale watching tourism worldwide in recent years (O'Connor et al., 2009) and an apparent increasing demand for swim-with-cetaceans interactions (Rose et al., 2005;

2003), it is probable that tourist demand for swimming-with-dwarf minke whales in the GBR will attract new operators to the Ribbon Reefs during the winter months should the opportunity arise to acquire existing (latent) or new SWW-endorsements. Any proposal for expansion of the SWW activity however should be preceded by an appropriate evaluative process (e.g. Limits of Acceptable Change and the above SWAMM).

Whale watching cannot be assumed to be an ecologically benign activity. Whilst the economic benefits, opportunities for research and increased public awareness for conservation issues are widely touted incentives to promote whale watching tourism, the recent emergence of longer-term studies showing cumulative impacts on targeted cetacean populations (e.g. Christiansen, Lusseau, Stensland & Berggren, 2010; Bejder et al., 2006) highlights the need for a precautionary approach to whale watching management. Neves (2010) provides a critical appraisal of the way in which whale watching is portrayed as a sustainable alternative to whale hunting in media and by conservation NGOs, arguing that unsustainable whale watching practices and the capitalist nature of such tourism are often overlooked in such discourses. The Whale and Dolphin Conservation Society policy to not support commercial swim-with-cetaceans programs (WDCS, 2009) might therefore be considered an exception to the dominant discourse reported by Neves (2010), and the sustainability assessment of the GBR SWW activity would benefit from WDCS' continued participation as stakeholders, and their critical gaze.

The opportunities presented by the GBR SWW activity include economic benefits to the local community, enhancement of our scientific knowledge of a poorly understood and still undescribed subspecies of whale, intrinsic benefits of the SWW experience for tourists (i.e. personal satisfaction and well-being), and the stimulation of SWW tourists' and the wider community's awareness of conservation issues for cetaceans and the marine environment. The realisation of such opportunities however must be balanced by the stakeholders' acceptance of their responsibilities, to ensure that this commercial exploitation of the whales does not have adverse ecological consequences, and that the range of social values attributed to the whales and the SWW activity continue to be upheld. The stakeholders of the GBR SWW activity can potentially set a world-leading example for their approach towards the sustainable

management of a whale watching tourism industry. Their continued collaboration and commitment to a long-term evaluative and adaptive process (for example the proposed Swimming-with Whales Adaptive Management Model) will be critical to achieving such aspirations and to achieving a genuinely sustainable swimming-with-whales tourism activity.

7.4.1 Management recommendations arising from the four studies

Management recommendations drawn from findings from the four studies (Chapters 3 – 6) are summarised below. Several of these recommendations were incorporated into a Final Report to the GBRMPA (*indicated by an asterisk) to assist with their 2010 review of the SWW activity (among other recommendations developed by co-authors; Birtles et al., 2010). Specific recommendations include:

(i) A framework for the ongoing collaborative and adaptive management of the SWW activity (e.g. the above proposed *Swimming-with-Whales Adaptive Management Model*) should be implemented to ensure that longer-term management and sustainability objectives are met (through monitoring of sustainability indicators) as individual actors in the process change over time.

(ii) The evaluation of an appropriate scale for the SWW industry should be based on a Limits of Acceptable Change process, with input from all key stakeholders and with ongoing monitoring implemented. The social values of the whales and the SWW experience (documented in Chapter 4) should be used to assist with this process and efforts made to ensure that these values are upheld. Due to the unknown longer-term impacts of the SWW activity on the whales and the recent discovery of short-term behavioural changes (i.e. desensitisation; Mangott, 2010), a precautionary approach is strongly recommended.

(iii) Continued involvement and collaboration between key stakeholder groups in management processes is vital; efforts should continue be made to engage with local, national and international wildlife conservation NGOs

(e.g. IFAW and WDCS) and other relevant stakeholder groups for their expertise and valuable feedback.

(iv) *The stakeholder workshops were shown to be a highly effective forum for the assessment of emerging management issues and the rapid implementation of new management protocols. Such workshops should form a basis for the ongoing management and monitoring of the GBR SWW activity and should be held at least once annually (e.g. in May, prior to each minke season).

(v) A sustainable source(s) of revenue should be sought by stakeholders for the ongoing monitoring and review of the SWW activity. Appropriate contributions from each stakeholder group should also be evaluated (including financial and/or in-kind support).

(vi) *The Code of Practice should continue to be reviewed and refined as necessary in stakeholder workshops. Further evaluation of protocols to minimise the occurrence and risks of entanglement and potential harm to humans and whales during SWW interactions should be an immediate priority in this process. A risk assessment matrix developed by Mangott (2010) provides an excellent basis for this evaluation.

(vii) *Permits/endorsements should continue to form the basis for management of the SWW activity and should be revocable by the management agency via a clear process should unacceptable trends or evidence of non-compliance become apparent.

(viii) *The completion and submission of Whale Sighting Sheets for every minke whale encounter should continue to be a permit condition for SWW-endorsed operators.

(ix) *The submission of vessel effort data by SWW-endorsed operators during the minke whale season should also be made obligatory via a permit condition, to allow standardisation of analyses of the whale sightings data, and to monitor trends in SWW industry effort, minke whale encounter rates and the proportion of total encounter time to industry effort. Such data can be collected by vessel crew (e.g. using Vessel Movement Logs), however automated electronic logging devices will provide more consistent sampling and ensure data quality.

(x) *Education and interpretation are essential to achieving good management of minke whale encounters. New and updated interpretive tools will be required and their effectiveness should also be assessed. Broader stakeholder involvement in the development of such interpretation is desirable, to ensure all relevant goals and values are incorporated. Minimum standards for the use of educational and interpretive materials should also be considered as a condition or criteria of the SWW-endorsements.

(xi) Vessel crew should be targeted specifically in an education program as they are most important source of information for passengers on these vessels. Additional 'minke whale encounter management' training for crew should become a requirement for SWW-endorsed operators. Details on the requirements and implementation of such a training and accreditation scheme should be developed in a stakeholder workshop.

(xii) Compliance and enforcement of SWW regulations is almost entirely dependent on the SWW-endorsed operators and their crew. Operators must be vigilant in monitoring and reporting illegal/suspect SWW activities. Managers must demonstrate a clear process for addressing such compliance issues and provide appropriate feedback to all stakeholders in a timely manner.

(xiii) Passenger surveys can be an effective tool for monitoring the performance of individual operators, however an appropriate forum and process for identifying non-compliant/sub-standard operators must be developed in a stakeholder workshop. The use of positive incentives (rewarding good performance) in favour of sanctions and deterrents is likely to achieve better outcomes.

(xiv) An assessment of the scale of incidental minke whale encounters by non-SWW-endorsed operators should be made as soon as possible. This should involve an education program targeting tourism operators to ensure their compliance with whale watching regulations and to facilitate their voluntary contribution of whale sightings data to an expanded sightings network. Public workshops (additional to those outlined in the SWAMM) and/or information sessions should be led and/or attended by the

GBRMPA and interpretive media developed to inform and gain support from tourism operators and other Reef users.

7.4.2 Recommendations for further research

There are substantial gaps in our knowledge of the biology, behaviour and life-history of dwarf minke whales that clearly need to be addressed in order to determine the extent of human-related threats, both within and outside the Great Barrier Reef Marine Park. The following questions are considered to be of a high priority for future research:

1. *What is the size of the GBR dwarf minke whale population?* Research based on of photo-identification of individual dwarf minke whales in the GBR has so far provided preliminary estimates of the number of interacting whales (Sobtzick, 2011), however studies of the dwarf minke whale population, their distribution and abundance in the GBR will require systematic surveys from dedicated research platforms (e.g. including vessels and/or aircraft).
2. *What are the whales' migratory patterns?* Sightings of dwarf minke whales in the GBR occur each austral winter however where these whales spend the remainder of each year (nine to ten months) remains a mystery. Satellite and/or radio tracking studies to determine migration patterns will also assist in the development of more complete assessments of risks and threats to dwarf minke whales beyond GBR waters, and genetic studies will help to determine key biological and population parameters. Due ethical considerations however must be given for the invasive sampling techniques associate with such studies. All research on the GBR dwarf minke whale population to date has been non-invasive (i.e. no physical contact has been made with a whale). The risk of harm to whales (and potentially also to people) associated with the attachment of tags (via darts) and/or the taking of biopsies must be given careful consideration and weighed against the need for the knowledge that can be gained. Such invasive sampling techniques are incompatible with tourism activities and must therefore be conducted from a dedicated research vessel.

3. *What are the longer-term effects of SWW interactions on individual dwarf minke whales' behaviour?* Further evaluations of the cumulative effects of SWW interactions on dwarf minke whales will require longer-term behavioural studies to establish the whales' normal behaviour/activity budgets when in the GBR (e.g. via remote sensing and/or observation from dedicated platforms) and the evaluation of potential behavioural changes in individual whales (using photo-identification) associated with repeated SWW interactions. The continuation of photo-ID studies (e.g. Sobtzick, 2011) is also necessary to assess the extent of cumulative interactions for individual whales, as well as for monitoring other valuable population characteristics (e.g. demographics, survivorship).
4. *What is the purpose of the whales' aggregation in the GBR?* Since field research began in 1996 there have been no observations of the whales feeding and it is considered likely that the GBR provides habitat for winter breeding (Birtles et al., 2002). While some suspected courtship behaviour has been observed during SWW interactions (Mangott, 2010), the hypothesis that the whales visit the GBR for breeding remains unconfirmed.
5. *What are the longer-term influences of the SWW experience on tourists, and how can environmental awareness and educational outcomes associated with the experience be enhanced?* As outlined in Chapter 4 (Section 4.5.2.6), all efforts should be made to maximise the possible benefits for the whales and their habitat. The 'peak' nature of the GBR SWW experience provides an opportunity to influence the attitudes and behaviour of participants, to contribute towards the conservation of whales and the marine environment.

Finally, the effectiveness of the management model must also be evaluated as part of any sustainability monitoring program (Holling, 1978; Bell & Morse, 1999). The implementation of sustainability indicators (and potentially the SWAMM) will thus require further studies to evaluate the management processes and ensure the assessment framework is effective, and to assist progress towards the sustainability objectives.

7.4.3 Limitations of this research

The author recognises that all research activities (e.g. methodological approaches, techniques, instruments and analyses) have limitations, and acknowledges those associated with the research presented in this thesis. Limitations of the methodologies employed are stated in Chapter 2 and in the respective methods sections of Chapters 3-6, however there is also the potential for personal bias in analyses of the qualitative data that formed a substantial part of this research. Systematic coding procedures were implemented to minimise the potential for such bias (as outlined in Chapter 2; Section 2.2.2).

In Chapters 4 and 5, passenger questionnaires were used to characterise SWW participants' experiences and values of the whales, and their perceptions of the management of SWW interactions. The potential for sampling bias (favouring English-literate participants) must be acknowledged. While attempts were made to provide native language surveys for Japanese SWW participants (Appendix 15), the potential increase in SWW participants from other non-English speaking countries may have led to an insufficient representation of such segments. The analysis of open-ended statements in the passenger questionnaire sample may also have been influenced by personal bias, despite efforts being made during the coding process to preserve objectivity (e.g. by adhering to a systematic and 'grounded' approach and ratification of codes by volunteers and colleagues).

Semi-structured in-depth interviews were conducted with stakeholder key informants and a sample of highly experienced crew to address a number of research questions and develop sustainability objectives (Chapters 4-6). It is possible that the phrasing and order of questions during these interviews influenced the respondents' answers, and the potential for personal bias in the coding and interpretation of answers must also be acknowledged, however all efforts were made by the researcher to remain neutral and objective during these processes. The PAR process employed to develop sustainability objectives was, necessarily, driven by the researcher and thus the outcomes were undoubtedly influenced by personal values. It is intended however that the proposed SWAMM process will allow these objectives to be modified and refined by the stakeholders as more information is gathered, as new people become involved, and as the social values of these stakeholders evolve over time.

References

Alder, J. (1993). Permits, An Evolving Tool for the Day-to-Day Management of the Cairns Section of the Great Barrier Reef Marine Park. *Coastal Management*, 21: 25-36.

Allan, C. & Curtis, A. (2003). Regional Scale Adaptive Management: Lessons from the North East Salinity Strategy (NESS). *Australasian Journal of Environmental Management*, 10: 76-84.

Allen, S. (2006). Short-term effects of dolphin watching in Port Stephens, NSW. Presentation to the National Whale and Dolphin Research Conference, Adelaide, 21-22 February 2006. Commonwealth Department of the Environment and Heritage. Available online: http://www.deh.gov.au/coasts/species/cetaceans/conference/pubs/ww-allen.pdf (Last accessed 17 August 2008).

Amante-Helweg, V. (1996). Ecotourists' beliefs and knowledge about dolphins and the development of cetacean ecotourism. *Aquatic Mammals*, 22: 131-140.

ANZECC (2000). *Australian National Guidelines for Cetacean Observation & Areas of Special Interest for Cetacean Observation*. Environment Australia, Canberra.

Argyris, C. & Schön, D.A. (1989). Participatory Action Research and Action Science Compared: A Commentary. *American Behavioral Scientist*, 32: 612-623.

Arnold, J.S. & Fernandez-Gimenez, M. (2007). Building Social Capital Through Participatory Research: An Analysis of Collaboration on Tohono O'odham Tribal Rangelands in Arizona. *Society and Natural Resources*, 20: 481–495.

Arnold, P.W. (1997). Occurrence of dwarf minke whales (*Balaenoptera acutorostrata*) on the northern Great Barrier Reef, Australia. *Reports of the International Whaling Commission 47*: 419-424.

Arnold, P.W. & Birtles, R.A. (1999). *Towards sustainable management of the developing dwarf minke whale tourism industry in northern Queensland*. CRC Reef Research Centre Technical Report No. 27. CRC Reef Research Centre, Townsville. 30pp.

Arnold, P.W., Birtles, R.A., Dunstan, A., Lukoschek, V.& Matthews, M. (2005a). Colour patterns of the dwarf minke whale *Balaenoptera acutorostrata sensu lato*: description, cladistic analysis and taxonomic implications. *Memoirs of the Queensland Museum*, 51 (2): 277-307.

Arnold, P.W. Birtles, R.A., Sobtzick, S., Matthews , M. & Dunstan, A. (2005b). Gulping behaviour in rorqual whales: underwater observations and functional interpretation. *Memoirs of the Queensland Museum*, 51(2): 309-332.

Arnold, P., Marsh, H. & Heinsohn, G. (1987). The Occurrence of Two Forms of Minke Whales in East Australian Waters With a Description of External Characteristics and Skeleton of the Diminutive or Dwarf Form. *Sci. Rep. Whales Res. Inst.*, 38: 1-46.

Australian State of the Environment Committee (2006). Australia State of the Environment 2006. Commonwealth Department of the Environment and Heritage, Canberra. Available online: http://www.environment.gov.au/soe/2006/publications/report/index.html (Last accessed 20 October 2010).

Azzellino, A., Gaspari, S.A., Airoldi, S. & Lanfredi, C. (2008). Biological consequences of global warming: Does sea surface temperature affect cetacean distribution in the western Ligurian sea? *Journal of Marine Biological Association of the United Kingdom*, 88: 1145–1152.

Bailey, J. (1997). Environmental Impact Assessment and Management: An Underexplored Relationship. *Environmental Management* 21 (3): 317-327.

Baldauf, R.B. Jr. & Jernudd, B.H. (1986). Aspects of Language Use in Cross-Cultural Psychology. *Australian Journal of Psychology*, 38 (3): 381-392.

Ballantyne, R., Packer, J., Hughes, K. & Dierking, L. (2007). Conservation learning in wildlife tourism settings: lessons from research in zoos and aquariums. *Environmental Education Research*, 13 (3): 367-38.

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K. & Turner, K. (2002). Economic Reasons for Conserving Wild Nature. *Science*, 297: 950-953.

Bannister, J.L., Kemper, C.M. & Warneke, R.M. (1996). The Action Plan for Australian Cetaceans. Australian Nature Conservation Agency, Canberra. Available online: http://www.environment.gov.au/coasts/publications/cetaceans-action-plan/index.html (Last accessed 15 December 2010).

Beach, D. W., & Weinrich, M. (1989). Watching the whales: Is an educational adventure for humans turning out to be another threat for an endangered species? *Oceanus*, 32, 84-88.

Beaumont, N. & Dredge, D. (2010). Local tourism governance: a comparison of three network approaches. *Journal of Sustainable Tourism*, 18 (1): 7-28.

Bejder, L. & Samuels, A. (2003). Evaluating the effects of nature-based tourism on cetaceans. In Gales, N. J., Hindell, M. A. & Kirkwood, R. (Eds.). *Marine Mammals: Fisheries, Tourism and Management Issues* (Vol. 1, Ch. 12: 229-256). Collingwood, Australia: CSIRO Publishing.

Bejder, L., Samuels, A., Whitehead, H., Gales, N., Mann, J., Connor, R., Heithaus, M., Watson-Capps, J., Flaherty, C. & Krützen, M. (2006). Decline in Relative Abundance of Bottlenose Dolphins Exposed to Long-Term Disturbance. *Conservation Biology*, 20 (6): 1791–1798.

Bell, S. & Morse, S. (1999). *Sustainability Indicators: Measuring the immeasurable*. Earthscan Publications Ltd, London.

Bell, S. & Morse, S. (2003). *Measuring Sustainability: Learning from doing*. Earthscan Publications Ltd, London.

Best, P.B. (1985). External characters of southern minke whales and existence of a diminutive form. *Scientific Reports of the Whales Research Institute, Tokyo*, 36: 1-33.

Birtles, A., Arnold, P., Curnock, M., Salmon, S., Mangott, A., Sobtzick, S., Valentine, P., Caillaud, A. & Rumney, J. (2008). *Code of Practice for dwarf minke whale interactions in the Great Barrier Reef World Heritage Area*. Great Barrier Reef Marine Park Authority, Townsville, Australia. Available online: http://www.gbrmpa.gov.au/__data/assets/pdf_file/0007/34549/Dwarf_Minke_Whale_Code_of_Practice.pdf (Last accessed 4 August 2010).

Birtles, R.A., Arnold P.W. & Dunstan, A. (2002a). Commercial swim programs with dwarf minke whales on the northern Great Barrier Reef, Australia: some characteristics of the encounters with management implications. *Australian Mammalogy*, 24: 23-38.

Birtles, R.A., Valentine , P. & Curnock, M. (2001a). *Tourism based on free-ranging marine wildlife. Opportunities and responsibilities*. Wildlife Tourism Research Report Series: No.11. Status Assessment of Wildlife Tourism in Australia Series. CRC Sustainable Tourism. 62pp.

Birtles, A., Arnold, P., Curnock, M., Valentine, P. & Dunstan, A. (2001b). *Developing ecologically sustainable minke whale tourism (1999-2001)*. Final Report to the Commonwealth Department of Environment and Heritage (Environment Australia), November 2001.

Birtles, A., Arnold, P., Valentine, P., Barnett, B. & Dunstan, A. (2002c). *Sustainability indicators and other information needed to assess ecological sustainability of dwarf minke whale-swimmer interactions*. Unpublished report to the International Whaling Commission Scientific Committee, SC/55/WW11; 22pp.

Birtles, A., Valentine, P., Curnock, M., Arnold, P. & Dunstan, A. (2002b). *Incorporating visitor experiences into ecologically sustainable dwarf minke whale tourism in the northern Great Barrier Reef*. CRC Reef Research Centre Technical Report No. 42. CRC Reef Research Centre Ltd., Townsville. Available online: http://www.reef.crc.org.au/publications/techreport/index.html (Last accessed 7 September 2010).

Birtles, A., Valentine, P., Curnock, M., Mangott, A., Sobtzick, S. & Marsh, H. (2010). Dwarf Minke Whale Tourism Monitoring Program (2003-2008): Final Report to the Great Barrier Reef Marine Park Authority, 21 June 2010. 117pp.

Black, R. (2007). Professional Certification: A Mechanism to Enhance Ecotour Guide Performance (Chapter 17). In R. Black and A. Crabtree (eds). *Quality Assurance and Certification in Ecotourism*. CABI International, Oxfordshire, UK.

Bogdan, R. & Taylor, S.J. (1975). *Introduction to Qualitative Research Methods*. John Wiley & Sons, New York.

Bowen, R.E. & Riley, C. (2003). Socio-economic indicators and integrated coastal management. *Ocean & Coastal Management*, 46: 299-312.

Bowett, J. & Hay, P. (2009). Whaling and its controversies: Examining the attitudes of Japan's youth. *Marine Policy*, 33: 775–783.

Buckley, R. (2003). Ecological Indicators of Tourist Impacts in Parks. *Journal of Ecotourism*, 2 (1): 54-66.

Bureau of Meteorology (2010). Queensland Radar Site Information, Australian Government Bureau of Meteorology website: http://www.bom.gov.au/weather/radar/info/QLD.info.shtml (Last accessed 3 September 2010).

Busch, D.E. & Trexler, J.C. (2002). *Monitoring Ecosystems: Interdisciplinary Approaches for Evaluating Ecoregional Initiatives*. Island Press, Washington, D.C.

Callicott, J.B., Crowder, L.B. & Mumford, K. (1999). Current Normative Concepts in Conservation. *Conservation Biology*, 13 (1): 22-35.

Charmaz, K. (2006). *Constructing grounded theory: a practical guide through qualitative analysis*. Sage Publications Ltd., London.

Christiansen, F., Lusseau, D., Stensland, E. & Berggren, P. (2010). Effects of tourist boats on the behaviour of Indo-Pacific bottlenose dolphins off the south coast of Zanzibar. *Endangered Species Research*, 11: 91-99.

Clark, W.C. (2007). Sustainability Science: A room of its own. *Proceedings of the National Academy of Sciences* (PNAS), 104 (6): 1737–1738.

Clark, W.C. & Dickson, N.M. (2003). Sustainability science: The emerging research program. *Proceedings of the National Academy of Sciences* (PNAS), 100 (14): 8059–8061.

Cole, D.N. & Stankey, G.H. (1997). Historical Development of Limits of Acceptable Change: Conceptual Clarifications and Possible Extensions. In: McCool, S. F.; Cole, David N., (eds). *Proceedings—Limits of Acceptable Change and related planning processes: progress and future directions*; 1997 May 20–22; Missoula, MT. Gen. Tech. Rep. INT-GTR-371. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Cole, S. (2007). Implementing and evaluating a code of conduct for visitors. *Tourism Management*, 28: 443–451.

Commonwealth of Australia (2000). Environment Protection and Biodiversity Conservation Regulations 2000. Available online: http://www.frli.gov.au/ComLaw/Legislation/LegislativeInstrumentCompilation1.nsf/0/6762C4F433643BDACA25728800075F3C?OpenDocument (Last accessed 8th October 2010).

Commonwealth Department of the Environment and Heritage (2003). Triple Bottom Line Reporting in Australia - A Guide to Reporting Against Environmental Indicators. Commonwealth DEH website: http://www.deh.gov.au/settlements/industry/finance/publications/indicators/chapter1.html (Last accessed 9 May 2006).

Commonwealth Department of the Environment and Heritage (2005). Australian National Guidelines for Whale and Dolphin Watching 2005. Available online: http://www.deh.gov.au/coasts/publications/whale-watching-guidelines-2005.html (Last accessed 11 October 2010).

Commonwealth Department of Tourism (1994). *National Ecotourism Strategy*. Australian Government Publishing Service, Canberra.

Constantine, R. (1999). *Effects of tourism on marine mammals in New Zealand*. Science for Conservation Series, No. 106. Department of Conservation, Wellington, New Zealand.

Constantine, R. (2001). Increased avoidance of swimmers by wild bottlenose dolphins (Tursiops truncatus) due to long-term exposure to swim-with-dolphin tourism. *Marine Mammal Science*, 17 (4): 689-702.

Corbiére-Nicollier, T., Ferrari, Y., Jemelin, C. & Jolliet, O. (2003). Assessing sustainability: An assessment framework to evaluate Agenda 21 actions at the local level. *International Journal of Sustainable Development and World Ecology*, 10 (3): 225-237.

Corkeron, P.J. (1995). Humpback whales (*Megaptera novaeangliae*) in Hervey Bay, Queensland: behaviour and responses to whale-watching vessels. *Canadian Journal of Zoology*, 73: 1290-1299.

Costanza, R., & Ruth, M. (1998). Using Dynamic Modeling to Scope Environmental Problems and Build Consensus. *Environmental Management*, 22 (2): 183-195.

CRC Reef Research Centre (2002). *Dwarf minke whales in the Great Barrier Reef: Current state of knowledge, May 2002* (brochure). CRC Reef Research Centre Ltd., Townsville.

CRC Reef Research Centre (2004). *Minke Magic*. Press Release, 2 June 2004. CRC Reef Research Centre. Available online: http://www.reef.crc.org.au/media/MinkeMagic.htm (Accessed 28 August 2009).

Curnock, M. (1998). *A comparison of Japanese and non-Japanese scuba divers' experiences and perceptions of the Great Barrier Reef, with a focus on dwarf minke whale-diver interactions*. B.Admin. (Tourism) Honours thesis, James Cook University.

Curtin, S. (2005). Nature, Wild Animals and Tourism: An Experiential View. *Journal of Ecotourism*, 4 (1). 15pp.

Curtin, S. (2006). Swimming with Dolphins: a Phenomenological Exploration of Tourist Recollections. *Int. J. Tourism Res*. 8: 301–315.

Curtin S. & Garrod, B. (2008). Vulnerability of Marine Mammals to Diving Tourism Activities. In: Garrod, B. & Gössling, S. *New frontiers in marine tourism: diving experiences, sustainability, management*. Amsterdam: Elsevier.

Dann, G., Nash, D. & Pearce, P. (1988). Methodology in Tourism Research. *Annals of Tourism Research*, 15: 1-28.

Davis, D., Banks, S., Birtles, A., Valentine, P. & Cuthill, M. (1997). Whale sharks in Ningaloo Marine Park: managing tourism in an Australian marine protected area. *Tourism Management*, 18 (5): 259-271.

Decrop, A. (1999). Triangulation in qualitative tourism research. *Tourism Management*, 20: 157-161.

DeMares, R. (2000). Human Peak Experience Triggered by Encounters with Cetaceans. *Anthrozoos*, 13 (2): 89-103.

DeMares, R. & Krycka, K. (1998). Wild animal triggered peak experiences: transpersonal aspects. *The Journal of Transpersonal Psychology*, 30 (2): 161-177.

Dobson, J. (2007). 'Jaws of Jawsome'? Exploring the shark-diving experience. *Proceedings of the 5th International Coastal & Marine Tourism Congress*, 11-15 September 2007, Auckland, New Zealand.

Duffus, D.A. & Dearden, P. (1990). Non-Consumptive Wildlife-Oriented Recreation: A Conceptual Framework. *Biological Conservation*, 53: 213-231.

Dunstan, A., Sobtzick, S., Birtles, A. & Arnold, P.W. (2008). Size estimation and population demographics of dwarf minke whales in the northern Great Barrier Reef. *Journal of Cetacean Management*, 9 (3): 49-57.

Duprey, N.M.T., Weir, J.S. & Würsig, B. (2008). Effectiveness of a voluntary code of conduct in reducing vessel traffic around dolphins. *Ocean & Coastal Management* 51: 632–637.

Ecotourism Australia (2003). Nature and Ecotourism Certification Program, 2nd Ed. Available online: http://www.ecotourism.org.au/neap2.pdf (Last accessed 18 November 2009).

Erbe, C. (2002). Underwater noise of whale-watching boats and potential effects on killer whales (*Orcinus orca*), based on an acoustic impact model. *Marine Mammal Science*, 18 (2): 394-418.

ESD Steering Committee (1992). *National Strategy on Ecologically Sustainable Development* (NSESD), Australian Government Publishing Service, Canberra, December 1992. Available online: http://www.environment.gov.au/about/esd/publications/strategy/index.html (Last accessed 29 October 2010).

Evans, P.G.H. & Hammond, P.S. (2004). Monitoring cetaceans in European waters. *Mammal Rev.* 34 (1): 131-156.

Farrell, T.A. & Marion, J.L. (2002). The Protected Area Visitor Impact Management (PAVIM) Framework: A Simplified Process for Making Management Decisions. *Journal of Sustainable Tourism*, 10 (1): 31-51.

Farrell, B. & Twining-Ward, L. (2005). Seven Steps Towards Sustainability: Tourism in the Context of New Knowledge. *Journal of Sustainable Tourism*, 13 (2): 109-121.

Field, S. A., O'Connor, P.J., Tyre, A.J. & Possingham, H.P. (2007). Making Monitoring Meaningful. *Austral Ecology*, 32: 485-491.

Field, S.A. Tyre, A.J., Jonzen, N., Rhodes, J.R. & Possingham, H.P. (2004). Minimizing the cost of environmental management decisions by optimizing statistical thresholds. *Ecology Letters*, 7: 669–675.

Field, S.A., Tyre, A.J. & Possingham, H.P. (2005). Optimising allocation of monitoring effort under economic and observational constraints. *J. Wildlife Manage*. 69(2) 473-482.

Fowler, F.J. (2002). *Survey Research Methods*. 3rd Edition. Applied Social Research Methods Series, Vol. 1. London: Sage Publications.

Franceschi, D. & Kahn, J.R. (2003). Beyond strong sustainability. *International Journal of Sustainable Development and World Ecology*, 10 (3): 211-220.

Fraser, E.D.G., Dougill, A.J., Mabee, W.E., Reed, M. & McAlpine, P. (2006). Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. *Journal of Environmental Management*, 78: 114–127.

Frohoff, T.G. (2004). Behavioral indicators of stress in odontocetes during interactions with humans: a preliminary review and discussion. *Rep Int. Whal. Commn* 52: SC/52/WW2.

Galvin, S.L. & Herzog, H.A. (1993). Ethical ideology, animal rights activism, and attitudes toward the treatment of animals. *Ethics and Behavior*, 2: 263-286.

Gambaiani, D.D., Mayol, P., Isaac, S.J. & Simmonds, M.P. (2008). Potential impacts of climate change and greenhouse gas emissions on Mediterranean marine ecosystems and cetaceans. *Journal of the Marine Biological Association of the United Kingdom*, 89: 179–201.

Garrod, B. & Fennell, D.A. (2004). An Analysis of Whalewatching Codes of Conduct. *Annals of Tourism Research*, 31 (2): 334-352.

GBRMPA (1983). *Great Barrier Reef Marine Park Regulations 1983*. Great Barrier Reef Marine Park Authority. Available online: http://www.gbrmpa.gov.au/corp_site/about_us/legislation_regulations (Last accessed 11 October 2010).

GBRMPA (2005). Research Needs for Protection and Management of The Great Barrier Reef Marine Park 2005. Available online, Great Barrier Reef Marine Park Authority website: http://www.gbrmpa.gov.au/corp_site/info_services/science/research_priorities/index.html (Last accessed 28 October 2010).

GBRMPA (2006). *Dwarf Minke Whale Tourism Monitoring Program* (web page). Great Barrier Reef Marine Park Authority website: http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/natural_values/whales_dolphins/dwarf_minke_whales (Last accessed 4 August, 2010).

GBRMPA (2007). Operational Policy on Whale and Dolphin Conservation in the Great Barrier Reef Marine Park. Great Barrier Reef Marine Park Authority, Townsville. Available online: http://www.gbrmpa.gov.au/corp_site/about_us/policies (Last accessed 13 October 2010).

GBRMPA (2009). Great Barrier Reef Outlook Report 2009. Available online, Great Barrier Reef Marine Park Authority website: http://www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report (Last accessed 29 October 2010).

Gedamke, J., Costa, D.P. & Dunstan, A. (2001). Localization and visual verification of a complex minke whale vocalization. *Journal of the Acoustical Society of America*, 109 (6): 3038-3047.

Genot, H. (1995). Voluntary Environmental Codes of Conduct in the Tourism Sector. *Journal of Sustainable Tourism*, 3 (3): 166-172.

Gerber, L.R., DeMaster, D.P. & Kareiva, P.M. (1999). Gray Whales and the Value of Monitoring Data in Implementing the U.S. Endangered Species Act. *Conservation Biology*, 13 (5): 1215–1219.

Greenwood, D.J. Whyte, W.F. & Harkavy, I. (1993). Participatory Action Research as a Process and as a Goal. *Human Relations*, 46: 175-192.

GRI (2006). Global Reporting Initiative website homepage: http://www.globalreporting.org/ (Last accessed 29 October 2010).

Grimble, R. & Wellard, K. (1997). Stakeholder Methodologies in Natural Resource Management: a Review of Principles, Contexts, Experiences and Opportunities. *Agricultural Systems*, 55 (2) 173-193.

Grootaert, C. & van Bastelaer, T. (2002). *Understanding and measuring social capital*. World Bank, Washington, DC.

Gullett, W., Paterson, C. & Fisher, E. (2001). Substantive precautionary decision-making: The Australian Fisheries Management Authority's 'Lawful Pursuit' of the precautionary principle. *Australasian Journal of Natural Resources Law & Policy*, 7, 95-135.

Guy, G.B. & Kibert, C.J. (1998). Developing indicators of sustainability : US experience. *Building Research & Information*, 26 (1) : 39-45.

Ham, S.H. (1992). Environmental Interpretation: *A Practical Guide for People with Big Ideas and Small Budgets*. Fulcrum Publishing: Colorado.

Hardi, P. & Zdan, T. (1997). *Assessing Sustainable Development: Principles in Practice*. International Institute for Sustainable Development, Winnipeg. Available online: http://www.iisd.org/pdf/bellagio.pdf (Last accessed 11 October 2010).

Harger, J.R.E., & Meyer, F.M. (1996). Definition of indicators for environmentally sustainable development. *Chemosphere*, 33: 1749–1775.

Hasling, J. (2003). *Meet the Minkes: Creating an Interpretation Package which emphasizes personal connections between humans and whales*. M. Tourism thesis, James Cook University, Townsville.

Hassan, S.S. (2000). Determinants of Market Competitiveness in an Environmentally Sustainable Tourism Industry. *Journal of Travel Research*, 38: 239-245.

Hauser, D.D.W., VanBlaricom, G.R., Holmes, E.E & Osborne, R.W. (2006). Evaluating the use of whalewatch data in determining killer whale (Orcinus orca) distribution patterns. *J. Cetacean Res. Manage*. 8(3): 273-281.

Hawthorn, D. (2003). *Exploring the practical application of Sustainability Indicators for nature-based tour operators: a case study in interpretation and the swim-with-dwarf minke whale industry on the northern Great Barrier Reef*. M. Tourism Thesis, James Cook University, Townsville.

Heckel, G., Espejel, I. & Fischer, D.W. (2003). Issue Definition and Planning for Whalewatching Management Strategies in Ensenada, Mexico. *Coastal Management*, 31: 277-296.

Henry, I.P. & Jackson, G.A.M. (1996). Sustainability of Management Processes and Tourism Products and Contexts. *Journal of Sustainable Tourism*, 4 (1): 17-28.

Herzing, D.L. (1999). Minimizing impact and maximizing research during human/dolphin interactions in the Bahamas. In: Dudzinski, M., Frohoff, G.T. & Spradlin, T.R. (Eds.), *Wild Dolphin Swim Program Workshop*: Maui, Hawaii.

Higham, J.E.S. & Bejder, L. (2008). Managing Wildlife-based Tourism: Edging Slowly Towards Sustainability? *Current Issues in Tourism*, 11 (1): 75-83.

Higham, J.E.S. & Bejder, L. & Lusseau, D. (2009). An integrated and adaptive management model to address the long-term sustainability of tourist interactions with cetaceans. *Environmental Conservation*, 35 (4): 294-302.

Higham, J.E.S. & Carr, A. (2002). Ecotourism visitor experiences in Aotearoa/New Zealand: challenging the environmental values of visitors in pursuit of pro-environmental behaviour. *Journal of Sustainable Tourism*, 10: 277-294.

Higham, J.E.S., Lusseau, D. & Hendry, W. (2008). Wildlife Viewing: The Significance of the Viewing Platforms. *Journal of Ecotourism*, 7 (2 & 3):132-141.

Holling, C.S. (ed) (1978). *Adaptive Environmental Assessment and Management*. John Wiley & Sons, New York.

Honey, M. (1999). *Ecotourism and Sustainable Development: Who Owns Paradise?* Washington: Island Press.

Hoyt, E. (2001). Whale Watching 2001: Worldwide Tourism Numbers, Expenditures and Expanding Socioeconomic Benefits. International Fund for Animal Welfare, Yarmouth Port MA. Available online: http://www.ifaw.org/Publications/Program_Publications/Whales/asset_upload_file98_12328.pdf (Last accessed 29 October 2010).

Hoyt, E. & Hvenegaard, G.T. (2002). A Review of Whale-Watching and Whaling with Applications for the Caribbean. *Coastal Management*, 30: 381-399.

ICR (2002). Research Plan for Cetacean Studies in the Western North Pacific under Special Permit (JARPN II). International Whaling Commission Document SC/54/O2. Institute of Cetacean Research, Government of Japan. Available online: http://www.icrwhale.org/eng/AbstractSC5402.pdf (Last accessed 7 October 2010).

IUCN (2008). The IUCN Red List of Threatened Species (*Balaenoptera acutorostrata*). Available online: http://www.iucnredlist.org/apps/redlist/details/2474/0 (Last accessed 28 October 2010).

IWC (2000). *Report of the Sub-Committee on Whalewatching*, Annex M: 52nd Meeting of the International Whaling Commission, Adelaide, June-July 2000.

IWC (2004). *Report of the Workshop on the Science for Sustainable Whalewatching*. Breakwater Lodge, Cape Town South Africa, 6-9 March 2004. International Whaling Commission. Avaliable online: http://www.iwcoffice.org/conservation/whalewatching.htm (Last accessed 29 October 2010).

Johnson, B.L. (1999). The role of adaptive management as an operational approach for resource management agencies. *Conservation Ecology* 3(2): 8

Kajikawa, Y. (2008). Research core and framework of sustainability science. *Sustainability Science*, 3: 215–239.

Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., Facheux, S., Gallopin, G.C., Gruebler, A., Huntley, B., Jager, J., Jodha, N.S., Kasperson, R.E., Mabogunje, A., Matson, P., Mooney, H., Moore III, B., O'Riordan, T. &, Svedin, U., (2001). Sustainability Science. *Science* 27 (292), 641–642.

Kauffman, J. (2009). Advancing sustainability science: report on the International Conference on Sustainability Science (ICSS) 2009. *Sustainability Science*, 4: 233–242.

Kiszka, J., MacLeod, K., Van Canneyt, O., Walker, D. & Ridoux, V. (2007). Distribution, encounter rates, and habitat characteristics of toothed cetaceand in the Bay of Biscay and adjacent waters from platform-of-opportunity data. *ICES Journal of Marine Science*, 64: 1033-1043.

Komiya, M. (2002). *Interpretation for Japanese Ecotourists: a case study of swim-with minke whale tourism in the GBR*. M. Tourism Thesis, James Cook University.

Koski, K.L. & Osborne, R.W. (2005). The Evolution of Adaptive Management Practices for Vessel-based Wildlife Viewing in the Boundary Waters of British Colombia and Washington State. From Voluntary Guidelines to Regulations? *Proceedings of the 2005 Puget Sound Georgia Basin Research Conference*, 29-31 March 2005, Seattle, Washington. Available online: http://www.engr.washington.edu/epp/psgb/2005psgb/ (Last accessed 29 October 2010).

Laist, D.W., Knowlton, A.R., Mead, J.G., Collett A.S. & Podesta, M. (2001). Collisions between ships and whales. *Marine Mammal Science*, 17: 35-75.

Lawrence, T.B., Phillips, N. & Hardy, C. (1999). Watching Whale Watching: Exploring the Discursive Foundations of Collaborative Relationships. *The Journal of Applied Behavioural Science*, 35 (4): 479-502.

Lawrence, T.B., Wickins, D. & Phillips, N. (1997). Managing Legitimacy in Ecotourism. *Tourism Management*, 18 (5): 307-316.

Leaper, R., Fairbairns, R., Gordon, J., Hiby, A., Lovell, P. & Papastavrou, V. (1997). Analysis of Data Collected from a Whalewatching Operation to Assess Relative Abundance and Distribution of the Minke Whale (*Balaenoptera acutorostrata*) Around the Isle of Mull, Scotland. *Rep Int. Whal. Commn*. 47: SC/48/NA16.

Lee, K.N. (1999). Appraising adaptive management. *Conservation Ecology* 3(2): 3 (Available online: http://www.consecol.org/vol3/iss2/art3/; Last accessed 17 October 2007).

Lee, S. & Jamal, T. (2008). Environmental Justice and Environmental Equity in Tourism: Missing Links to Sustainability. *Journal of Ecotourism*, 7(1): 44-67.

Linstone, H.A. & Turoff, M. (1975). *The Delphi Method: Techniques and Applications*. Reading, MA: Addison-Wesley Publishing Company.

Linstone, H.A. & Turoff, M. (Eds) (2002). *The Delphi Method: Techniques and Applications*. Reading, MA: Addison-Wesley Publishing Company. Online version: http://www.is.njit.edu/pubs/delphibook/ (Last accessed 4 November 2010).

Luria, S.M. & Kinney J.S. (1970). Underwater vision. *Science*, 167: 1454.

Lusseau, D. (2004). The Hidden Cost of Tourism: Detecting Long-term Effects of Tourism Using Behavioural Information. *Ecology and Society*, 9 (1): 2. Available online: http://www.ecologyandsociety.org/vol9/iss1/art2 (Last accessed 29 October 2010).

Lusseau, D, & Bejder, L. (2007). The Long-term Consequences of Short-term Responses to Disturbance Experiences from Whalewatching Impact Assessment. *International Journal of Comparative Psychology*, 20(2): 228-236.

Macleod, K., Fairbairns, R., Gill, A., Fairbairns, B., Gordon, J., Blair-Myers, C. & Parsons, E.C.M. (2004). Seasonal distribution of minke whales *Balaenoptera acutorostrata* in relation to physiography and prey off the Isle of Mull, Scotland. *Mar Ecol Prog Ser*, 277: 263-274.

Mangott, A.H. (2004). *The Management of Day Boat Operations in the Dwarf Minke Whale Swim-with Industry in the Great Barrier Reef*. Master of Tourism thesis, James Cook University, Townsville.

Mangott, A. (2005). *The Management of Day Boat Operations in the Dwarf Minke Whale Swim-with Industry in the Great Barrier Reef*. Summary Report to the Great Barrier Reef Marine Park Authority, May 2005.

Mangott, A.H. (2010). *Behaviour of dwarf minke whales (*Balaenoptera acutorostrata *subsp.) associated with a swim-with industry in the northern Great Barrier Reef*. PhD thesis, James Cook University, Townsville.

Manidis Roberts Consultants (1997). *Developing a Tourism Optimisation Management Model: a model to monitor and manage tourism on Kangaroo Island, South Australia: Final Report*. Manidis Roberts Consultants, Surrey Hills, UK. 75pp.

Mann, J. (1999). Behavioural sampling methods for cetaceans: a review and critique. *Marine Mammal Science*, 15 (1): 102-122.

Mann, J. (2000). Unraveling the dynamics of social life - long term studies and observational methods. In J. Mann, R. C. Connor, P. Tyack & H. Whitehead (Eds.), *Cetacean societies - field studies of dolphins and whales* (pp. 45-64). Chicago: University of Chicago Press.

Mapstone, B.D. (1995). Scalable decision rules for environmental impact studies: effect size, Type I and Type II errors. *Ecological Applications*, 5 (2): 401-410.

Markwell, K. (2001). An intimate rendezvous with nature? Mediating the tourist-nature experience at three tourist sites in Borneo. *Tourist Studies*, 1 (1): 39-57.

Maslow, A. (1968). *Towards a psychology of being*. Van Nostrand Reinhold, New York.

Mason, P. (2005). Visitor Management in Protected Areas: From 'Hard' to 'Soft' Approaches? *Current Issues in Tourism*, 8 (2 & 3): 181-194.

McTaggart, R. (1991). Principles for Participatory Action Research. *Adult Education Quarterly*, 41: 168-187.

Meadows, D. (1998). *Indicators and Information Systems for Sustainable Development.* A Report to the Balaton Group. The Sustainability Institute, Hartland Four Corners VT. Available online: http://www.nssd.net/pdf/Donella.pdf (Last accessed 4 November 2010).

Miller, D.K. (2005). *Towards sustainable wildlife tourism experiences for certified scuba divers on coral reefs*. PhD thesis, James Cook University, Townsville.

Miller, G. (2001). The development of indicators for sustainable tourism: results of a Delphi survey to tourism researchers. *Tourism Management*, 22: 351-362.

Miller, G. & Twining-Ward, L. (2005). *Monitoring for a Sustainable Tourism Transition: The Challenge of Developing and Using Indicators*. CABI Publishing, Oxfordshire, UK.

Minke Whale Project (2002). *Management of Swim-With-Dwarf Minke Whale Activities in the northern Great Barrier Reef: Workshop Issues Paper, 19th April 2001*. Unpublished Issues Paper for Workshop discussion.

Minke Whale Project (2008). *MWP Research Newsletter #10, May 2008*. Minke Whale Project, James Cook University, Townsville. Available online: http://www.minkewhaleproject.org (Last accessed 3 August 2010).

Moore, S.E. & Clarke, J.T. (2002). Potential impact of offshore human activities on gray whales (*Eschrichtius robustus*). *Journal of Cetacean Research and Management*, 4 (1): 19-25.

Moscardo, G. (1996). Mindful visitors: Heritage and tourism. *Annals of Tourism Research* 23 (2): 376-397.

Moscardo, G. (1998). Interpretation and Sustainable Tourism: Functions, Examples and Principles. *Journal of Tourism Studies*, 9 (1), 2-13.

Moscardo, G. (1999). *Making visitors mindful: Principles for creating sustainable visitor experiences through effective communication*. Sagamore Publishing Inc., Champaign, Illinois.

Moustakas, C. (1994). *Phenomenological Research Methods*. Sage Publications, Thousand Oaks, CA.

Muloin, S. (1998). Wildlife tourism: The psychological benefits of whale watching. *Pacific Tourism Review*, 2: 199-213.

Natural History New Zealand (2002). *Mystery of the Minkes*. Television documentary (National Geographic Channel).

Neves, K. (2010). Cashing in on Cetourism: a Critical Ecological Engagement with Dominant E-NGO Discourses on Whaling, Cetacean Conservation, and Whale Watching. *Antipode*: 42 (3): 719-741.

O'Connor, S., Campbell, R., Cortez, H. & Knowles, T. (2009). *Whale Watching Worldwide: tourism numbers, expenditures and expanding economic benefits*. A special report from the International Fund for Animal Welfare, Yarmouth MA, USA, prepared by Economists at Large. Available online: http://www.ifaw.org/whalewatchingworldwide (Last accessed 29 October 2010).

O'Neill, F. (2000). *Ecologically Sustainable Management of Human-Minke Whale Interactions: Visitor Experiences with Dwarf Minke Whales in the Northern Great Barrier Reef*. M. Tourism Thesis, James Cook University.

O'Riordan, T. (2001). The Precautionary Principle and Civic Science. In O'Riordan, T., Cameron, J. & Jordan, A. (eds). *Reinterpreting the Precautionary Principle*. Cameron May: London.

OECD; Organisation for Economic Cooperation and Development (1993). *OECD Core set of indicators for environmental performance reviews*. OECD Environment Directorate, Paris.

Orams, M. B. (1995). Using interpretation to manage nature-based tourism. *Journal of Sustainable Tourism*, 4(2), 81-94

Orams, M.B. (1996). A conceptual model of tourist-wildlife interaction: the case for education as a management strategy. *Australian Geographer*, 27 (1): 39-51.

Orams, M.B. (2000). Tourists getting close to whales, is it what whale-watching is all about? *Tourism Management* , 21: 561-569.

Orams, M. B. (2004). Why dolphins may get ulcers: considering the impacts of cetacean-based tourism in New Zealand. *Tourism in Marine Environments*, 1(1): 17-28.

Ostrom, E. (1990). Collective Action and the Evolution of Social Norms. *Journal of Economic Perspectives*, 14 (3): 137-158.

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences* (PNAS), 104 (39): 15181–15187.

Ostrom, E., Janssen, M.A. & Anderies, J.M. (2007). Going beyond panaceas. *Proceedings of the National Academy of Sciences* (*PNAS*), 104 (39): 15176–15178.

Palmer, J., Cooper, I. & van der Vorst, R. (1997). Mapping out fuzzy buzzwords – who sits where on sustainability and sustainable development. *Sustainable Development, Vol 5*: 87-93.

Pastene, L.A., Acevedo, J., Goto, M., Zerbini, A.N., Acuna, P. & Aguayo-Lobo, A. (2010). Population structure and possible migratory links of common minke whales, *Balaenoptera acutorostrata*, in the Southern Hemisphere. *Conservation Genetics*, 11: 1553-1558.

Patterson, M.E., Watson, A.E., Williams, D.R. & Roggenbuck, J.R. (1998). An hermeneutic approach to studying the nature of wilderness experiences. *Journal of Leisure Research*, 30 (4): 423-452.

Peake, S. Innes, P. & Dyer, P. (2009). Ecotourism and conservation: factors influencing effective conservation messages. *Journal of Sustainable Tourism*, 17 (1): 107-127.

Pearce, D. (1989). Sustainable futures: some economic issues. In Botkin, D., Caswell, M., Estes, J. & Orio, A. (eds). *Changing the Global Environment: Perspectives on Human Involvement*. Academic Press, Boston, USA.

Pearce, D.G. & Wilson, P.M. (1995). Wildlife-Viewing Tourists in New Zealand. *Journal of Travel Research*, 34 (2): 19-26.

Pearce, D.W. & Turner, R.K. (1990). *Economics of Natural Resources and the Environment*. Harvester Wheatsheaf, New York.

Pearce, P.L. (1988). *The Ulysses factor: Evaluating visitors in tourist settings*. New York: Springer-Verlag.

Pearce, P.L. (2006). The value of a benchmarking approach for assessing service quality satisfaction in environmental tourism. In B. Prideaux, G. Moscardo & B. Laws (Eds.), *Managing tourism and hospitality services: Theory and international applications* (pp. 282-299). London: CABI.

Peel, J. (2005). *The Precautionary Principle in Practice: Environmental Decision Making and Scientific Uncertainty*. The Federation Press, Sydney NSW.

Peterson, G., De Leo, G.A., Hellman, J.J., Janssen, M.A., Kinzig, A., Malcolm, J.R., O'Brien, K.L., Pope, S.E., Rothman, D.S., Shevliakova, E. & Tinch, R.R.T. (1997). Uncertainty, Climate Change, and Adaptive Management. *Conservation Ecology* 1(2): 4. Online version: http://www.consecol.org/vol1/iss2/art4/ (Last accessed 4 November 2010).

Pezzey, J. (1997). Sustainability Constraints Versus "Optimality" Versus Intertemporal Concern, and Axioms Versus Data. *Land Economics*, 73 (4): 448-466.

Pollock, K.H., Nichols, J.D., Simons, T.R., Farnsworth, G.L., Bailey, L.L. & Sauer, J.R. (2002). Large scale wildlife monitoring studies: statistical methods for design and analysis. *Envirometrics*, 13: 105-119.

Port Douglas & Mossman Gazette (2009). "*Undersea goes down*". Thursday 5th February 2009. News Ltd.

Ramirez, R. (1999). Stakeholder analysis and conflict management. In Buckles, D. (ed.). *Cultivating Peace: Conflict and Collaboration in Natural Resource Management*. International Development Research Centre, The World Bank, Washington.

Redclift, M. (2005). Sustainable Development (1987-2005): An Oxymoron Comes of Age. *Sustainable Development*, 13: 212-227.

Reed, M., Fraser, E.D.G., Morse S. & Dougill, A.J. (2005). Integrating Methods for Developing Sustainability Indicators to Facilitate Learning and Action. *Ecology and Society* 10(1) [online] http://www.ecologyandsociety.org/vol10/iss1/resp3/ (Last accessed 14 September 2009).

Riley, S.J., Siemer, W.F., Decker, D.J., Carpenter, L.H., Organ, J.F. & Berchielli, L.T. (2003). Adaptive Impact Management: An Integrative Approach to Wildlife Management. *Human Dimensions of Wildlife*, 8: 81-95.

Robbins, J. (2000). A review of scientific contributions from commercial whalewatching platforms. Paper SC/52/WW9 presented to the IWC Scientific Committee, June 2000. 11pp.

Robbins, J. & Mattila, D.K. (2000). The use of commercial whalewatching platforms in the study of cetaceans: benefits and limitations. Paper SC/52/WW8 presented to the IWC Scientific Committee, June 2000. 7pp.

Roggenbuck, J.W. & Driver, B.L. (1999). Benefits of Nonfacilitated Uses of Wilderness. In: McCool, S.F., Cole, D.N., Borrie, W.T., O'Loughlin, J. (Eds). *Wilderness Science in a Time of Change Conference Proceedings, Vol. 3: Wilderness as a place for scientific inquiry. 23-27 May 1999, Missoula MT*. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Roman, G.S.J., Dearden, P. & Rollins, R. (2007). Application of Zoning and "Limits of Acceptable Change" to Manage Snorkelling Tourism. *Environmental Management*, 39: 819-830.

Rose, N.A., Weinrich, M. & Finkle, M. (2003). Swim-with-whales tourism – a preliminary review of commercial operations. Paper SC/55/WW4 presented to the IWC Scientific Committee, June 2003.

Rose, N.A., Weinrich, M., Iniguez, M.A. & Finkle, M. (2005). Swim-with-whales tourism – an updated review of commercial operations. Paper SC/57/WW6 presented to the IWC Scientific Committee, June 2005.

Royal Institute of International Affairs (2002). *Chatham House Rule*. Royal Institute of International Affairs United Kingdom website: http://www.chathamhouse.org.uk/about/chathamhouserule/ (Last accessed 28 July 2010).

Ryan, C. (2002). Equity, management, power sharing and sustainability - issues of the 'new tourism'. *Tourism Management*, 23: 17-26.

Salafsky, N., Margoluis, R., Redford, K.H. & Robinson, J.G. (2002). Improving the Practice of Conservation: a Conceptual Framework and Research Agenda for Conservation Science. *Conservation Biology*, 16 (6): 1469–1479.

Scarpaci, C., Dayanathi, D. & Corkeron, P.J. (2003). Compliance with Regulations by 'Swim-with-Dolphins" Operations in Port Phillip Bay, Victoria, Australia. *Environmental Management*, 31 (3): 342-347.

Scarpaci, C., Nugegoda, D. & Corkeron, P.J. (2004). No detectable improvement in compliance to regulations by "swim-with-dolphin" operators in Port Phillip Bay, Victoria, Australia. *Tourism in Marine Environments*, 1 (1): 41–48.

Scarpaci, C., Nugegoda, D. & Corkeron, P.J. (2005). Tourists swimming with Australian fur seals (*Arctocephalus pusillus*) in Port Phillip Bay, Victoria, Australia: Are tourists at risk? *Tourism in Marine Environments*, 1: 89-95.

Schänzel, H.A. & McIntosh, A.J. (2000). An Insight into the Personal and Emotive Context of Wildlife Viewing at the Penguin Place, Otago Peninsula, New Zealand. *Journal of Sustainable Tourism*, 8(1): 36-52.

Scheer, M., Hofmann, B. & Behr, I.P. (2004). Ethogram of selected behaviours initiated by free-ranging short-finned pilot whales (*Globicephala macrorhynchus*) and directed to human swimmers during open water encounters. *Anthrozoos*, 17: 244-258.

Scheidat, M., Castro, C., Gonzalez, J., & Williams, R. (2004). Behavioural responses of humpback whales (*Megaptera novaeangliae*) to whalewatching boats near Isla de la Plata, Machalilla National Park, Ecuador. *Journal of Cetacean Research and Mangement*, 6: 63-68.

Schusler, T.M., Decker, D.J. & Pfeffer, M.J. (2003). Social Learning for Collaborative Natural Resource Management. *Society and Natural Resources*, 15: 309–326.

Senate Standing Committee on Environment, Communications and the Arts (2008). Answers to questions on notice; Environment, Water, Heritage and the Arts portfolio, Supplementary Budget Estimates, October 2008. Available online: http://www.aph.gov.au/senate/Committee/eca_ctte/estimates/supp_0809/ewha/gbrmpa.pdf (Last accessed 9 November 2010).

Shackley, M. (1996). *Wildlife Tourism*. International Thomson Business Press: London.

Shafer, C.S. & Inglis, G.J. (2000). Influence of Social, Biophysical, and Managerial Conditions on Tourism Experiences Within the Great Barrier Reef World Heritage Area. *Environmental Management*, 26 (1): 73-87.

Sirakaya, E. (1997). Attitudinal compliance with ecotourism guidelines. *Annals of Tourism Research*, 24 (4): 919-951.

Sirakaya, E., Jamal, T.B. & Choi, H.S. (2001). Developing Indicators for Destination Sustainability. In: Weaver, D.B. (ed.) *The Encyclopaedia of Ecotourism*. CAB International, Wallingford, UK, pp. 411-432.

Sirakaya, E. & Uysal, M. (1997). Can Sanctions and Rewards Explain Conformance with Ecotourism Guidelines? *Journal of Sustainable Tourism*, 5 (4): 322-332.

Slovic, P. (2000). *The Perception of Risk*. Earthscan Publications: London.

Smith, C.L., Gilden, J., Steel, B.S. & Mrakovcich, K. (1998). Sailing the Shoals of Adaptive Management: The Case of Salmon in the Pacific Northwest. *Environmental Management*, 22 (5): 671–681.

Smith, L. (2000). *Evaluating Interpretation for Managing Dwarf Minke Whale – Human Interactions in the Great Barrier Reef*. M. Tourism Thesis, James Cook University.

Sobtzick, S. (2011). *Dwarf minke whales in the northern Great Barrier Reef and implications for the sustainable management of the swim-with whales industry*. PhD thesis, James Cook University, Townsville.

Spangenberg, J.H. (2004). Reconciling sustainability and growth: criteria, indicators, policies. *Sustainable Development*, 12: 74–86.

Stankey, G.H., Cole, D.N., Lucas, R.C., Petersen, M.E. & Frissell, S.S. (1985). *The limits of acceptable change (LAC) system for wilderness planning*. Gen. Tech. Rep. INT-176. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Sterner, T. (2003). *Policy Instruments for Environmental and Natural Resource Management*. RFF Press, Washington DC.

Stoeckl, N., Birtles, A., Farr, M., Mangott, A., Curnock, M. & Valentine, P. (2010a). Live-aboard dive boats in the Great Barrier Reef: their regional economic impact and the relative values of their target marine species. *Tourism Economics*, 16 (4): 995-1018.

Stoeckl, N. Birtles, A., Valentine, P., Farr, M., Curnock, M., Mangott A. & Sobtzick, S. (2010b). *Understanding the social and economic values of key marine species in the Great Barrier Reef*. Final Report to the Reef and Rainforest Research Centre, 14th July 2010. 75pp.

Stoeckl, N., Smith, A., Newsome, D. & Lee, D. (2005). Regional Economic Dependence on Iconic Wildlife Tourism: Case studies of Monkey Mia and Hervey Bay. *The Journal of Tourism Studies*, 16 (1): 69-81.

Strange T. & Bayley, A. (2008). *Sustainable development: linking economy, society, environment*. London: OECD Publishing.

Strauss, A. & Corbin, J. (1998). *Basics of qualitative research: Grounded theory, procedures and techniques*. Sage Publications, Newbury Park, CA.

Swart, R.J., Raskin, P. & Robinson, J. (2004). The problem of the future: sustainability science and scenario analysis. *Global Environmental Change*, 14: 137–146.

Tourism Queensland (2009). Deal Done to bring 300,000 tourists back to Cairns. Media release, 26th November 2009. Available online: http://www.tq.com.au/news-room/corporate-media/media-releases/media-releases_home.cfm (Accessed 26 November 2009).

Townsend, C. (2003). Marine Ecotourism through Education: A Case Study of Divers in the British Virgin Islands. In B. Garrod & J. Wilson (Eds.), *Marine Ecotourism: Issues and Experiences*. Clevedon: Channel View Publications.

Tremblay, P. (2002). Tourism Wildlife Icons: Attractions of Marketing Symbols? *Journal of Hospitality and Tourism Management*, 9 (2): 164-180.

Tribe, J. (2001). Research Paradigms and the Tourism Curriculum. *Journal of Travel Research*, 39: 442-448.

UNCED (1992a). *Agenda 21*. United Nations Conference on Environment and Development, Rio de Janerio, Brazil, 3-14 June 1992. Available online: http://www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf (Last accessed 29 October 2010).

UNCED (1992b). *Rio Declaration on Environment and Development*, Annex 1, Report of the United Nations Conference on Environment and Development, Rio de Janerio, Brazil, 3-14 June 1992. UN Doc A/CONF.151/26. Available online: http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm (Last accessed 29 October 2010).

UNEP (2002). *Sustainability Reporting Guidelines 2002*. Global Reporting Initiative. Available online: http://www.unep.fr/scp/gri/pdf/gri_2002_guidelines.pdf (Last accessed 19 October 2010).

UNEP (2006). *Sustainability Reporting Guidelines 2006*. Global Reporting Initiative. Available online: http://www.globalreporting.org/ReportingFramework/ReportingFrameworkDownloads/ (Last accessed 19 October 2010).

Valentin, A. & Spangenberg, J.H. (2000). A guide to community sustainability indicators. *Environmental Impact Assessment Review*, 20: 381–392.

Valentine, P.S., Birtles, R.A., Curnock, M., Arnold, P.W. & Dunstan, A. (2004). Getting closer to whales - passenger expectations and experiences, and the management of swim with dwarf minke whale interactions in the Great Barrier Reef. *Tourism Management* 25: 647–655.

Van den Bergh, J.C.J.M. (1996). *Ecological Economics and Sustainable Development: Theory, Methods and Applications*. Edward Elgar Publishing Ltd, Cheltenham, UK

Vander Stoep, G.A. & Gramann, J.H. (1987). The Effect of Verbal Appeals and Incentives on Depreciative Behaviour Among Youthful Park Visitors. *Journal of Leisure Research*, 19 (2): 69-83.

Veron, J.E.N. (2008). *A Reef in Time: The Great Barrier Reef from Beginning to End*. Cambridge, MA: Harvard University Press.

Walsh, R.G., Loomis, J.B. & Gillman, R.A. (1984). Valuing Option, Existence, and Bequest Demands for Wilderness. *Land Economics*, 60 (1): 14-29.

Walters, C.J. (1986). *Adaptive Management of Renewable Resources*. Macmillan Publishing Company, New York.

Walters, C.J. (1997). Challenges in adaptive management of riparian and coastal ecosystems. *Conservation Ecology*, 1(2):1 Online version: http://www.consecol.org/vol1/iss2/art1/ (Last accessed 4 November 2010).

Walters, C.J. & Hilborn, R. (1978). Ecological Optimisation and Adaptive Management. *Ann Rev. Ecol. Sys*. 9: 157-188.

Walters, C.J. & Holling, C.S. (1990). Large-scale management experiments and learning by doing. *Ecology*, 71 (6): 2060-2068.

Watkins, W. A. (1986). Whale reactions to human activities in Cape Cod waters. *Marine Mammal Science*, 2: 251-262.

WCED (1987). *Report of the World Commission on Environment and Development "Our Common Future"*. Report to the United Nations General Assembly A/42/427, 4th August, 1987.

WDCS (2006). *WDCS Policy On Swimming With Dolphins*. Whale and Dolphin Conservation Society International website: http://www.wdcs.org/connect/whale_watch/story_details.php?select=60 (Last accessed 28 October 2010).

Weaver, D.B. & Lawton, L. (1999). *Sustainable tourism: a critical analysis*. CRC for Sustainable Tourism: Gold Coast, QLD.

Whitt, A.D. & Read, A.J. (2006). Assessing compliance to guidelines by dolphin watching operators in Clearwater, Florida, USA. *Tourism in Marine Environments*, 3 (2): 117-130.

Wilson, C. & Tisdell, C. (2001). Sea turtles as a non-consumptive tourism resource especially in Australia. *Tourism Management*, 22: 279-288.

WTO (2004). *Indicators of Sustainable Development for Tourism Destinations: A Guidebook*. World Tourism Organisation, Madrid.

Young, O., Berkhout, F., Gallopin, G., Janssen, M., Ostrom, E. & van der Leeuw, S. (2006). The Globalization of Socio-Ecological Systems: An Agenda for Scientific Research. *Global Environmental Change*. 16 (3): 304–316.

Appendix 1: Quadruple-Bottom-Line sustainability objectives and potential sustainability indicators for the GBR SWW activity.

1. Ecological Sustainability Objectives

1.1 The GBR dwarf minke whale population size and structure are not impacted by human influences.

Sub-objectives:

a. The interacting GBR dwarf minke whale population size and structure are not changed by the swimming-with-whales activity.
b. Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat.

1.2 The GBR dwarf minke whale population is not displaced from its key habitats (e.g. feeding, breeding grounds, migratory paths) as a result of human influences.

Sub-objective:

a. Dwarf minke whales are not displaced from the areas where they are commonly seen in the GBR as a result of interactions with vessels and swimmers.

1.3 Dwarf minke whales are not physically harmed as a result of their interactions with vessels and swimmers.

1.4 Dwarf minke whales initiate and voluntarily maintain all their interactions with vessels and swimmers.

1.5 Dwarf minke whales are not impeded from following their life-sustaining behaviour patterns (e.g. feeding, resting, nursing, socialising and reproducing) as a result of human influences.

Sub-objective:

a. The energy and behavioural budgets of dwarf minke whales are not significantly altered as a result of the swimming-with-whales activity.

1.6 Dwarf minke whales do not show signs of disturbance as a result of repeated interactions with vessels and swimmers.

1.7 Dwarf minke whales are not habituated as a result of the swimming-with-whales activity.

1.8 The habitat of the GBR dwarf minke whale population is conserved in perpetuity.

Sub-objective:

a. Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way.

Table 1: Ecological Sustainability Objectives, relevance, key issues, questions and potential Sustainability Indicators

Objective	**Relevance and key issues**	**Key questions and knowledge gaps**	**Potential indicators** to measure progress towards this objective.	**Tools / methods** for monitoring this indicator	**Requirements**
1.1 The GBR dwarf minke whale population size and structure are not impacted by human influences. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Measuring progress towards this objective is a challenging research task that is not currently being addressed. This objective however reflects a shared vision for the conservation of dwarf minke whales. Further research is needed to establish presently unknown but critically important population characteristics before any impacts on the whales' population size and structure will be detectable. Two sub-objectives are provided below, which focus on (a) the GBR swimming-with-whales (SWW) activity and (b) the stakeholders of this industry, to assist their progress towards the achievement of this broad objective.	The size and structure of the GBR dwarf minke whale population are unknown. *What human influences are threatening the GBR dwarf minke whale population in the GBR?* The abundance and distribution of dwarf minke whales throughout the GBR is insufficiently known. *What human influences are threatening the GBR dwarf minke whale in their broader habitat (i.e. when not in the GBR)?* The broader habitat (i.e. migration range and distribution) of the GBR dwarf minke whale population when outside the GBR is unknown.	i. Research is initiated to determine the characteristics of the GBR dwarf minke whale population.	Methods for addressing these knowledge gaps and determining the characteristics of the GBR dwarf minke whale population include (but are not limited to): • Aerial surveys. • Dedicated vessel-based surveys. • Photo-ID studies. • Genetic studies. • Size estimation (telemetric) studies. • Radio and satellite tracking. • An expanded whale sightings network (both within the GBRMP and elsewhere along the east coast of Australia).	Support from all key stakeholder groups (Commonwealth Government, the GBRMPA, relevant wildlife conservation NGOs and the SWW tourism industry) will be required to initiate such research. Funding and in-kind support will be required for dedicated scientific studies. Broader community participation in an expanded whale sightings network will require support and/or funding from the GBRMPA, State and Commonwealth Governments.

Sub-objective: **1.1 (a) The interacting GBR dwarf minke whale population size and structure are not changed by the swimming-with-whales activity.** <u>Status:</u> *This sub-objective was approved by participants at the 18/4/08 stakeholder workshop.*	Changes in size and structure of the *interacting* population are detectable by monitoring for trends in indicators such as: (i) the number of interacting whales in the GBR, (ii) gender ratios of interacting whales and (iii) age/size class ratios of interacting whales. However, determining the cause of any observed trends will be very difficult. SWW operators can contribute to ongoing monitoring of encounter and interaction rates through their collection of whale sightings and effort data. Further sustainability indicators to be developed and evaluated via dedicated population biology and behavioural studies (e.g. Sobtzick, *in review*; Mangott, 2010).	The size and structure of the interacting dwarf minke whale population remain poorly understood, however recent research by Sobtzick (*in review*) provides a preliminary estimate of the interacting population size.	i. Numbers of interacting whales recorded each season from standardised observations on dedicated research platforms do not decrease. ii. The proportion of re-sighted animals (both within and between seasons) does not change significantly over time.	Long-term photo-identification studies.	The MWP research team have conducted standardised field observations including development of a photo-ID catalogue since 1996. Sufficient funding and in-kind support will be required to ensure standardised monitoring continues into the long-term.
			iii. The demography of interacting whales (i.e. gender ratio, age/size class ratios) does not change significantly over time.	Gender recognition combined with Photo-ID study. Size estimation (telemetric) studies. Genetic studies.	Funding and in-kind support will be required for dedicated scientific studies.
Sub-objective: **1.1 (b) Stakeholders of the GBR swimming-with-dwarf minke whales tourism industry promote, and achieve support for, the conservation of dwarf minke whales and their habitat.** <u>Status:</u> *This sub-objective was approved by participants at the 18/4/08 stakeholder workshop.*	This objective recognises that the GBRMP is important habitat for dwarf minke whales and that stakeholders must promote and achieve support for the conservation of the GBR and the broader marine environment.	Marine species and the marine environment are under pressure from a range of human-related threats (e.g. effects of climate change, pollution and marine debris, fishing and fisheries). The extent to which dwarf minke whales (among most other marine species) are being affected by these threats is unknown.	i. SWW-endorsed operators use high quality interpretation to promote the conservation values of dwarf minke whales and the GBRMP to their clients.	Passenger briefings on vessels. Interpretive talks/slideshows. Multimedia interpretive tools.	Crew should be aware of dmw and GBR conservation issues and values to ensure appropriate and factual messages about dmw are promoted to SWW participants.
			ii. Stakeholders of the GBR SWW industry lobby government for the conservation of dwarf minke whales and their broader habitat (within and outside the GBRMP).	Letters to politicians. Public awareness campaigns.	Stakeholders should plan and coordinate lobbying efforts to ensure effective lobbying on key issues.

1.2 The GBR dwarf minke whale population is not displaced from its key habitats (e.g. feeding, breeding grounds, migratory paths) as a result of human influences. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Measuring progress towards this objective is a challenging research task that is not currently being addressed. This objective however reflects a shared vision for the conservation of dwarf minke whales. Research is needed to establish the extent of habitat for the GBR population of dwarf minke whales. A sub-objective is provided below which focuses on the GBR SWW activity.	The key habitat areas (i.e. feeding and breeding grounds, migration paths) for the GBR dwarf minke whale population are unknown.	i. Research is initiated to address these knowledge gaps.	Tools and methods as outlined under 1.1 (i).	Requirements as outlined under 1.1(i).
Sub-objective: **1.2 (a) Dwarf minke whales are not displaced from the areas where they are commonly seen in the GBR as a result of interactions with vessels and swimmers.** *Status:* *This sub-objective was approved by participants at the 18/4/08 stakeholder workshop.*	Displacement of interacting dwarf minke whales from the areas they commonly use in the GBR (e.g. Lighthouse Bommie) is detectable by monitoring interaction rates at sites where dwarf minke whales are regularly encountered. However, determining the cause of any observed changes is very difficult.	The purpose and significance of dwarf minke whales' aggregation in the GBR each winter has not yet been established.	i. Encounter rates (for the SWW tourism industry) at Reef sites do not change significantly over time. ii. The proportion of total whale encounter time to total vessel effort at Reef sites does not change significantly over time.	Whale Sighting Sheets (WSS) provide data to calculate the total encounter duration at each site. Vessel effort data for each site is calculated from GPS and/or Vessel Movement Logs (VML)	SWW-endorsed operators are required to complete and submit a WSS for every minke whale encounter. Presently, VML are completed and submitted on a voluntary basis by SWW operators. A long-term solution is required for analysis and reporting of these monitoring data.

1.3 Dwarf minke whales are not physically harmed as a result of their interactions with vessels and swimmers. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Mangott (2010) outlines a risk assessment matrix to evaluate and assist the management of risks to whales and humans during SWW activities.	The long-term cumulative effects of the SWW activity on the whales' behaviour is unknown.	i. Incidents resulting in physical harm to whales do not occur or are extremely rare.	GBRMPA Incident Report Forms. Passenger reports in surveys (e.g. Appendix 13, Q.34: *"Did you observe anything during your trip that might have caused a negative impact on the whale(s)?"*).	The Code of Practice requires that crew of SWW-endorsed vessels report all such incidents to the GBRMPA. Copies of reports should also be forwarded to the Minke Whale Project. Incidents should be reviewed by all stakeholders and management actions considered to prevent re-occurrence.
1.4 Dwarf minke whales initiate and voluntarily maintain all their interactions with vessels and swimmers. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	It is illegal for vessels to approach closer than 100m to a whale, and swimmers must not move towards a whale when closer than 30m.	The extent of non-endorsed SWW activities occurring in the GBRMP is unknown.	i. No significant increase in the proportion of encounters for which vessels were under power at the time of first sighting.	Whale Sighting Sheets (Appendix 4, Q.15: *"Vessel status when whale(s) first sighted…"*).	As above for 1.2 (a) (i).
			ii. Incidents involving breaches of EPBC and/or GBRMP Regulations do not occur or are extremely rare.	GBRMPA Incident Report Forms.	As above for 1.3 (i).
1.5 Dwarf minke whales are not impeded from following their life-sustaining behaviour patterns (e.g. feeding, resting, nursing, socialising and reproducing) as a result of human influences. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Research is needed to establish the extent of habitat for the GBR population of dwarf minke whales. A sub-objective is provided below which focuses on the GBR SWW activity.	Research questions as above for 1.1, 1.2 and 1.2(a).	i. Research is initiated to address these knowledge gaps	Tools and methods as outlined under 1.1 (i).	Requirements as outlined under 1.1(i).

Sub-objective: **1.5 (a) The energy and behavioural budgets of dwarf minke whales are not significantly altered as a result of the swimming-with-whales activity.** <u>Status:</u> *This sub-objective was approved by participants at the 30/5/08 stakeholder workshop.*	It is possible to monitor for short-term behavioural changes, however we do not yet know the energy and behavioural budgets for dwarf minke whales and more behavioural research is required to establish these. Determining the long-term consequences of any short-term behavioural changes poses further challenges for future research into dwarf minke whale behaviour. Further sustainability indicators to be developed and evaluated via behavioural studies.	Research questions as above for 1.2 and 1.2(a). In addition: *How long do dwarf minke whales stay in the GBR each year?* *What is the behavioural budget for dwarf minke whales when in the GBR?* *What is the energy budget for dwarf minke whales when in the GBR?*	i. Research is initiated to address these knowledge gaps.	Tools and methods as outlined under 1.1 (i).	Requirements as outlined under 1.1(i).
1.6 Dwarf minke whales do not show signs of disturbance as a result of repeated interactions with vessels and swimmers. <u>Status:</u> *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	It is difficult to determine whether whales are disturbed by the presence of vessels or swimmers. A list of behaviours is provided in the Code of Practice which may indicate possible disturbance. Further sustainability indicators to be developed and evaluated via dedicated behavioural studies. The extent to which individual whales are involved in repeated interactions can be determined through photo-ID studies (e.g. Sobtzick, *in review*).	Research questions as above for 1.5(a) Further research into dwarf minke whale behaviour is required (including acoustic studies) to establish behavioural signs of disturbance.	i. Dwarf minke whales do not display 'potential disturbance behaviours' with increasing frequency over repeated interactions.	Dedicated field observers/researchers. Behavioural observations linked to identified whales (photo-ID study). Passenger reports of disturbance in surveys (e.g. Appendix 13, Q.34: *as above*)	As above for 1.2 (i).
			ii. Research is initiated to address these knowledge gaps.	Tools and methods as outlined under 1.1 (i).	Requirements as outlined under 1.1(i).
1.7 Dwarf minke whales are not habituated as a result of the swimming-with-whales activity. <u>Status:</u> *This objective was approved by participants at the 30/5/08 stakeholder workshop.*	There are a range of potential risks to the whales that may be increased if they become habituated to interactions with humans (e.g. entanglement, vessel strike, hunting). Further sustainability indicators to be developed and evaluated via dedicated behavioural studies.	Research questions as above for 1.5(a) and 1.6.	i. Research is initiated to address these knowledge gaps.	Tools and methods as outlined under 1.1 (i).	Requirements as outlined under 1.1(i).

1.8 The habitat of the GBR dwarf minke whale population is conserved in perpetuity. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Measuring progress towards this objective is a challenging research task that is very broad in scope. This objective reflects a shared vision for the conservation of the GBR and the marine environment. A sub-objective is provided below which focuses on the GBR SWW activity.	*What is the spatial extent of the GBR dwarf minke whale population's habitat, within and outside the GBRMP?* *Is the habitat of dwarf minke whales (both inside and outside the GBR) being degraded?*	*NB. A wide range of indicators are required for monitoring the state of the GBR and the broader marine environment.*	Reef-wide surveys are currently conducted by the Australian Institute of Marine Science (AIMS) and ReefCheck Australia.	The GBRMPA is responsible for coordinating and supporting government and non-government organisations involved in monitoring the health of the GBRMP. The conservation of the GBR is a community-wide responsibility.
Sub-objective: **1.8 (a) Swimming-with-whales endorsed tourism operators in the GBR operate in an ecologically sustainable way.** *Status:* *This sub-objective was approved by participants at the 18/4/08 stakeholder workshop.*	The evaluation of ecological sustainability requires full-cost accounting of the ecological footprint (EF) for the business. EF calculations account for the consumption of energy, foodstuffs, raw materials and water, and the production of wastes (including carbon dioxide from the burning of fossil fuels), transport-related impacts and the use of productive land associated with buildings, roads and other infrastructure. The EF of an organization or destination represents the demands it places upon the Earth's natural resources, and it is expressed in terms of an equivalent land/sea area, in global hectares (gha). It is important to recognize that a large proportion of the net EF associated with tourism in the GBRMP will be associated with long-haul air travel by international tourists (i.e. primarily carbon dioxide and other emissions from aircraft). SWW-endorsed operators can significantly reduce the net EF of their business in the short-	*What is the ecological footprint of the SWW tourism industry?* *What are the impacts on the GBR associated with the SWW operators and are these sustainable?*	i. SWW-endorsed operators support research and monitoring to evaluate impacts of their activities on the marine environment and implement procedures to reduce such impacts to an ecologically sustainable level.	Reef site monitoring. Water quality monitoring. Crew/passenger reporting of incidents.	SWW operators will require support and assistance from the GBRMPA and researchers to evaluate their impacts on the marine environment.
			ii. SWW-endorsed operators conduct an audit of their net EF and take steps to reduce, and where necessary, contribute to a guaranteed and accredited offsetting scheme, to achieve an appropriate EF benchmark.	EF audits by the operator. Independent EF audits. Nationally/globally recognised EF benchmarking and accreditation scheme.	SWW operators will require support and assistance from the GBRMPA and researchers to evaluate their EF and determine methods for achieving an appropriate EF benchmark.
			iii. An increasing proportion of SWW-participants contribute to a guaranteed and accredited offsetting scheme to offset the carbon emissions and EF of their journey away from home.	Passenger surveys (e.g. Appendix 13, Q.37: "*Have you taken any steps to reduce or offset the ecological footprint or carbon emissions of your trip to the GBR?*").	As above.

	term by encouraging their clients to contribute to a guaranteed and accredited (e.g. by the Australian Greenhouse Office) offsetting scheme.		iv. SWW-endorsed vessels adhere to Best Practice environmental standards of operation.	Operators are accredited by the Nature and Ecotourism Accreditation Program and are subject to periodic audits.	Best Practice environmental standards of operation for GBR tourism operators are outlined in the GBRMPA's handbook for tourism operators in the GBR ("Onboard") available online.
			v. Divers and snorkellers adhere to Best Practice diving/snorkelling standards.	Passenger reporting of incidents. Crew reporting of incidents.	Best Practice environmental standards for diving and snorkelling are outlined in the GBRMPA's handbook for tourism operators in the GBR ("Onboard") available online.

2. Social Sustainability Objectives

2.1 Swimming-with-whales endorsed tourism operators in the GBR:

a. provide a consistently high-quality experience for all participants.
b. use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR.
c. implement risk management procedures to minimise the risk of harm to participants.
d. foster a greater awareness of sustainability and the conservation of whales and other marine life among their crew and passengers.
e. contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research.
f. achieve and maintain the support of the local community, such that it values the whales and the industry, for its sustainable use of the Reef and interactions with the whales.

2.2 Swimming-with-whales participants:

a. are familiar with the Code of Practice before they encounter dwarf minke whales.
b. are prepared for their encounter, with realistic expectations of minke interactions.
c. comply with the Code of Practice.
d. contribute to research and monitoring of dwarf minke whales.
e. have an outstanding minke experience.

2.3 Researchers studying dwarf minke whales in the GBR:

a. communicate relevant findings to all stakeholders in an ongoing collaborative learning process.

Table 2: Social Sustainability Objectives, relevance, key issues, questions and potential Sustainability Indicators

Objective	**Relevance and key issues**	**Key questions and knowledge gaps**	**Potential indicators** to measure progress towards this objective.	**Tools / methods** for monitoring this indicator	**Requirements**
2.1 (a) Swimming-with-whales endorsed tourism operators in the GBR provide a consistently high-quality experience for all participants. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	The following elements were recognised by stakeholders as contributing to a "high quality experience": • Participants' expectations being met or exceeded and a high rating of satisfaction with the experience. • Use of high quality interpretation (defined under 2.1b below). • Good management of whale interactions by crew. • Good briefings and passenger preparedness for swimming-with-whales. • Participants understanding & following the Code of Practice. • Participants' personal/intrinsic values of the whales being upheld.	*Are passengers' expectations of the swim-with-dwarf minke whales experience realistic?* *What crew training is required to ensure SWW participants are adequately briefed and prepared for the experience?*	i. Passenger mean rating of satisfaction with the SWW experience meets or exceeds a minimum standard (agreed by stakeholders).	Passenger questionnaires (e.g. Appendix 13, Q.23: "*How would you rate your satisfaction with your minke whale experience on this trip?*").	Crew on SWW-endorsed vessels should be appropriately trained to manage interactions with the whales and interpret the experience for participants. Development of a crew training course, meeting the requirements and approval of all key stakeholders, is recommended.
			ii. Passengers' expectations of the SWW experience are met or exceeded (e.g. with regard to likelihood of encounters, no. of whales, closeness, behaviours seen, length of encounter).	Passenger questionnaires (e.g. Appendix 13, Q.24: "*Overall, how well did your minke whale experience meet your expectations?*").	Managers of SWW-endorsed tourism operators are responsible for advertising the minke experience in an appropriate manner, by promoting realistic expectations among potential clients. Realistic expectations should include the weather conditions, the likelihood of interactions, numbers of whales, closeness of approaches, particular whale behaviours (e.g. exuberant displays) and adherence to relevant management protocols.
			iii. No reported incidences of inappropriate advertising.	Incidences of inappropriate advertising reported by industry/managers/ researchers and/or other stakeholders.	Incidents should be reviewed by all stakeholders and management actions considered to prevent re-occurrence.

2.1 (b) Swimming-with-whales endorsed tourism operators in the GBR use high quality interpretation to promote further understanding and appreciation of dwarf minke whales, other cetaceans and marine life in the GBR. <u>Status:</u> *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	High quality interpretation is defined here as: • Factually correct and incorporates current/latest knowledge (e.g. latest research findings) • Has a clear and relevant theme/message • Accessible and understandable (e.g. language) • Interesting, engaging, stimulating and thought-provoking • May include use of multimedia • Enhances knowledge, encourages "mindfulness", influences attitudes and behaviour.	*What tools are most effective for delivering important messages to passengers?*	i. Passengers received adequate SWW briefings and other interpretive material on their trip.	Passenger questionnaires (e.g. Appendix 13, Q.27: "*What sources of information about minke whales did you receive/have access to on this trip?*").	As above for 2.1(a) i.
			ii. Appropriately trained crew and/or guides are present on SWW trips and participate in SWW briefings and delivery of other interpretation.	Certification by an appropriate training course.	As above for 2.1(a) i.
			iii. Passenger mean ratings of the quality of information provided about dwarf minke whales on their trip meets or exceeds a minimum standard (agreed by stakeholders).	Passenger questionnaires (e.g. Appendix 13, Q.26: "*Overall, how would you rate the quality of information you received about minke whales on this trip?*").	As above for 2.1(a) ii.
2.1 (c) Swimming-with-whales endorsed tourism operators in the GBR implement risk management procedures to minimise the risk of harm to participants. <u>Status:</u> *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Although there have been no reports of injury to swimming-with-dwarf minke whale participants, some dwarf minke whale behaviours have been identified (in the Code of Practice) that may pose a risk to humans and/or the whales, if they occur in close proximity to swimmers or objects in the water. Mangott (2010) outlines a risk assessment matrix to evaluate and assist the management of risks to whales and humans during SWW activities.	Further research into dwarf minke whale behaviour is required.	i. Incidents resulting in physical harm to SWW participants do not occur or are extremely rare.	GBRMPA Incident Report Forms.	The Code of Practice requires that crew of SWW-endorsed vessels report all such incidents to the GBRMPA. Copies of reports should also be forwarded to the MWP. Incidents should be reviewed by all stakeholders and management actions considered to prevent re-occurrence.

2.1 (d) Swimming-with-whales endorsed tourism operators in the GBR foster a greater awareness of sustainability and the conservation of whales and other marine life among their crew and passengers. <u>Status:</u> *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	The ecological sustainability of the Great Barrier Reef ecosystem and broader marine environment are under increasing pressure from human-related threats. SWW-endorsed operators (and the wider GBR tourism industry) have an opportunity and obligation to raise their clients' awareness of such issues to increase public support for measures to protect and conserve the marine environment.	*Can high quality interpretation, when combined with the SWW experience, influence participants' attitudes towards environmental conservation and change their behaviour?*	i. Post-experience surveys of SWW participants show an increased awareness and appreciation of whales and marine life.	Follow-up surveys of SWW participants (via email or web): *To be developed*.	Student research project opportunity (tourism/ environmental sciences).
			ii. Appropriately trained crew and/or guides are present on SWW trips and participate in SWW briefings and delivery of other interpretation.	Possible additional SWW permit condition *– to be reviewed by stakeholders.*	As above for 2.1(a) i.
2.1 (e) Swimming-with-whales endorsed tourism operators in the GBR contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research. <u>Status:</u> *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	SWW operators can support research in many ways, including: • by providing in-kind vessel berths/spaces for researchers on SWW trips. • by facilitating collection of data for research.	*To what extent can crew and passengers contribute to research and monitoring for sustainable management?* *How effectively can different interpretive tools influence the quality and quantity of data collected by crew and passengers?*	i. SWW operators submit Whale Sighting Sheets (WSS) for every encounter with dwarf minke whales.	WSS received from each operator each season.	It is a permit requirement of SWW-endorsed operators that they complete and submit a Whale Sighting Sheet for every dwarf minke whale encounter.
			ii. SWW operators provide in-kind spaces on SWW trips for researchers.	Post-season research report to stakeholders (in-kind contributions).	The number of spaces that can be provided in-kind will vary between operators.
			iii. Crew on SWW vessels facilitate collection of data for research (e.g. including passenger questionnaires, images/video for photo-ID).	Post-season research report to stakeholders (monitoring data returns).	Crew on SWW vessels need to be aware of the research aims and data instruments to ensure high quality data returns. Interpretive tools can be used to enhance crew and passengers' contribution to data collection. Additional crew training may also be required.

2.1 (f) Swimming-with-whales endorsed tourism operators in the GBR achieve and maintain the support of the local community, such that it values the whales and the industry, for its sustainable use of the Reef and interactions with the whales. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	SWW-endorsed operators (and the wider GBR tourism industry) have an opportunity to raise public awareness for issues relevant to the protection and conservation of dmw, the GBR and the broader marine environment. By conducting their activities in a sustainable manner, SWW operators provide an example to the local community and wider public of sustainable use of the Reef and whales.	*How does the community value dwarf minke whales and the GBR swim-with industry?*	i. Media articles/stories featuring SWW operators contain positive messages about the sustainable use of the Reef and/or interactions with the whales.	Published media (e.g. dive & travel magazines, newspapers), television stories, wildlife/nature documentaries.	Media articles/stories featuring SWW operators are reviewed by stakeholders.
			ii. Passengers' perceive the activities of SWW operators to be ecologically sustainable.	Passenger questionnaires (e.g. Appendix 13, Q.35: *"Do you have any concerns about the sustainability of this kind of tourism?*").	Results of passenger questionnaires are reviewed by stakeholders in annual workshops.
			iii. SWW operators are accredited by a nationally/internationally recognised body for their ecologically sustainable operation (e.g. NEAP, Green Globe).	Possible additional SWW permit condition for operators to be accredited to a minimum standard – *to be reviewed by stakeholders.*	Stakeholders should discuss whether such accreditation could become a permit requirement of SWW activities.
2.2 (a) Swimming-with-whales participants are familiar with the Code of Practice before they encounter dwarf minke whales. *Status:* *This objective was approved by participants at the 16/11/07 stakeholder workshop.*	Adherence to the Code of Practice is a permit condition of SWW-endorsed operators. The Code of Practice received a major update in 2008 to improve its ease of use by crew and passengers.	*Is the Code of Practice understood by all SWW participants?* *How can the SWW protocols best be communicated to passengers on SWW-endorsed day-boats?*	i. Passengers received adequate SWW briefings outlining relevant protocols in the Code of Practice before their first SWW encounters.	Passenger questionnaires (e.g. Appendix 13, Q.31: "*Are you familiar with the Code of Practice for dwarf minke whale interactions in the GBRWHA?*").	Results of passenger questionnaires are reviewed by stakeholders in annual workshops.

2.2 (b) Swimming-with-whales participants are prepared for their encounter, with realistic expectations of minke interactions. *Status:* *This objective was approved by participants at the 16/11/07 stakeholder workshop.*	Briefings of SWW participants prior to an encounter with whales should include the following details: • weather conditions, • the likelihood and average duration of in-water interactions (seasonally dependent), • numbers of whales, closeness of approaches, particular whale behaviours (e.g. exuberant displays) • adherence to relevant protocols in the Code of Practice, with explanations.	*What is the most effective way of preparing passengers for swimming with minke whales?*	i. Passenger survey responses indicate that SWW participants felt sufficiently prepared for their SWW encounter (minimum standard to be agreed by stakeholders).	Passenger questionnaires (e.g. Appendix 13, Q.33: "*Do you feel you were adequately prepared for your encounter(s) with minke whales?*").	Results of passenger questionnaires are reviewed by stakeholders in annual workshops.
			ii. Passengers' expectations of the SWW experience are met or exceeded (e.g. with regard to likelihood of encounters, no. of whales, closeness, behaviours seen, length of encounter).	Passenger questionnaires (e.g. Appendix 13, Q.24: as above).	As above for 2.1(a) ii.
2.2 (c) Swimming-with-whales participants comply with the Code of Practice. *Status:* *This objective was approved by participants at the 16/11/07 stakeholder workshop.*	Management of passengers in the water during an interaction is the responsibility of vessel crew.		i. No reported breaches of compliance with the Code of Practice (including responses in passenger questionnaires).	Passenger questionnaires (e.g. Appendix 13, Q. 32: "*Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew?*" + Q.25: *"Was there anything that impacted negatively on your minke whale experience?"*). Crew and/or passenger reporting of incidents via GBRMPA Incident Report Forms.	As above for 2.2(a) ii.
2.2 (d) Swimming-with-whales participants contribute to research and monitoring of dwarf	SWW participants can contribute to research and monitoring of dmw in several ways, including: • completing a passenger questionnaire. • recording behavioural observations in an Interaction Behaviour Diary		i. SWW participants provide data for research and monitoring (e.g. including passenger questionnaires, behaviour diaries, images/video for photo-ID).	Post-season research report to stakeholders (data returns).	Data returns for each season should be reviewed by stakeholders in annual workshops.

minke whales. *Status:* *This objective was approved by participants at the 16/11/07 stakeholder workshop.*	• donating copies of underwater photographs/video footage of whales to the photo-ID study • donating money to support research and monitoring of the SWW activity.		ii. SWW participants contribute financially to dwarf minke whale research and monitoring.	Post-season research report to stakeholders (passenger donations to research & monitoring fund).	SWW operators can facilitate and collect donations from passengers on board the vessel.
2.2 (e) Swimming-with-whales participants have an outstanding minke experience. *Status:* *This objective was approved by participants at the 16/11/07 stakeholder workshop.*	Elements contributing to a 'high quality' SWW experience are outline above in 2.1 (a). The former objective focuses on SWW operators providing the experience. This objective focuses on the outcomes, as experienced by the SWW participants.	*How does the GBR dwarf minke whale experience compare with other marine and terrestrial wildlife tourism interactions worldwide?*	i. Passengers' mean rating of satisfaction with the SWW experience is consistently high (meeting stakeholder-agreed minimum standard).	Passenger questionnaires (e.g. Appendix 13, Q.23: as above).	Vessel crew assistance with passenger questionnaire collection is needed to ensure adequate samples are achieved.
			ii. Passengers' expectations of the SWW experience are met or exceeded.	Passenger questionnaires (e.g. Appendix 13, Q.24: as above).	As above for 2.2 (e) i.
2.3 (a) Researchers studying dwarf minke whales in the GBR communicate relevant findings to all stakeholders in an ongoing collaborative learning process. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Over the period 2003-2008, the GBRMPA funded bi-annual workshops for industry, researchers and managers, at which members of the MWP research team presented updates on the latest findings from each season. These workshops provided a valuable forum for the communication of research findings and discussion of management issues between stakeholders. Funding will be required to ensure the continuity of such workshops.	*What are the key short, medium and long-term research priorities for dwarf minke whales on the GBR?*	i. Regular occurrence of workshops involving reporting of research results to all key stakeholders.	Research and monitoring results are reported regularly to stakeholders in workshops.	As above for 2.2 (d) i.
			ii. Research reports, publications and other outputs are made accessible to all stakeholders.	Reports and papers available online; disseminated to stakeholders. Hard copies distributed to stakeholders at workshops.	Researchers are responsible for disseminating research results in an accessible format for all stakeholders.

3. Economic Sustainability Objectives and Indicators

3. Swimming-with-dwarf minke whales tourism in the GBR is an economically sustainable industry.

Sub-objectives include:

Swimming-with-whales endorsed tourism operators in the GBR:

a. are resilient to short-term market fluctuations and adaptable to long-term market trends.
b. contribute adequately to the conservation of the resource on which they depend.
c. contribute adequately to the local community.
*d. *incorporate natural capital valuations (e.g. dive site 'health' conditions, species diversity & abundance) into their cost-benefit analyses.*
*e. *become carbon neutral by: _____*

Note: these two objectives have not been approved by stakeholders of the GBR SWW activity and are pending further discussion at stakeholder workshops.

Table 3: Economic Sustainability Objectives, relevance, key issues, questions and potential Sustainability Indicators

Objective	**Relevance and key issues**	**Key questions and knowledge gaps**	**Potential indicators** to measure progress towards this objective.	**Tools / methods** for monitoring this indicator	**Requirements**
3. Swimming-with-dwarf minke whales tourism in the GBR is an economically sustainable industry. *Status:* *This objective was approved by participants at the 12/12/08 stakeholder workshop.*	Businesses must be economically viable to ensure continuity of operation and an ongoing commitment to the maintenance and stewardship of the resource. Sub-objectives are provided below which focus on components associated with this broad objective.	*What is an economically sustainable scale for this industry (for both the size of individual operations and the size of the industry)?*	Operators will have their own financial and operational indicators to monitor the performance of their business. *Potential additional indicators to be developed.*	Marketing feedback/studies. Financial statements. Inbound and domestic tourism statistics and forecasts (e.g. from Tourism Queensland and Tourism Australia).	Operators should engage with local and regional tourism organsations (e.g. Tourism Tropical North Queensland, TQ) to facilitate coordinated marketing and reporting of tourism forecasts.

3 (a) Swimming-with-whales endorsed tourism operators in the GBR are resilient to short-term market fluctuations and adaptable to long-term market trends. *Status:* *This sub-objective was approved by participants at the 12/12/08 stakeholder workshop.*	Live-aboard dive tourism operations typically have high operating costs and depend on a relatively small market segment that can be highly price-sensitive. Many destinations worldwide are in direct competition for this market. The GBR dwarf minke whale phenomenon however is a unique drawcard. Predictable sightings of dwarf minke whales are limited to a short season (approx. 6-8 weeks per year). SWW operators are multi-species operations and depend upon a range of dive sites and marine wildlife species to attract their clients.	*Is the number of tourists travelling to the region for the primary purpose of swimming-with-dwarf minke whales changing?*	Operators will have their own financial and operational indicators to monitor the performance of their business. *Potential additional indicators to be developed.*	Marketing feedback/studies. Financial statements. Inbound and domestic tourism statistics and forecasts (e.g. from Tourism Queensland and Tourism Australia).	Operators should be financially robust to withstand slumps in demand.
3 (b) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the conservation of the resource on which they depend. *Status:* *This sub-objective was approved by participants at the 12/12/08 stakeholder workshop.*	Stakeholders must collectively agree on what constitutes an 'adequate' contribution. Such contributions can include: • Providing financial and/or in-kind support to research and monitoring of dwarf minke whales, other marine species and the marine environment. • Contributing to the Great Barrier Reef Environmental Management Charge (EMC)	*To what extent does the presence of researchers on board SWW tours benefit the passengers' experience?*	i. SWW operators contribute financially to dwarf minke whale research and other GBR research projects.	Voluntary passenger donations. Cash contributions (Independent or as co-investment towards other research funding applications).	Stakeholders should discuss and agree on any specific minimum requirements for contributions made by SWW operators to ensure adequate financial and logistical support for ongoing monitoring.
			ii. SWW operators provide in-kind vessel spaces to researchers to allow them to collect scientific research/ monitoring data.	Research reports at stakeholder workshops (e.g. researcher days at sea provided in-kind).	As above for 3 (b) i.

3 (c) Swimming-with-whales endorsed tourism operators in the GBR contribute adequately to the local community. <u>Status:</u> *This sub-objective was approved by participants at the 12/12/08 stakeholder workshop.*	Stakeholders must collectively agree on what constitutes an 'adequate' contribution. Such contributions can include: • Employing local residents. • Using local suppliers and services. • Encouraging clients (tourists) to utilise other local businesses.	*What is the economic value of dwarf minke whales to the SWW industry*? *What is the economic contribution of the SWW industry to the region?*	i. SWW operators employ local residents.	Accreditation audits (e.g. Nature & Ecotourism Accreditation Program, Green Globe).	Stakeholders should discuss and agree on any specific minimum requirements for contributions made by SWW operators to the local community.
			ii. SWW operators utilise local suppliers and services.	As above.	
			iii. SWW participants utilise other local businesses.	Passenger questionnaires (e.g. Appendix 13, Q.47: "*While in the Cairns/Port Douglas region what is the approximate amount that you have spent (or will spend) per day…?"*	
3 (d) Swimming-with-whales endorsed tourism operators in the GBR incorporate natural capital valuations (e.g. dive site 'health' conditions, species diversity & abundance) into their cost-benefit analyses. <u>Status:</u> ***Approval pending for this sub-objective. Discussed by participants at the 12/12/08 stakeholder workshop. Further workshop discussion of issues and implications is required***.	SWW operators are unlikely to have the resources to conduct their own valuations of natural capital. Such research and monitoring must be considered as a high priority for the GBRMPA. Examples of current research & monitoring programs include the MTSRF Key Species Project, ReefCheck, and GBRMPA's BleachWatch & Sightings Network. *Note. Environmental damages must not be considered to be compensated by benefits from manufactured capital (e.g. income).*	*What is the 'value' of the Reef sites and species utilised by the SWW industry?* *Is the natural capital of the SWW industry declining in value due to human impacts on the GBR?*	*Indicators to be developed*.		Further research is required to develop indicators to assist stakeholders of the SWW industry in monitoring natural capital.

3 (e) Swimming-with-whales endorsed tourism operators in the GBR become carbon neutral by _____. <u>*Status:*</u> ***Approval pending for this sub-objective. Discussed by participants at the 12/12/08 stakeholder workshop. Further workshop discussion of issues and implications is required.***	Offsetting the carbon emissions of a business should be considered a last resort after all efforts had been made to reduce emissions. Any offsets should be guaranteed by an accredited (e.g. by the Australian Greenhouse Office) offsetting scheme and should be invested locally (e.g. offsets that include carbon capture and storage in the GBR catchment may also help to improve water quality in the GBR lagoon).	*What is the carbon footprint of the SWW industry?* *To what extent are SWW participants willing to offset the carbon emissions of their travel?*	*Indicators to be developed*.		Further research is required to develop indicators to assist the SWW industry in its efforts to become carbon neutral.

4. Managerial Sustainability Objectives and Indicators

4.1 Management of the GBR swimming-with-dwarf minke whales tourism industry:

a. is widely acknowledged as World's Best Practice.
b. involves all stakeholders in a collaborative and participatory process.
c. contributes to capacity building and knowledge sharing between all stakeholders.
d. is transparent in all decision making processes.
e. is informed by and responsive to relevant findings from scientific research.
f. applies the Precautionary Principle.
g. adapts and responds to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale).
h. utilises appropriate planning processes (e.g. the Limits of Acceptable Change process) to ensure efficient and equitable use of the resource at a sustainable scale.
i. operates within an adaptive management framework.

4.2 Swimming-with-whales endorsed tourism operators in the GBR:

a) comply with all relevant management requirements.

Table 4: Managerial Sustainability Objectives, relevance, key issues, questions and potential Sustainability Indicators

Objective	**Relevance and key issues**	**Key questions and knowledge gaps**	**Potential indicators** to measure progress towards this objective.	**Tools / methods** for monitoring this indicator	**Requirements**
4.1 (a) Management of the GBR swimming-with-dwarf minke whales tourism industry is widely acknowledged as World's Best Practice. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Management of the GBR SWW activity has an opportunity and a responsibility set a world-leading example for the sustainable management of marine wildlife tourism. Whilst the GBR SWW activity has several unique characteristics, the collaborative and adaptive management approach can provide lessons benefitting the management of other Australian and international wildlife tourism.	*How is management of the GBR SWW activity perceived within Australia and internationally?*	i. Management of the GBR SWW exceeds benchmarks set by other whalewatching and marine tourism in Australia and worldwide.	Literature reviews. Media reviews. Marketing and advertising reviews. Peer-reviewed publications.	Researchers to review and report other leading examples of sustainable wildlife tourism management for benchmarking.
			ii. Positive feedback from SWW participants, researchers, managers and representatives of NGOs with experience of management issues associated with other whalewatching and marine wildlife tourism industries.	As above, also including: Passenger questionnaire feedback. (e.g. Appendix 13, Q.32: as above). Word of mouth feedback.	

4.1 (b) Management of the GBR swimming-with-dwarf minke whales tourism industry involves all stakeholders in a collaborative and participatory process. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Due to the geographical remoteness of the SWW activity and the infrequency of an enforcement presence, active industry involvement in the management of this activity is essential. Collaboration involving a wide range of key stakeholders (e.g. including researchers, managers, industry, and wildlife conservation NGOs) ensures that all values of the whales are represented and management actions have a higher probability of achieving their objectives.		i. Regular occurrence of SWW management workshops to which all key stakeholders are invited.	Minutes of stakeholder workshops.	Sufficient funding and other resources are required to organise and host regular stakeholder workshops. The GBRMPA is best-equipped to ensure the ongoing occurrence of such workshops.
			ii. All key stakeholder groups are consulted in management decisions affecting the SWW industry.	Stakeholder feedback via workshops and follow-up studies.	The GBRMPA is responsible for ensuring that all key stakeholders are consulted in management processes leading to policy changes affecting the SWW activity.
			iii. All key stakeholder groups are satisfied with all management processes and decisions affecting the SWW activity.	Stakeholder feedback via workshops and follow-up studies.	The GBRMPA is responsible for communicating outcomes of management processes and decisions to relevant stakeholder groups.
4.1 (c) Management of the GBR swimming-with-dwarf minke whales tourism industry contributes to capacity building and knowledge sharing between all stakeholders. *Status:* *This objective was approved by participants at the 30/5/08 stakeholder workshop.*	Capacity building in the context of managing the GBR SWW tourism industry will include: • Ongoing stakeholder learning about the resource. • Investment in research, education and training. • Strengthening industry resilience and ability to adapt to change. • Precautionary rather than reactive management decisions.	*How can the GBR SWW industry increase its resilience and mitigate against the effects of:* • *Global climate change?* • *Ocean acidification?* • *The Global Financial Crisis?* • *Other threats to the GBR tourism industry, dwarf minke whales and the GBR?*	i. Discussions of key management issues involving all key stakeholders occur regularly.	Stakeholder workshops.	As above for 4.1 (b) i.
			ii. Stakeholder support for and investment in research to strengthen industry resilience and adaptability to changes in the social-ecological system.	Collaborative and multi-institutional research initiatives.	Support will be needed from all stakeholders for research to address key questions regarding current and potential threats to the whales and the SWW industry.

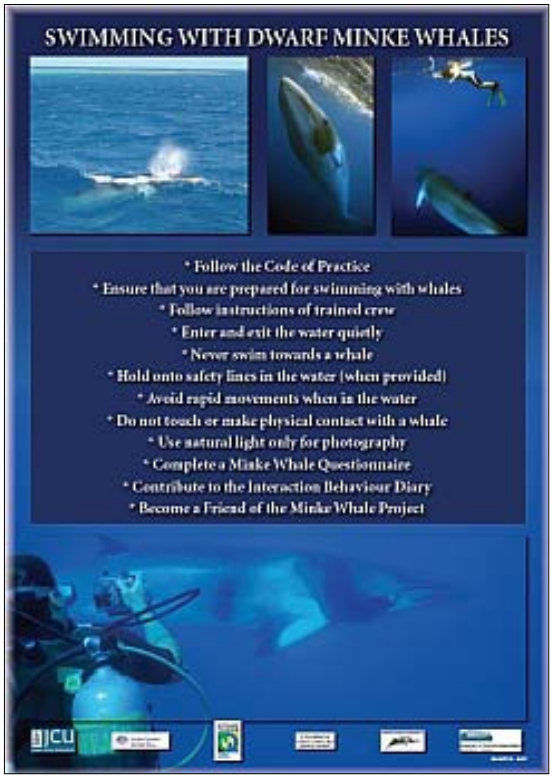
4.1 (d) Management of the GBR swimming-with-dwarf minke whales tourism industry is transparent in all decision making processes. *<u>Status:</u>* *This objective was approved by participants at the 30/5/08 stakeholder workshop.*	Commercial in-confidence may apply to certain information for some decisions (e.g. permit assessments by the GBRMPA). In such cases the process and policy framework for assessments must be clear to all stakeholders.	*Are all key stakeholders sufficiently informed about management issues affecting their resource?*	i. All key stakeholder groups are satisfied with all management processes and decisions affecting the SWW activity.	Stakeholder feedback via workshops and follow-up studies.	As above for 4.1 (b) ii.
4.1 (e) Management of the GBR swimming-with-dwarf minke whales tourism industry is informed by and responsive to relevant findings from scientific research. *<u>Status:</u>* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Management decisions must be based on the best available scientific evidence. Given the lack of knowledge of dwarf minke whale biology, ecology and behaviour, comparisons may be drawn from relevant studies of other cetaceans and marine mammals.	*What are the research priorities for sustainable management of the SWW activity?*	i. Management review and decision making processes show clear references to relevant findings from scientific research.	Literature reviews. Evidence provided in reports and policy documents.	As above for 4.1 (b) iii.

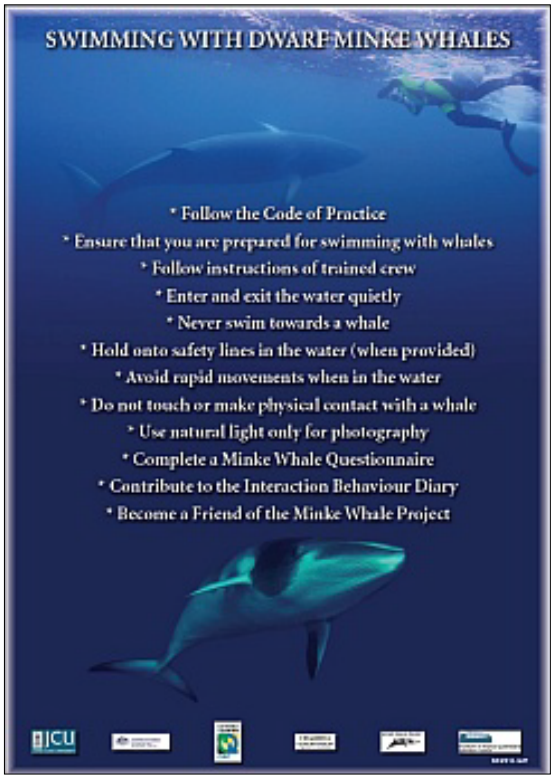
4.1 (f) Management of the GBR swimming-with-dwarf minke whales tourism industry applies the Precautionary Principle. *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	The accepted definition of the Precautionary Principle is that provided by National Environment Protection Council Act 1994: *Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:* *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and* *(ii) an assessment of the risk-weighted consequences of various options.*	*How can uncertainties be reduced or eliminated?*	i. Risk assessments are conducted in management review and decision-making processes wherever the possibility of degradation to the resource exists.	Evidence provided in reports and policy documents.	As above for 4.1 (b) iii.
			ii. An appropriate level of monitoring is implemented following the introduction of any significant changes in the management of the SWW activity.	Research tools and instruments will vary depending on monitoring requirements and available resources. Stakeholder and scientific peer-review of monitoring results.	Monitoring priorities should be based on a risk assessment of the likely outcomes associated with the management decision/policy.
4.1 (g) Management of the GBR swimming-with-dwarf minke whales tourism industry adapts and responds to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale). *Status:* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Management issues, current and potential threats and opportunities should be reviewed by stakeholders on a regular basis.	*What is the adaptive and responsive capacity of the SWW industry to potential impacts of:* • *Global climate change?* • *Ocean acidification?* • *The Global Financial Crisis?* • *Other threats to the GBR tourism industry, dwarf minke whales and the GBR?*	i. Occurrence of SWW stakeholder workshops to proactively review and plan for emerging issues, threats and opportunities affecting the SWW industry.	Stakeholder workshops.	As above for 4.1 (b) i.
			ii. Stakeholder support for and investment in research to strengthen industry resilience and adaptability to changes in the social-ecological system.	Collaborative and multi-institutional research initiatives.	As above for 4.1(c) ii.

4.1 (h) Management of the GBR swimming-with-dwarf minke whales tourism industry utilises appropriate planning processes (e.g. the Limits of Acceptable Change process) to ensure efficient and equitable use of the resource at a sustainable scale. *Status:* *This objective was approved by participants at the 12/12/08 stakeholder workshop.*	The Limits of Acceptable Change (LAC) process (Stankey et al., 1985) was developed as a toolkit for parks & recreation managers to deal with the issue of recreational carrying capacity. The LAC process requires managers and stakeholders to define minimally acceptable changes to the resource (i.e. impacts) in order to achieve a compromise between (i) protection of the resource, (ii) protection of visitor experiences and values, and (iii) meeting the goals of resource users. A limit is placed on the level of impact/change to the resource that is acceptable. Impacts and trends are monitored, and when a predetermined level of adverse change is detected, management actions are implemented to mitigate and prevent further deterioration to the resource.	*What is the ecological carrying capacity of the GBR SWW industry?* *What is the social carrying capacity of the GBR SWW industry?* *What is the economically optimal/sustainable scale of the GBR SWW industry?* *What is the optimal management scale of the SWW industry (i.e. for compliance and enforcement)?*	i. All key stakeholders are consulted in a transparent process when reviewing potential changes to the scale and distribution of the SWW activity.	Evidence provided in reports and policy documents.	The GBRMPA is responsible for adopting an appropriate process when reviewing the SWW activity and implementing limits to its scale and distribution.
			ii. Monitoring is implemented that is able to detect adverse changes in the resource.	Research tools and instruments will vary depending on monitoring requirements and available resources. Stakeholder and scientific peer-review of monitoring results.	As above for 4.1(f) ii.
			iii. Management actions are prescribed for responding to unacceptable changes.	Management responses must be agreed by all key stakeholders in a transparent process.	As above for 4.1 (b) ii.
4.1 (i) Management of the GBR swimming-with-dwarf minke whales tourism industry operates within an adaptive management framework. *Status:* *This objective was approved by participants at the 12/12/08 stakeholder workshop.*	Adaptive management treats management policies as experiments. Adaptive management requires: • Collaboration involving all key stakeholders. • Development of objectives and indicators for monitoring. • Ongoing research and monitoring to understand cause-effect relationships. • Regular stakeholder workshops to review indicators and objectives, and implement management actions. • Reversibility of management decisions (if found to produce undesirable outcomes). • Ongoing stakeholder learning about the resource. • Transparency of information, decision processes and outcomes.	What are costs associated with implementing an adaptive management model for the GBR SWW?	As above for 4.1(b) – (h).	As above for 4.1(b) – (h).	As above for 4.1(b) – (h).

4.2 (a) Swimming-with-whales endorsed tourism operators in the GBR comply with all relevant management requirements. *<u>Status:</u>* *This objective was approved by participants at the 18/4/08 stakeholder workshop.*	Demonstration of consistent high compliance with management protocols by operators sets an example to passengers and other marine tourism operations in the GBR and elsewhere.	Are crew and staff of permitted operators willing to report observed breaches of compliance to the GBRMPA?	i. Incidents involving breaches of compliance with relevant management protocols do not occur or are extremely rare.	Incident Report Form (IRF) submitted to GBRMPA by vessel crew. Reports from passengers via questionnaires (e.g. Appendix 13, Q.32: as above). Researcher observations.	The Code of Practice requires that crew of SWW-endorsed vessels report all such incidents to the GBRMPA. Copies of reports should also be forwarded to the MWP.

Appendix 2: Colour posters developed for SWW-endorsed vessels in 2006
(English and Japanese versions were printed in A3 and laminated)





Appendix 3: “Meet the Minkes” Interpretive DVD (2007)

<insert DVD copy here>

Appendix 4

MINKE WHALE PROJECT WHALE SIGHTING SHEET 2008

Australian Government
Great Barrier Reef Marine Park Authority

We are interested in all of your whale sightings, but are particularly keen on hearing about minkes (dwarf minke whale pictured above left). Please fill out this sheet as best you can to help our sightings records.

Part A: Fill in immediately when whales are seen:

1. **Time** of initial sighting:…….. 2. **Date**: _____ / _____ / **2008**

3. **Location**: Coordinates at start: **Lat**:……..……..……(S) **Long**:……..……(E)

4. Approx. **distance from vessel** when first sighted: ……..… 5. Time of first approach (*to within 30m*) ……

Part B: Fill in immediately after end of encounter:

6. **Time** of last sighting:…… 7. **Vessel**:…….…….. 8. Your name: ……..……

9. Coordinates at end (*if drifting/steaming*): **Lat**:……. (S) **Long**:……(E)

10. How did the encounter end? (*please tick one*) …☐ Whale(s) left the boat ☐ Boat left the whale(s)

Part C. Fill in at end of encounter:

11. Type of whale: (*please circle one*) **M**inke / **H**umpback / **O**ther:……..……..

12. Number of whales: …… **A**pprox / **C**ertain

13. Estimated size(s): (*No. of whales*): more than 6m: #_____; 4m-6m: #_____; less than 4m: #_____

14. Any calves? (*2008 calf will be < ½ size of mother, in close proximity to her & breathing more often*): # _____

- If a cow & calf were seen; how long did they stay in the area? (*give times*) **From**:_____ **To**: _____

15. Vessel status when whale(s) first sighted: (*please circle one*) **A**nchored / **M**oored / **S**teaming / **D**rifting

16. Did the vessel status change during the encounter? *(Please explain and give times; e.g. "dropped mooring to drift at 15:35")*

……..…….…….

17. Distance drifted during encounter: …… *naut. miles* 18. Average wind speed: …… *knots*

19. Average wave height: ……..…..… *metres* 20. Underwater visibility …… *metres*

21. Name of nearest reef or dive site:……..…… 22. Distance to that reef/site:…….. ____

23. Closest approach distance by whale(s) (*metres from boat*): …… 24. Rope used?: **Y** / **N** (*please circle one*)

25. Maximum number of divers in at one time: Using snorkel: …… Using SCUBA: ……..

26. Brief description of encounter (*e.g. movement of whales, swimmers, etc; use back of page if necessary*): ..……..…..

……..…….

……..……

27. Were any of the following behaviours observed? (*Tick where appropriate and **write number of times** observed*)

(*For descriptions of behaviours see the CRC Reef brochure, the Interaction Behaviour Diary or the Minke Whale Project interpretive DVD 2007*)

☐ Breaching? # *times*:_____ ☐ Headrise/Spyhop? # ____ ☐ Bubble blast? #_____ ☐ Gulping? #:_____

☐ Sudden speed up? # _____ ☐ Sharp veer away? #_____ ☐ Sudden deep dive? #: _____

☐ Jaw clap? # _____ ☐ Belly presentation? #_____ ☐ Close approach (<3m)? #:_____

☐ Motorboating? #:_____ ☐ Pirouetting? #:_____ ☐ Very close approach (<1m)? # _____

☐ Vocalisation(s)? (*please describe*): ……..…… ☐ Physical contact (*please describe*)……..……

☐ Other (*please specify*)……..……

28. Description of any significant markings/ scars on the whales *(use back of page if necessary)*: ……..…….....

……..…….

29. Photos and/or video available : **Y** / **N** 30. Name of photo/videographer : ……..……..

31. Your contact details / vessel stamp:

Address & Telephone:……..……...

Email:……..…….

Please return completed forms and copies of any photos/video to the Minke Whale Project:

c/- Dr Alastair Birtles (Minke Whale Project Leader), Tourism, School of Business, James Cook University, Townsville QLD 4811.
Ph: (07) 4781 4736 Fax: (07) 4781 4019 Email: Alastair.Birtles@jcu.edu.au

The Minke Whale Project will forward copies of all completed Whale Sighting Sheets to the Great Barrier Reef Marine Park Authority. The Minke Whale Project is partially funded by the Great Barrier Reef Marine Park Authority: "Dwarf Minke Whale Tourism Research and Monitoring Programme." Summaries of the season's data will be provided to operators.

Thank you for your help with this research.

Appendix 5: Agendas for seven stakeholder workshops held over 2006-2008.

Australian Government
Great Barrier Reef
Marine Park Authority

PROPOSED AGENDA
for the
2006 PRE-SEASON INDUSTRY WORKSHOP
Friday 26 May 2006, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide an update for current operators on the dwarf minke whale research program; with guidelines for sustainable interactions with whales, details of interpretive materials and opportunities for participation in the research for the 2006 season.

Time: Workshop from 2:00pm – 5:00pm (afternoon tea provided)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda: 2:00 Welcome and introductions

2:15 Information from managers (GBRMPA, Qld EPA, DEH)

2:30 PhD student projects 2006-2008:
- Whale ID study – Susan Sobtzick
- Whale behaviour – Arnold Mangott
- Sustainability indicators – Matt Curnock

3:15 Workshop on potential impacts/risks and sustainability objectives

4:00 Industry protocols for encounter management in 2006
- Draft vessel approach and departure protocols for minke encounters
- Draft protocol for cow-calf interactions
- Other encounter management issues (e.g. incident reporting, management of private and incidental tourist encounters, evidence gathering in support of changes to management, SMAs).

4:30 Industry participation in research and monitoring in 2006
- Data sheets (WSS2006, Minke Whale Questionnaire, Vessel Movement Log)
- How the industry can help research in 2006 ("What you can do.")
- Researcher access to vessels
- Research funding for 2006 onward

4:40 Interpretive material for the industry

4:50 Industry feedback and the future

The GBRMPA Humpback and Dwarf Minke Whale Information Night is from 6:30pm in same room.
The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Australian Government
Great Barrier Reef
Marine Park Authority

PROPOSED AGENDA
for the
2006 POST-SEASON INDUSTRY WORKSHOP
Friday 15 December 2006, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide a debriefing to GBRMPA permitted operators on the 2006 season, an update on research findings and highlights from the 2006 season, an opportunity for industry feedback to protected area managers and researchers, discussion of management issues from the field season and possible changes to the Code and discussion of research opportunities for 2007-2009.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:00pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;
Review and adoption of Summary and Outcomes of 2006 Pre-Season Workshop (26/5/06; MWP Draft Document No. 2006.01.3)

1:15 GBRMPA introduction, feedback on 2006 season: issues and developments; any additional comments from EPA/QPWS

1:30 Initial feedback from permitted operators (approx. 5 minutes each).

2:15 Research report (Alastair Birtles and MWP research team)

1. 2006 minke season summary & highlights (Alastair)
2. Summary of 2006 industry data returns (WSS, MWQs, Vessel Movement Logs, Interaction Behaviour Diaries) (Alastair)
3. Whale Sighting Sheet (WSS2006) preliminary results (Matt Curnock)
4. PhD update: minke whale behaviour study (Arnold Mangott)
5. PhD update: photo-ID study (Susan Sobtzick)
6. PhD update: sustainable management (Matt Curnock)
7. Sustainability Objectives, Indicators and developing an Adaptive Management Model (Alastair, Peter Valentine & Matt)
8. Funding update, future research & industry involvement (Alastair & Peter Valentine)

3:15 Afternoon tea

3:30 Workshop discussion of management issues and any potential changes to Code of Practice for the 2007 season

1. Compliance with Code of Practice; National Whale & Dolphin Watching Guidelines 2005
2. Incidental and non-permitted vessel interactions
3. Increasing passenger numbers on vessels (GBRMPA)
4. Feedback on *Vessel Approach Distances and Departure Protocol* from 2006 season
5. Feedback on *Protocol for Behaviour with a Cow and Calf* from 2006 season
6. Observations of minke whale behaviour in 2006 (mooring & vessel positions)
7. Feedback on draft working document: "*Potential anthropogenic impacts on dwarf minke whales in the Great Barrier Reef*" (MWP Draft Document No. 2006.02.3)
8. New draft working document for feedback: "*Potential sustainability objectives and indicators for swim-with-dwarf minke whale tourism in the GBR*" (MWP Draft Doc. No. 2006.03.4)
9. Review of the GBRMPA Whale and Dolphin Conservation Policy in 2006/07
10. Other issues

4:30 Final industry feedback to managers and researchers (all)

4:40 Minke Whale Project 4th International Awards for Excellence for 2006

4:50 Best of 2006 minke video footage (by Susan Sobtzick)

5:00 Closing remarks (A/Prof Peter Valentine)

Drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with industry and management participants.

Australian Government
Great Barrier Reef Marine Park Authority

PROPOSED AGENDA
for the
2007 PRE-SEASON INDUSTRY WORKSHOP
Friday 25 May 2007, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide an update for current operators on the dwarf minke whale research program; with guidelines for sustainable interactions with whales, discussion of management issues and possible changes to the Code of Practice, details of interpretive materials and opportunities for participation in the research for the 2007 season.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:00pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;
Review and adoption of Minutes of 2006 Post-Season Workshop (15/12/06).

1:20 GBRMPA introduction, issues and developments; any additional comments from EPA/QPWS

1:40 Research report & update for 2007 minke season (Alastair Birtles and MWP research team)

9. Whale Sighting Sheets (2007 update)
10. PhD update: minke whale behaviour study (Arnold Mangott)
11. PhD update: photo-ID study (Susan Sobtzick)
12. PhD update: sustainable management (Matt Curnock)
13. MTSRF project update: "Social and Economic Values of Key GBR Species"

2:40 Workshop discussion of management issues for the 2007 season

11. Updates to the Code of Practice
12. Other encounter management issues (e.g. incident reporting, management of private and incidental tourist encounters, evidence gathering in support of changes to management, SMAs).
13. New GBRMPA Operational Policy on Whale and Dolphin Conservation in the GBRMP 2007
14. Other issues

3:15 Afternoon tea

3:30 Industry participation in research and monitoring in 2007

- Data sheets (WSS2007, Minke Whale Questionnaire, Vessel Movement Log, Interaction Behaviour Diaries, donated whale photos)
- Researcher access to vessels
- Industry fundraising for Minke Whale Project research in 2007 (passenger contributions)

4:00 Interpretive material for the industry (including MWP Interpretive DVD 2007)

4:50 Industry feedback and the future

5:00 Workshop close; drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Australian Government
Great Barrier Reef Marine Park Authority

PROPOSED AGENDA
for the
2007 POST-SEASON INDUSTRY WORKSHOP
Friday 16 November 2007, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide a debriefing to GBRMPA permitted operators on the 2007 season, an update on research findings and highlights from the 2007 season, an opportunity for industry feedback to protected area managers and researchers, discussion of management issues from the field season, discussion of Sustainability Objectives for swim-with-minke whales tourism and discussion of research opportunities for 2008 onwards.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:30pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;
Review and adoption of Minutes of 2007 Pre-Season Workshop (25/5/07)

1:15 GBRMPA introduction, issues and developments; any additional comments from EPA/QPWS

1:30 Initial feedback from permitted operators on 2007 season (approx. 5 mins each)

2:15 Research report on 2007 minke season (Alastair Birtles and MWP research team)

1. 2007 Season Highlights
2. Preliminary results of Whale Sighting Sheets (WSS2007)
3. Passenger questionnaire results update (MWQ2002-2005)
4. MTSRF project update: "Social and Economic Values of Key GBR Species"
5. PhD update: minke whale behaviour study (Arnold Mangott)
6. PhD update: photo-ID study (Susan Sobtzick)

3:00 Discussion of encounter management, ropes & potential entanglement

3:15 Afternoon tea

3:30 Whale & Dolphin Conservation Society activities and swim-with policy update (Dr Mike Bossley)

3:45 Mini-Workshop on Sustainability Objectives (includes brief PhD update and intro by Matt Curnock)

5:10 Minke Whale Project 5th International Awards for Excellence 2007

5:20 Best of 2007 minke video footage

5:30 Workshop close; drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Australian Government
Great Barrier Reef
Marine Park Authority

PROPOSED AGENDA
for the
GBR DWARF MINKE WHALE TOURISM CODE OF PRACTICE & SUSTAINABILITY OBJECTIVES WORKSHOP
Friday 18 April 2008, Tradewinds Cairns Esplanade

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To review 2008 updates to the Code of Practice and develop Sustainability Objectives for swimming-with-dwarf minke whales tourism. This special workshop provides industry, managers, researchers and other stakeholders the opportunity to review and refine management protocols for the 2008 and subsequent minke seasons, and develop long-term objectives to guide future management decisions for this unique industry.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:00pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;

1:10 Brief update on MWP research

1:25 Code of Practice Workshop – participants are invited to identify items in the draft revised Code of Practice for review and discussion

- Review of ropes and potential entanglement issue

2:45 Afternoon tea and informal discussion

3:15 Workshop on Sustainability Objectives (facilitated by Matt Curnock)

5:00 Workshop close; drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Australian Government
Great Barrier Reef
Marine Park Authority

PROPOSED AGENDA
for the
2008 PRE-SEASON INDUSTRY WORKSHOP
Friday 30 May 2008, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide an update for swimming-with-whales endorsed operators in the GBRMP; with discussion of management issues, the new Code of Practice, Sustainability Objectives, details of interpretive materials and opportunities for participation in the research for the 2008 season.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:00pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;
Review and adoption of Minutes of 2007 Post-Season Workshop (16/11/07).

1:20 GBRMPA introduction, issues and developments; any additional comments from EPA/QPWS

1:30 International Fund for Animal Welfare (IFAW) brief update on cetacean activities and policy (Jorge Luis Basave)

1:40 Research report & update for 2008 minke season (Alastair Birtles and MWP research team)

14. Whale Sighting Sheets (2008 update)
15. MTSRF project update: "Social and Economic Values of Key GBR Species"
16. PhD update: minke whale behaviour study (Arnold Mangott)
17. PhD update: photo-ID study (Susan Sobtzick)
18. PhD update: sustainable management & sustainability objectives (Matt Curnock)

3:00 Afternoon tea

3:15 Workshop discussion of management issues for the 2008 season

15. The new *Code of Practice for dwarf minke whale interactions in the GBRWHA*
16. Other encounter management issues (e.g. incident reporting, management of private and incidental tourist encounters, use of ropes and preventing entanglements – including reporting of outcomes of the recent CHARROA meeting on this subject).
17. Other issues.

3:45 Industry participation in research and monitoring in 2008

- Data sheets (WSS2008, Minke Whale Questionnaire, Vessel Movement Log, Interaction Behaviour Diaries, donated photos/video for whale identification)
- Researcher access to vessels
- Industry fundraising for Minke Whale Project research in 2008 (passenger contributions)

4:30 Interpretive material for the industry

4:50 Industry feedback and the future

5:00 Workshop close; drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Australian Government
Great Barrier Reef Marine Park Authority

PROPOSED AGENDA
for the
2008 POST-SEASON INDUSTRY WORKSHOP
Friday 12 December 2008, Tradewinds Cairns Esplanade

MANAGEMENT OF SWIM-WITH-WHALE (DWARF MINKE WHALE) ACTIVITIES IN THE NORTHERN GREAT BARRIER REEF

Hosted by the Great Barrier Reef Marine Park Authority and the Minke Whale Project research team

Aims of the workshop:

To provide a debriefing to GBRMPA permitted operators on the 2008 season, an update on research findings and highlights from the 2008 season, an opportunity for industry feedback to protected area managers and researchers, discussion of management issues from the field season, discussion of Sustainability Objectives for swim-with-minke whales tourism and discussion of research opportunities for 2008 onwards.

Time: Lunch provided from 12:00pm;
Workshop from 1:00pm – 5:30pm (afternoon tea included)

Chair: Dr Alastair Birtles (James Cook University Senior Lecturer and Minke Whale Project Leader)

Agenda:

1:00 Welcome and introductions; review and adoption of Agenda;
Review and adoption of Minutes of 2008 Pre-Season Workshop (30/5/08)

1:15 GBRMPA introduction, issues and developments; any additional comments from EPA/QPWS

1:30 Initial feedback from permitted operators on 2008 season (approx. 5 mins each)

2:15 Research report on 2008 minke season (Alastair Birtles and MWP research team)

1. 2008 Season Highlights
2. Preliminary results of Whale Sighting Sheets (WSS2008)
3. Passenger questionnaire results update (MWQ2008)
4. MTSRF project update: "Social and Economic Values of Key GBR Species"
5. PhD update: minke whale behaviour study (Arnold Mangott)
6. PhD update: photo-ID study (Susan Sobtzick)

3:15 Afternoon tea

3:30 Matt Curnock PhD update and Mini-Workshop on Sustainability Objectives.

4:00 Discussion of management issues arising from 2008 season
(e.g. use of ropes, incidental encounters by non-SWW-endorsed vessels, other issues)

4:30 Funding for research and monitoring from 2009 onwards

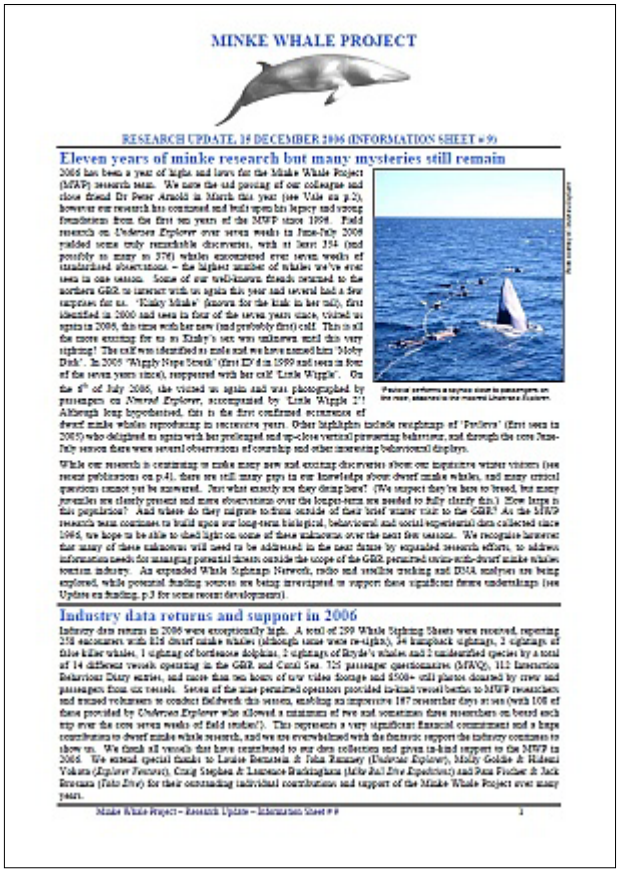
4:45 Minke Whale Project 6th International Awards for Excellence 2008

4:50 2008 minke video footage highlights

5:00 Workshop close; drinks and savories outside at the Tradewinds Esplanade Bar

The Minke Whale Project research team will stay overnight in Cairns and are happy to continue informal discussions with participants over dinner.

Appendix 6: Scans of Minke Whale Project Research Newsletters from 2006 and 2007



MINKE WHALE PROJECT

RESEARCH UPDATE, 31 DECEMBER 2006 (INFORMATION SHEET # 9)

Eleven years of minke research but many mysteries still remain

2006 has been a year of highs and lows for the Minke Whale Project (MWP) research team. We now the sad passing of our colleague and close friend Dr Peter Arnold in March this year (see Vale on p.2), however our research has continued and built upon his legacy and strong foundations from the first ten years of the MWP since 1996. Field research on *Undersea Explorer* over seven weeks in June-July 2006 yielded some truly remarkable discoveries, with at least 354 (and possibly as many as 370) whales encountered over seven weeks of standardised observations – the highest number of whales we've ever seen in one season. Some of our well-known friends returned to the northern GBR to interact with us again this year and several had a few surprises for us. 'Kinky Minke' (known for the kink in her tail), first identified in 2000 and seen in four of the seven years since, visited us again in 2006, this time with her new (and probably first) calf. This is all the more exciting for us as Kinky's sex was unknown until this very sighting! The calf was identified as male and we have named him 'Moby Dick'. In 2005 'Wiggly Nope Swash' (first ID'd in 1999 and seen in four of the seven years since), reappeared with her calf 'Little Wiggle'. On the 5th of July 2006, the visited us again and was photographed by passengers on *Nimrod Explorer*, accompanied by 'Little Wiggle' [1]. Although long hypothesised, this is the first confirmed occurrence of dwarf minke whales reproducing in successive years. Other highlights include resightings of 'Perfecta' (first seen in 2005) who delighted us again with her prolonged and up-close vertical pursuering behaviour, and through the core June-July season there were several observations of courtship and other interesting behavioural displays.

Perfecta performs a surprise close to passengers on the river, observed in the mouth of Endeavour Estuary.

While our research is continuing to make many new and exciting discoveries about our inquisitive winter visitors (see recent publications on p.4), there are still many gaps in our knowledge about dwarf minke whales, and many critical questions cannot yet be answered. Just what exactly are they doing here? (We suspect they're here to breed, but many juveniles are clearly present and more observations over the longer-term are needed to fully clarify this.) How large is this population? And where do they migrate to/from outside of their brief winter visit to the GBR? As the MWP research team continues to build upon our long-term biological, behavioural and social experimental data collected since 1996, we hope to be able to shed light on some of these unknowns over the next few seasons. We recognise however that many of these unknowns will need to be addressed in the near future by expanded research efforts, to address information needs for managing potential threats outside the scope of the GBR permitted swim-with-dwarf minke whales tourism industry. An expanded Whale Sightings Network, radio and satellite tracking and DNA analyses are being explored, while potential funding sources are being investigated to support these significant future undertakings (see Update on funding, p.3 for some recent developments).

Industry data returns and support in 2006

Industry data returns in 2006 were exceptionally high. A total of 289 Whale Sighting Sheets were received, reporting 258 encounters with 816 dwarf minke whales (although some were re-sights), 34 humpback sightings, 2 sightings of false killer whales, 1 sighting of bottlenose dolphins, 2 sightings of Bryde's whales and 2 unidentified species by a total of 14 different vessels operating in the GBR and Coral Sea. 725 passenger questionnaires (MWQs), 112 Interaction Behaviour Diary entries, and more than ten hours of tow video footage and 8500+ still photos donated by crew and passengers from six vessels. Seven of the nine permitted operators provided in-kind travel berths to MWP researchers and trained volunteers to conduct fieldwork this season, enabling an impressive 167 researcher days at sea (with 108 of these provided by *Undersea Explorer* who allowed a maximum of two and sometimes three researchers on board each trip over the core seven weeks of field studies!). This represents a very significant financial commitment and a huge contribution to dwarf minke whale research, and we are overwhelmed with the fantastic support the industry continues to show us. We thank all vessels that have contributed to our data collection and given in-kind support to the MWP in 2006. We extend special thanks to Louise Bennetts & John Ramsay (*Undersea Explorer*), Molly Goldie & Hideaki Yokota (*Explorer Ventures*), Craig Stephen & Laurence Buckingham (*Ocean Free*), Sandy Bell (*Silver Seas Expeditions*) and Pete Fischer & Jack Brennan (*Tula Tula*) for their outstanding individual contributions and support of the Minke Whale Project over many years.

Vale Dr Peter Arnold

Dr Peter Arnold (1948-2006) on undersea watch for minkes, and the very last light of the day and enjoying every minute.

Dr Peter Arnold (1948-2006) was a passionate and dedicated scientist, a loving husband and father, a loyal friend and colleague, and a true gentleman. Peter was a man of many talents, and his contributions to the study of whales and dolphins in Australian waters and beyond will be long remembered. Peter was a Senior Curator of Tropical Natural History at the Museum of Tropical Queensland and Chief Investigator and co-Founder of the Minke Whale Project, passed away suddenly on the 7th of March 2006. Peter began documenting the very first sightings records of dwarf minkes on the GBR in the early 1990s, and undertook the first dedicated dwarf minke whale field studies alongside Dr Alastair Birtles, John Ramsay and Andy Dunston on the *Undersea Explorer* in 1996. A dedicated and widely respected marine mammal scientist, Peter co-authored the current Code of Practice for swimming-with-dwarf minke whales and has been a leading author of many scientific papers, annual and international conference presentations (including to the Whalewatching Sub-Committee of the International Whaling Commission Scientific Committee) on dwarf minke whale biology and management. His research into Australia's coastal dolphins also led to the discovery (with JCU PhD student Isabel Beasley) of the newly described Australian snubfin dolphin species. Peter co-supervised many JCU postgraduate students involved in the MWP and in other areas over the years, and was always generous in sharing his time and immense knowledge of the natural world and scientific literature. He was a great friend to the MWP research team and much of the scientific community who knew him, and his cheerful presence (especially when on *Undersea*'s top deck searching for minkes) is greatly missed. As the dwarf minke whale has yet to be formally described to the scientific literature, it has been suggested by several world-leading researchers that when it eventually is named, it might be after Peter Arnold. We certainly hope that this does eventuate.

Public comment sought on whale & dolphin conservation in the GBR

The Great Barrier Reef Marine Park Authority (GBRMPA) is revising its policy on whale and dolphin conservation to ensure consistency with the Australian Government's Australian National Guidelines for Whale and Dolphin Watching 2005 and Humpback Whale Recovery Plan 2005-2010. The review aims to ensure that an appropriate management framework for the conservation of whales and dolphins exists in the Great Barrier Reef Marine Park. The Draft Operational Policy can be accessed at http://www.gbrmpa.gov.au/corp_site/about_us/policies and comments can be emailed to species@gbrmpa.gov.au. The period for public comments closes on 14 January 2007. The MWP research team encourages all industry members and stakeholders to review and have their input into this important policy document, which will inform the framework for management of swim-with-dwarf minke whales tourism in the GBRMP.

Update on funding

2006 has been a busy year for members of the MWP research team, who collectively have submitted 11 applications and tenders for funding a range of research activities involving dwarf minke whales, including operational expenses for the PhD projects by Susan Sobtzick, Arnold Mangott and Matt Curnock. In early 2006 we applied to the Marine and Tropical Sciences Research Facility (MTSRF) under two programs: *Marine Species of Conservation Concern*, and *Analysis for Sustainable Tourism Management of Key GBR Marine Wildlife Species*. We are pleased to announce we were successful in being awarded funds under the latter program, which will enable an analysis of the social and economic values of dwarf minke whales (and other iconic species) to the regional community (see p.3 for further details). Susan, Matt and Arnold were each successful in their applications to the JCU Graduate Research Scheme, covering basic equipment and operational expenses for their PhDs in the latter half of 2006. They are currently awaiting the outcomes of applications to the Queensland Government *Growing the Smart State PhD Fund* to assist their research over 2007-09.

In October 2006 the MWP research team applied to the new Australian Centre for Applied Marine Mammal Science for funding to expand the current Whale Sightings Network and improve records of dwarf minke sightings south of Cairns and establish links for the collection of Western Australian sightings of dwarf minkes. This proposal, entitled '*Temporal and (genetic) structuring of dwarf minke whales in Australian Waters: Filling in the gaps*' also included the analyses of the long-term archival data set of minke whale images for identification, and standardised behavioural observation records, collected by Peter Arnold and Alastair Birtles since 1989. Funding has not previously been available to allow analyses of the >18,000 a/w still images, >70 hours of video footage and several 100s of hours of observational records of dwarf minke whale behaviour. These long-term data sets will enable the identification of personal cumulative effects of minke interactions over more than seven years prior to the PhD studies that begin in 2006. Sadly we have just heard that this application was unsuccessful. We will be making every endeavour to ensure this vital work is funded from other sources. Collaborating Organisations in this application included the GBRMPA, *Undersea Explorer*, the Cod Hole and Ribbon Reef Operators Association, the Whale and Dolphin Conservation Society (WDCS), the International Fund for Animal Welfare (IFAW), the Centre for Whale Research (Western Australia) Inc. and Western Whale Research Pty Ltd.

We are pleased to announce that we have been awarded $15,000 from the GBRMPA to analyse and report on the Minke Whale Questionnaires (MWQ) collected over 2002-2005. Funding has not previously been available for this, however operators collected an extraordinary total of 2298 MWQs from passengers over these three years to contribute to the monitoring of passenger experiences, perceptions of impacts, management of encounters and educational tools. We look forward to producing a GBRMPA report on these data and a paper by the end of June next year.

New research project studying the values of iconic marine species

Towards the end of 2006 a new research project began, partially funded for four years under the Marine and Tropical Sciences Research Facility (MTSRF) under Program 8 (led by Prof Renee Prideaux, JCU Cairns; Project 8.5.4), which will investigate the social and economic values of key marine species on the Great Barrier Reef. Led by Chief Investigators Dr Alastair Birtles, A/Prof Peter Valentine and Dr Natalie Stoeckl (JCU), the new project is examining tourism interactions with iconic Reef species, including sharks, rays, turtles, large fishes (e.g. potato cod, Maori wrasse) and dwarf minke whales, and will assess the value of these species to the tourism industry and the regional economy. The first survey for this project began in Oct 2006, involving passenger questionnaires on board *Undersea Explorer* and *Nimrod Explorer* during expeditions to the Far Northern GBR, where passengers are encountering large numbers of marine turtles, sharks and other iconic species. We hope to be interviewing many of you early in 2007 about a range of economic aspects of your businesses as background to understanding the socio-economic values of GBR marine wildlife.

PhD update: Arnold Mangott (dwarf minke whale behaviour)

The 2006 minke whale season was the first of three field seasons for my PhD research into minke whale behaviour and was a great success. Thanks to the support from the industry, I was able to spend 40 days at sea (24 days on *Undersea Explorer*, 10 days on *Nimrod Explorer* and 6 days on *Tula*). During this time I observed and recorded 89 minke whale encounters of which 39 were in-water interactions. I also recorded 80 hours of underwater audio including minke whale vocalisations whilst recording my surface observations, with the aim of comparing the occurrence of vocalisations within the context of different behaviours. Another outcome of this season was the collection of 116 Interaction Behaviour Diaries (IBD2006) over the season. The IBD allows crew and passengers to become involved in minke behaviour research by reporting their observations and impressions from minke encounters. I'd like to thank all of the permitted operators, crews and passengers for having me on board and for their great support and I look forward to watching the minkes with your help again in 2007.

PhD update: Susan Sobtzick (dwarf minke whale biology)

This minke season was a very exciting one for me, with many memorable encounters with some old friends including 'Kinky Minke' (with her new calf), 'Perfecta' and 'Meteorite'. Thanks to *Undersea Explorer* I was able to spend seven successive weeks at sea and shot more than ten hours of video footage from 42 in-water interactions. The number of still and video images donated by the industry and passengers towards my research this year exceeded all previous years, and I am now busily working on coding each of the 8500+ images for ID analyses. This contribution from the industry is extremely valuable for increasing potential re-sightings of known individual whales and will help improve our understanding of dwarf minke whale movement patterns, site fidelity, social structure and other important biological aspects whilst they are in the Great Barrier Reef. I'd like to thank everybody that donated copies of their underwater minke images this year and I look forward to your contributions again to the 2007 minke season!

PhD update: Matt Curnock (sustainable management)

G'day! 2006 has been a busy and productive year for my PhD research. I'm extremely grateful to all of the permitted operators for their contributions to the record data collection effort this year, in particular for collecting Minke Whale Questionnaires, which I will be analysing over the next few months before the 2007 minke season. In the 2006 season I was also able to collect GPS cruise track samples from seven permitted operators and I hope to expand the use of automated GPS loggers in the 2007 minke season to improve data collection of vessel search effort. I am currently preparing an interview survey for industry stakeholders in the GBR, swim-with-dwarf minke whales tourism industry, to identify Sustainability Objectives and screen potential Sustainability Indicators. I hope to begin interviewing owners and/or managers of the nine permitted vessels, some Sea and Commonwealth government management agency staff and representatives from conservation and wildlife NGOs in early 2007. Thanks for your support. Looking forward to another great minke season next year!

What to expect in 2007

In 2007 the MWP research team will continue our ongoing and long-term studies into the biology and behaviour of dwarf minke whales in the Great Barrier Reef and the sustainable management of swim-with interactions. We would like to engage the wider GBR tourism industry in reporting sightings of dwarf minkes that occur incidentally outside the Ribbon and Agincourt Reef complexes as part of an expanded Minke Whale Sightings Network. We are currently developing new interpretive tools to assist the industry in preparing their passengers for encounters in the 2007 season, including new colour posters and a trial DVD. We encourage all available staff and crews from the permitted vessels to attend the 2007 Pre-Season Workshop (date TBA) to help prepare for a successful 2007 minke season, and to ensure that all encounters are managed sustainably, that the quality and quantity of research data is maximised and that passengers' experiences swimming with dwarf minke whales continue to be wonderful!

MWP publications & conferences in 2006

Papers submitted in 2006:

Duncan, A., Sobtzick, S., Birtles, A. & Arnold, P. (under review). Size estimation and population demographics of dwarf minke whales in the northern Great Barrier Reef. *Aquatic Mammals & Management*.

Vale: for Dr Peter Gillham Arnold:

Memoirs of the Queensland Museum, Vol. 52 Part 1 (pp. 7-12), 15 November 2006. Available online: http://www.qm.qld.gov.au/organisation/publications/memoirs/52/MemQM52_1_7-12_Arnold.pdf

Advance Abstracts, Science, Vol. xx [2006] (Forthcoming).

New papers about to be submitted:

Birtles, A., Arnold, P., Valentine, P., Duncan, A., Ramsay, J. & Curnock, M. Development, evaluation and implementation of a Code of Practice for ecotourist management of swim-with dwarf minke whales tourism on the Great Barrier Reef. *Tourism Management*.

Birtles, A., Valentine, P.S., Miller, D.K. & Curnock, M. A closer look at certified SCUBA diving activities on the Great Barrier Reef: Visitors and expectations. *Tourism Management*.

Mangott, A., Birtles, A., Valentine, P., Arnold, P. & Curnock, M. Management difficulties of low-profitability wildlife interactions: a case study of the permitted day-boat operations among the swim-with-dwarf minke whale tourism industry in the Great Barrier Reef. *Tourism Management*.

Conference presentations & posters:

Birtles, A., Arnold, P., Valentine, P., Curnock, M., Mangott, A. & Sobtzick, S. (2006). Research for sustainable management of Australian dwarf minke whales. *National Whale and Dolphin Research Conference*, Adelaide 21-22 February 2006. Commonwealth Department of the Environment and Heritage. Available online: http://www.deh.gov.au/coasts/species/whales/conference-presentations.html

Birtles, A., Arnold P., Valentine, P., Curnock, M., Mangott, A. & Sobtzick, S. (2006). Research for sustainable management of Australian dwarf minke whales. *CRC Reef Research Partnership Workshop*, Townsville Hilton, James Cook University, Townsville, 25-26 July 2006.

Curnock, M., Birtles, A., Valentine, P., Arnold, P. & Duncan, P. (2006). Mechanisms for assessing the sustainability of the swim-with-dwarf minke whales tourism industry in the northern Great Barrier Reef. Poster presentation. (1) *National Whale and Dolphin Research Conference*, Adelaide 21-22 February 2006; (2) *2006 Ecotourism Australia International Conference*, Townsville, 30 October – 3 November 2006.

Mangott, A., Birtles, A., Arnold, P. & Curnock, M. (2006). The management of day boat operators in the Dwarf minke whale swim-with industry in the Great Barrier Reef. Poster presentation. (1) *National Whale and Dolphin Research Conference*, Adelaide 21-22 February 2006; (2) *2006 Ecotourism Australia International Conference*, Townsville, 30 October – 3 November 2006.

Sobtzick, S., Birtles, A., Arnold, P. & Duncan, A. (2006). Colour patterns and photo-identification of dwarf minke whales. Poster presentation. (1) *National Whale and Dolphin Research Conference*, Adelaide 21-22 February 2006; (2) *2006 Ecotourism Australia International Conference*, Townsville, 30 October – 3 November 2006.

Sobtzick, S., Duncan, A., Birtles, A. & Arnold, P. (2006). Size estimation and population demographics of dwarf minke whales in the northern Great Barrier Reef. Poster presentation. (1) *National Whale and Dolphin Research Conference*. Adelaide 21-22 February 2006; (2) *2006 Ecotourism Australia International Conference*, Townsville, 30 October – 3 November 2006.

In addition to the 2006 Dwarf Minke Whale Tourism Monitoring Workshops (26 May & 15 December), the MWP research team gave presentations to the industry at the GBRMPA 'Humpback and Dwarf Minke Whale Information Night' in Cairns (on 28 May) and at a Pre-Season Training Workshop in Port Douglas for the crews of permitted swim-with-minke day boats (on 27 May). During the June-July minke season, MWP researchers presented a total of 14 dwarf minke whale biology and research stakeholders to passengers and crews while onboard *Undersea Explorer*, *Nimrod Explorer*, *Tula* and *Spirit Sport*.

Thanks for your support!

The Minke Whale Project research team would like to thank the managers, staff and crew of the permitted swim-with minke operators for their ongoing support of the Project. We are also especially grateful to the vessels who provided in-kind access for our researchers and volunteers during the 2006 minke season, including the live-aboard vessels *Undersea Explorer*, *Nimrod Explorer*, *Tula* and *Spirit Sport*, and the day boats *Poseidon II*, *Silver Seas* and *Aristocat II*. We look forward to continuing this highly successful research collaboration in 2007 and beyond, to help improve our understanding of these impressive and charismatic little whales and promote sustainable interactions with them.

The Minke Whale Project research team

The MWP research team has been greatly strengthened by the inclusion of Prof. Helene Marsh, Dean of Postgraduate Studies and Professor of Environmental Sciences at JCU, who has kindly agreed to co-supervise Susan and Arnold following the passing of Dr Peter Arnold. We also welcome Dr Natalie Stoeckl, Program Head of Economics, JCU, and look forward to our collaborative research into the social and economic values of dwarf minke whales. Thanks to Dr Alastair Birtles (James Cook, JCU), A/Prof Peter Valentine (Head, School of Earth & Environmental Sciences), Prof Helene Marsh, Dr Natalie Stoeckl, PhD students Susan Sobtzick, Arnold Mangott and Matt Curnock (JCU). We thank our 2006 MWP research volunteers Jessica Meldrum, Sandra Nilsson, James Livingstone, Paula Perna, Ashley McLeod, Silvia Pigeo Silvestri, Veronique Morvilliers and Helena Hidalgo Pigeon. Matt and Anne Cresswell.

For further information please contact:

Dr Alastair Birtles
Tourism Program, James Cook University, QLD 4811
T: (07 4781) 4736, F: (07 4721) 1116, E: alastair.birtles@jcu.edu.au

A/Prof Peter Valentine
Earth & Environmental Sciences, JCU, QLD 4811
T: (07 4781) 4446, F: (07 4781) 4030, E: Peter.Valentine@jcu.edu.au

The Minke Whale Project is a combined initiative of James Cook University, the Museum of Tropical Queensland and *Undersea Explorer*. The Project has been partially funded by the Great Barrier Reef Marine Park Authority 2003-2006 (under the Dwarf Minke Whale Tourism Monitoring Program), the CRC Reef Research Centre 2004-2006 and CHARTOA (2006). It would not be possible without the support of *Undersea Explorer* and other members of the Cod Hole and Ribbon Reefs Operators Association.

CRC Reef MWP website: www.reef.crc.org.au/discoverreef/animals/minkewhales.html
New Minke Whale Project website under construction: www.marinemammals.org
The GBRMP A Dwarf Minke Whale Tourism Monitoring Programme:
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/natural_values/threatened_species/dwarf_minke_whales

MINKE WHALE PROJECT

MWP RESEARCH NEWSLETTER # 10 (2008)

Can a minke season get any better than 2007?

The 2007 June-July minke season was the Minke Whale Project's (MWP) 12th successive year of field studies of dwarf minke whales and their interactions with divers and snorkellers in the northern Great Barrier Reef (GBR). This long-term research collaboration with the GBR dive tourism industry has led to many important discoveries about the biology and behaviour of the whales, and has helped to improve our management of the swim-with interactions, with the aim of ensuring that they are ecologically sustainable. While the collaboration between the MWP researchers, the dive industry, government management agencies and other stakeholders has continued to improve each year, so too have data returns from the industry's encounters with the whales. In spite of several weeks of bad weather during the 2007 season, data returns and reports from the industry showed a highly successful season overall, with 273 minke encounters (172 of which were in-water) totalling 404 hours of contact (the highest ever reported). Highlights of the 2007 season included re-sightings of some well-known whales from previous years, including 'Pavlova' (pictured right; seen each season since 2005), 'Skeletons' (seen each season since 2004) and 'Pointy Girl' (first identified in 2004). There were many reports of interesting behaviours observed through the season; in particular from Pavlova, who was encountered on six separate occasions by *Spoil Sport*, *Undersea Explorer* and *Mermaid Explorer*, performing her unusual 'pursuiting' behaviour up close to many of their passengers.

Pavlova, the pursuiting minke returned to the same one on the Ribbon Reefs for the most spectacular year in 2007 and made many close approaches to divers and snorkellers. Photo © Jorgen Freund

In 2007 members of the research team (including eight new volunteers) spent 188 days at sea in total, collecting data from six different vessels. From on board the primary research vessel *Undersea Explorer*, Alastair Birtles and PhD students Susan Sobtzick and Arnold Mangott recorded a total of 326-330+ whales during more than 325 hours of interactions. The 2007 season was also the MWP research team's most successful season ever for data returns from vessel crew and passengers (see below for details). To encourage crew and passengers on the vessels to contribute to data collection for the research, a new DVD was developed by the MWP team and *Digital Dimensions* in 2007 for on-board use during the season. Entitled '*Meet the Minkes*', the DVD provides background information about the whales and the research, outlines the Code of Practice for in-water interactions, displays and describes a range of whale behaviours, and shows how to take good photos of the whales' colour patterns to help the photo-ID study.

The three PhD studies by Susan, Arnold and Matt will be completed prior to the 2009 minke season, and each study is expected to improve our knowledge of the whales and assist the sustainable management of these interactions. As the research team eagerly anticipates the 2008 season, we can't help but wonder what surprises and new discoveries lie in store. Can a minke season get any better than 2007? We look forward to finding out!

Fantastic industry data returns and support in 2007

The 2007 minke season resulted in the highest ever data returns from the industry, and the MWP research team are extremely grateful to the crews and passengers of the swim-with-minke permitted boats for their valuable contributions to the research. Data from the 2007 season included 212 Whale Sighting Sheets, 648 passenger questionnaires, 127 days of Vessel Movement Logs completed by skippers and crew, 204 Interaction Behaviour Diaries completed by passengers and crew, and 10,786 digital underwater images for the photo-ID study!

Contributing operators were recognised for their efforts at the 2007 Post-Season Workshop, held in Cairns on the 18th November. Certificates and highly-prized 'chocolate awards' were presented to operators and individual crew as part of the *5th Minke Whale Project International Awards for Excellence 2007*. Award winners included *Explorer Venture* (highest number of Whale Sighting Sheets + most complete whale sightings records), *Minke Reef Dive Expeditions* (highest number of Interaction Behaviour Diary entries by passengers and crew + most underwater video footage for whale identification), *Poseidon Cruises* (highest day boat data returns), *Tusa Dive* (highest number of Minke Whale Questionnaires + highest number of Vessel Movement Logs) and *Undersea Explorer* (highest number of still images for whale identification + providing outstanding researcher access and support). We look forward to your continued support and data collection efforts in 2008.

Friends of the MWP and donations

During the 2007 season, some of the swim-with-minke permitted vessels began collecting a voluntary $5 per day 'levy' from their passengers to help raise funds for the MWP research. Passengers were also able to donate individually to the MWP Fund, and those who donated $100 or more were sent a '*Friends of the Minke Whale Project*' Membership Package, which included a copy of the DVD 'Meet the Minkes', a wristband, colour brochure and newsletter, among other items. In 2007, these donations resulted in more than $10,000 going directly to the MWP Fund (established and audited by James Cook University), which has helped to provide basic equipment for conducting our field research as well as providing additional support for MWP postgraduate students' project expenses. We extend our sincere thanks to all donors and friends of the MWP, as well as the operators for facilitating these donations. In particular, we thank *Undersea Explorer* and *Minke Reef Dive Expeditions* for their outstanding fundraising efforts in 2007.

Photogenic minkes win awards

Some of our well-known GBR dwarf minke whales have been making a splash in wildlife photography competitions recently, attracting international interest. Professional wildlife photographer Jürgen ('Yogi') Freund won first place in the Oceans category of the 2007 Nature's Best Photography Windland Smith Rice International Awards in the USA (winning entry shown at right, which is also featured in the Australian Geographic 2008 Desk Diary), and he received a special commendation in the Shell Wildlife Photographer of the Year competition (U.K.) in the category "Animal Portraits", for his close-up portrait of the highly interactive whale known as 'Pavlova'. The MWP team congratulates Yogi on his achievements! We included one of Yogi's stunning prints in the 'Friends of the MWP' Membership Package in 2007.

Yogi's winning shot of Pavlova can be viewed in high resolution online at www.naturesbestphotography.com

The image of Pavlova on p.1 by Matt Curnock also picked up the Online Voters Award as well as Runner Up in the Animal Behaviour category in the 2007 Reef Check Australia Photography Competition, and it has since appeared on the BBC Science & Nature webpage and in Australian Traveller magazine.

Funding and sponsorship

The MWP research team have recently been sponsored by *Maui Jim Sunglasses* and *Probe Wetsuits*. This provides members of the team with important field equipment needed for the long hours spent outdoors on the top deck of the boat watching for whales, and the sometimes long hours spent conducting in-water observations. We are particularly grateful to Jo Forster from *Maui Jim* and David Forbes from *Probe* for their support and enthusiasm for this research.

There are still many unknowns about these whales (e.g. migration, population size) which will require expanded research efforts to address. The MWP team will be applying for funding for such studies in the near future, however for the 2008 season we consider that it is particularly important to broaden the scope of the current Minke Whale Sightings Network to include more vessels operating from Cairns and those further south in the GBR (e.g. 'Pointy Girl' mentioned on p.1 was photographed by scuba divers at Viper Reef off Townsville in 2007). Core funding for the MWP has been provided by the GBRMPA since 2003, enabling the collection and analyses of Whale Sighting Sheets from the nine permitted operators, and for conducting Pre- and Post-Season Workshops with this industry and other stakeholders. We are now seeking additional funding to facilitate an expanded sightings network, to help better understand the relative distribution and movements of the whales in GBR waters during the winter months, and we will work closely with the GBRMPA to encourage more tourism operators and Reef users to report their minke sightings and donate copies of any photographs.

Three cheers for our volunteers!

MWP volunteers assisting with boat, preparing lunches for the 2007 Post-Season Workshop. (L-R: Arnold Mangott, Hannibal Lehman, Susan Sobtzick, Jake Pratt, Anne Gruber, Dr Alastair Birtles, Lauren Hill, Rachel Arden, Mimi Takahashi and Nora Gregory.) Photo by Nora Gregory

The MWP has had some fantastic volunteer support in 2007 and we'd like to thank our dedicated 'vollies' for all the hours of data entry and field assistance they've contributed. We're also very grateful to the operators who provided in-kind berths on trips during the minke season, allowing the volunteer researchers to collect important data for the research, as well as provide biology slideshows to crew and passengers whilst on board. We had eight volunteers during the 2007 field season: Gloria Hidalgo Figueras, Lauren Hill, Veronique Morellin, Andrea Monge, Petra (Ichie) Lura, Sam Noonan, Mimi Takahashi and Anna Taweras. All were very busy prior to the field season assisting with data entry of Minke Whale Questionnaires, Whale Sighting Sheets and Interaction Behaviour Diaries, as well as helping with coding of acoustic recordings and digital images. The volunteers underwent two days of intensive training prior to their fieldwork, covering sampling methodologies for collecting quality data, and they were provided with detailed information on minke whale biology and behaviour to help them answer questions from passengers and crew on the vessels.

All vollies reported that they had a fantastic time in the field, observing and recording data from their whale encounters, so well as interacting with the vessel crew and passengers on board. Since the 2007 minke season we have had a number of new volunteers sign up to assist the MWP, while others have completed their JCU degrees and have returned to their home towns and countries - we wish them all the best for their future!

Update on *Social & Economic Values of Key GBR Marine Species* project

Having commenced in late 2006, with funding from the Marine and Tropical Science Research Facility (MTSRF), this research project aims to improve our understanding of the social and economic values of iconic marine wildlife species on the GBR. Among the marine animals of particular interest to the study are marine turtles, sharks and rays, whales and dolphins and large fishes such as potato cod and Maori wrasse. To achieve this, the research team, led by Dr Alastair Birtles and Dr Natalie Stoeckl from the JCU School of Business and Alfred Peter Yokumine from the School of Earth and Environmental Sciences, are surveying GBR tourism operators and tourists to determine the importance and value of these iconic marine species to Reef tourism, including the economic impact of these species on the local and regional communities. Visitor surveys have been collected from Reef tourists interacting with marine turtles, sharks, potato cod and minke whales, from live-aboard dive tourism vessels based in Cairns and Port Douglas over the past 12 months. Interviews with industry Key Informants were also conducted to identify marine animals of greatest importance to Reef tourism. In addition expenditure surveys have been distributed to Reef operators in Cairns and Port Douglas to evaluate their economical impact within the community. Preliminary findings from passenger surveys of trips to the Far Northern Section of the GBR were reported to the RRRA in June of last year. These data give an initial indication of the high values of particular species encountered. More surveys are needed to assess these values more accurately. In 2008 further surveys will be conducted in the Cairns and Port Douglas region, as well as other important reef tourism destinations such as Townsville and the Whitsundays. It is hoped that the outcomes of this study will benefit the GBR tourism industry and contribute to the sustainable management of these iconic marine animals.

PhD update: Arnold Mangott (dwarf minke whale behaviour)

The 2007 season was once again a great one. I spent 41 days at sea, 36 days on *Undersea Explorer*, three days on *Mermaid Explorer*, and one day each on *Pesonalee III* and *Aristocrat IV*. I was able to observe 75 encounters, of which 35 were in-water interactions. This adds up to amazing 88 hours in contact with whales. A major focus for me during the 2007 season was to record the spatial and temporal distribution of minkes during interactions. I found that during in-water interactions, the majority of the surfacing animals (50%) stayed within a 60 metres radius of the vessel, most often surfacing in the area where the rope and the swimmers were located. This focused spatial distribution around the vessel and swimmers, together with the extended interaction time (mean 160 minutes) is extraordinary and unknown among other cetaceans. In November 2007 I had the opportunity to present these findings in the form of a poster at the 17th Biennial Conference on the Biology of Marine Mammals in Cape Town, South Africa. I'd like to thank all the passengers, crew and owners of the permitted swim-with-minke vessels for their fantastic support over the last two years. Don't want to meet the minkes again in 2008!

PhD update: Susan Sobtzick (dwarf minke whale biology)

The past year was filled with excitement and some great successes for my project. Thanks to passenger donations to the MWP Fund, we were able to purchase a new video camera in 2007 allowing me to shoot minkes in high definition during my eight weeks onboard *Undersea Explorer*. The greater resolution of the new camera will enhance the size estimation study and the quality of the ID shots. In 2007 I shot more than 10 hours of underwater footage and received copies of >10,000 pictures donated by passengers and crew from nine different vessels; an unprecedented data return! As part of my PhD I evaluated the quality of the donated image data and their value for scientific research and I am very pleased to announce that passengers and crew on the boats have provided robust and high quality data. This enabled analyses of spatial and temporal patterns that would be impossible to achieve with a single research vessel. This is a fantastic outcome and I am very grateful to everyone who has contributed to the study by donating copies of their minke whale pictures. Keep them coming in 2008!

PhD update: Matt Curnock (sustainable management)

The 2007 season was another fantastic one for my PhD data collection. In addition to the hundreds of passenger questionnaires and Vessel Movement Logs collected by the industry, I conducted interviews with a sample of 16 highly experienced crew from the swim-with-minke permitted vessels (exploring practical aspects of minke encounter management) and had another series of in-depth interviews with 16 Stakeholder Key Informants to develop Sustainability Objectives for the industry. The Key Informants included owners and managers of the permitted swim-with minkes vessels, staff of Commonwealth and Qld State government management agencies, cetacean researchers and members of conservation NGOs. After incorporating their feedback on the Sustainability Objectives, I facilitated a Mini-Workshop for stakeholders to review and adopt some of these Objectives in November 2007. Further stakeholder workshops will be held in 2008 to review the remaining Objectives and screen potential Sustainability Indicators. I am very grateful to all of the stakeholders for their support for this process and for assisting my PhD research.

MWP outputs in 2007

The MWP research team had a highly productive year in 2007, with the following journal articles, conference papers and posters, reports and an interpretive DVD produced:

Birtles, A., Curnock, M., Valentine, P., Arnold, P., Stoeckl, N. & Mangott, A. (2007). Dwarf Minke Whale Tourism Monitoring Programme. 2006 Season Report to the Great Barrier Reef Marine Park Authority, 175 Pages. 2007.

Birtles, A., Valentine, P. & Curnock, M. (2007). MTSRF Preliminary Report to the Reef and Rainforest Research Centre and the Great Barrier Reef Marine Park Authority, 26 Page 2007. Condition and trends of dwarf minke whale populations in the GBRWHA.

Birtles, A., Valentine, P., Stoeckl, N., Mangott, A., Brown, V. & Curnock, M. (2007). Understanding the social and economic values of key marine species in the Great Barrier Reef. MTSRF Task 4.9.6 (a). Preliminary Report to the Reef and Rainforest Research Centre. 30 June 2007. 12pp.

Curnock, M., Birtles, A. & Valentine, P. (2008). Developing Sustainability Objectives and Indicators for swim-with-minke whales tourism in the Great Barrier Reef. *CRUISE 2008 Conference* (Working paper), 11-14 February 2008, Gold Coast.

Donovan, A., Schwab, L., Birtles, A. & Arnold, P. (in press). Video preference as a new habitat/ecologically sensitive method providing population demographics of dwarf minke whales in the north-west Great Barrier Reef. *Journal of Cetacean Research and Management*, xx: xxx-xxx.

Mangott, A., Birtles, A. & Marsh (2007). Interacting dwarf minke whales (*Balaenoptera acutorostrata subsp.*) – spatial and temporal distribution of breaching animals in the vicinity of tourism vessels and their swimmers. *17th Biennial Conference on the Biology of Marine Mammals* (Poster presentation), 29 Nov to 3 Dec 2007, Cape Town, South Africa.

Minke Whale Project (2007). *Meet the Minkes*. Minke Whale Interpretive DVD 2007.

Schwab, L., Birtles, A. and Marsh, H. (2007) Evaluating the potential of whalewatching tourists to provide robust data for photo-identification of dwarf minke whales in the Great Barrier Reef. *17th Biennial Conference on the Biology of Marine Mammals* (Poster presentation), 29 Nov to 3 Dec 2007, Cape Town, South Africa.

What to expect in 2008

In 2008 the MWP research team will continue to collect important data in collaboration with the permitted swim-with-minkes tourism operators, and we encourage the crews and passengers to continue reporting their observations and donating copies of their minke images to support this research. We will refine the Minke Whale Questionnaire (MWQ) for the 2008 season to include some new social Sustainability Indicators, which will be based on findings from previous seasons and the new Sustainability Objectives developed in Stakeholder Workshops. This will be the sixth field season the MWP is funded by the GBRMPA (for the Dwarf Minke Whale Tourism Monitoring Programme) and we will be submitting our Final Report to the Authority in 2008 based on analyses of trends in Whale Sighting Sheets and other data collected over the six-year period 2003-2008. The GBRMPA will conduct a review of the industry in 2009, including a reassessment of the swim-with-minkes permits. We will be seeking new funding for 2009 to continue research and monitoring of long-term trends and the sustainability of the swim-with interactions and we hope to be able to begin addressing some of the major unresolved questions about the whales' migration, population and general threats.

Thanks for your support!

The MWP research team would like to express their sincere gratitude to the staff and vessel crew of the nine permitted swim-with-minkes operators, the Great Barrier Reef Marine Park Authority (in particular Sarah Johnson, Anne Cuthand and Dr Karsten Dobbs), the Queensland Parks & Wildlife Service (especially Jesse Low), the Commonwealth Department of the Environment and Water Resources (in particular Dr Iqbal Mohammed), the International Fund for Animal Welfare (in particular Mick McIntyre and Darren Kindleysides) and the Whale and Dolphin Conservation Society (especially Dr Mike Bensley) for their support for this research. Special thanks also to Reto Minder and the team at *Digital Dimensions* for their support and assistance with production of '*Meet the Minkes*' DVD. We would also like to thank our *Friends of the Minke Whale Project* for their generous donations to assist the research, as well as all the many swim-with-minkes participants who have contributed to the Project either financially, and/or by completing a Minke Whale Questionnaire, Interaction Behaviour Diary or donating copies of their minke photos to the photo-ID study. Last but not least, we thank the whales themselves for giving us such rich, inspiring and memorable experiences!

The Minke Whale Project research team

Members of the JCU MWP research team in 2007/08 include Dr Alastair Birtles (Team Leader & Senior Lecturer in Environmental Management & Economics), Prof Peter Valentine (Head, School of Earth & Environmental Sciences), Prof Helene Marsh (Professor of Environmental Science), Dr Natalie Stoeckl (Senior Lecturer in Economics), and PhD students Susan Sobtzick, Arnold Mangott and Matt Curnock. 2007 season MWP research volunteers included Gloria Hidalgo Figueras, Lauren Hill, Veronique Morellin, Andrea Monge Rodriguez, Petra (Ichie) Lura, Sam Noonan, Mimi Takahashi and Anna Taweras. We acknowledge the long-standing contribution to the MWP of our colleague and friend, the late Dr Peter Arnold (1949-2004).

For further information please contact:

Dr Alastair Birtles
Tourism, School of Business, James Cook University, QLD 4811
T: 07 4781 4736; F: 07 4781 4018; E: Alastair.Birtles@jcu.edu.au

Mr Matt Curnock
Tourism, School of Business, James Cook University, QLD 4811
T: 07 4781 5426; F: 07 4781 4018; E: Matthew.Curnock@jcu.edu.au

The Minke Whale Project is a combined initiative of James Cook University, the Museum of Tropical Queensland and *Undersea Explorer*. The Project has been partially funded by the Great Barrier Reef Marine Park Authority 2003-2008 under the Dwarf Minke Whale Tourism Monitoring Program, the CRC Reef Research Centre 2004-2006, the Destination Tourism Competitive Research Centre PhD student support 2006-2007), CRARIEA (2004) and the Marine and Tropical Sciences Research Facility (MTSRF, 2006-2010). It would not be possible without the support of *Undersea Explorer* and other CRARIEA members.

CRC Reef MWP website: www.reef.crc.org.au/discoveryforyou/animals/minkewhales.html
New Minke Whale Project website under construction: www.minkewhaleproject.org
The GBRMPA Dwarf Minke Whale Tourism Monitoring Programme
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/natural_values/threatened_species/dwarf_minke_whales

Appendix 7: Vessel effort data completeness of coverage and presence of researchers on SWW-endorsed vessels during the 2006-2008 minke whale seasons (June-July only).

2006

Vessel	1st to 30th June 2006																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Undersea Explorer				v	v	v	v	v	v		v	v	v	v	v	v		v	v	v	v	v	v		v	v	v	v	v	v
Spoil Sport																v	v	v												v
Nimrod Explorer																														
Taka														v	v	v					v	v	v					v	v	v
Floreat																														
Poseidon III																														
Aristocat IV																														
Silver Sonic																														

Vessel	1st to 31st July 2006																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Undersea Explorer		v	v	v	v	v	v		v	v	v	v	v	v		v	v	v	v	v	v										
Spoil Sport	v	v	v	v																											
Nimrod Explorer																															
Taka												v	v	v																	
Floreat																															
Poseidon III																															
Aristocat IV																															
Silver Sonic																															

Legend:		**Researcher on-board? (Y/N)**	**Total number of vessel days**
	= Vessel in port/marina all day	N/A	32
	= Vessel in Coral Sea (outside GBRMP)	N/A	21
	= Vessel Movement Log (VML) only (completed by crew)	N	46
	= Researcher Log Sheet (RLS) only (completed by researcher)	Y	12
v	= RLS + VML	Y	25
	= RLS + GPS track log (via *Logger* or handheld GPS)	Y	19
v	= RLS + VML + GPS track log	Y	37
	= No effort data collected + no researcher on-board	N	296

2007

Vessel	1st to 30th June 2007																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Undersea Explorer			v	v	v	v	v	v		v	v	v	v	v	v															
Spoil Sport																		v	v	v		v	v	v						
Nimrod Explorer																								v	v	v	v	v	v	v
Taka																				v	v	v					v	v	v	
Floreat																														
Poseidon III																														
Aristocat IV																														
Silver Sonic																														

Vessel	1st to 31st July 2007																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Undersea Explorer																															
Spoil Sport													v	v	v	v	v	v													
Nimrod Explorer	v							v	v	v								v	v	v											
Taka				v	v	v								v		v	v														
Floreat																															
Poseidon III																															
Aristocat IV																															
Silver Sonic																															

Legend:		Researcher on-board? (Y/N)	Total number of vessel days
	= Vessel in port/marina all day	N/A	28
	= Vessel in Coral Sea (outside GBRMP)	N/A	21
	= Vessel Movement Log (VML) only (completed by crew)	N	78
	= Researcher Log Sheet (RLS) only (completed by researcher)	Y	1
v	= RLS + VML	Y	0
	= RLS + GPS track log (via *Logger* or handheld GPS)	Y	62
v	= RLS + VML + GPS track log	Y	50
	= No effort data collected + no researcher on-board	N	248

2008

Vessel	1st to 30th June 2008																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Undersea Explorer																														
Spoil Sport													v	v	v	v	v	v		v	v	v	v	v	v		v	v	v	v
Nimrod Explorer											v	v	v												v	v	v	v	v	v
Taka											v	v	v					v	v	v					v	v	v			
Floreat																														
*Eye to Eye**																														
Poseidon III																														
Aristocat IV																														v
Silver Sonic																														

Vessel	1st to 31st July 2008																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Undersea Explorer																															
Spoil Sport	v	v		v	v	v	v	v	v									v	v			v	v								
Nimrod Explorer		v			v	v	v		v	v	v	v	v	v																	
Taka																							v	v	v						
Floreat																															
*Eye to Eye**																															
Poseidon III																															
Aristocat IV					v															v	v										
Silver Sonic	v					v	v														v					v					

New operator commenced trips in 2008 using three different vessels (no overlapping trips).

Legend:		Researcher on-board? (Y/N)	Total number of vessel days
	= Vessel in port/marina all day	N/A	68
	= Vessel in Coral Sea (outside GBRMP)	N/A	21
	= Vessel Movement Log (VML) only (completed by crew)	N	155
	= Researcher Log Sheet (RLS) only (completed by researcher)	Y	14
v	= RLS + VML	Y	68
	= RLS + GPS track log (via *Logger* or handheld GPS)	Y	42
v	= RLS + VML + GPS track log	Y	0
	= No effort data collected + no researcher on-board	N	181

Appendix 8: Instructions for Minke Whale Project research volunteers conducting field work (2008)

2 June 2008

Minke Whale Project Research Volunteers – 2008 Field Season Information

Dear Team Member,

Thank you for volunteering to help the Minke Whale Project in 2008! Your help in collecting data during the field season is greatly appreciated, and we hope you enjoy your trip(s) and minke whale encounters while collecting vitally important sightings, photo-ID, behavioural and passenger data. This letter outlines what you can expect from the vessels and from the Minke Whale Project, and will help you prepare for your fieldwork. We have also outlined our expectations from you as a JCU Research Volunteer for the Minke Whale Project.

Before your trip

There are several items of paperwork that you must complete before you leave JCU for your trip, for insurance and liability purposes:

1. JCU Travel – please contact Susan Sobtzick [redacted] or Matt Curnock [redacted] and supply the necessary information, sign the forms, and Susan or Matt will submit these on your behalf.
2. JCU Field Trip Induction Form – outlining potential risks of fieldwork plus your next of kin details.
3. JCU Snorkelling Register Personal Questionnaire – via Susan or Matt. Please note that when conducting fieldwork for the Minke Whale Project, **any in-water data collection is to be performed on snorkel only** (in accordance with the Code of Practice for Dwarf Minke Whale Interactions). We realise that some of you will be conducting your fieldwork aboard a live-aboard diving vessel on the outer Great Barrier Reef, and you are welcome to participate in **recreational scuba dives** during your free time (dependent upon your SCUBA certification & under the instruction of the vessel crew). Unless you are on the JCU SCUBA Diving Register and have submitted a personal Dive Plan (with relevant medical certificate) to the University Dive Officer (Phil Osmond, 4729), **you are not permitted to conduct any fieldwork for JCU or the Minke Whale Project using SCUBA equipment**.

Travel to Cairns/Port Douglas

After completing and submitting the above forms, you will need to arrange your own transportation to meet the vessel for departure from either Cairns or Townsville. A complete itinerary for your trips, along with the vessel's itinerary can be obtained from Matt Curnock. Unfortunately the Minke Whale Project does not have enough funds for the 2008 season to cover all of your costs of travel, accommodation and meals. We can however reimburse some of your expenses associated with travel and accommodation only (up to $25 per night maximum for accommodation; *enough for a backpacker hostel*). **All travel and accommodation reimbursements must be pre-approved by Matt Curnock before you travel, and receipts must be provided to claim these costs back at the end of the season**. Any expenses you incur that are not pre-approved by Matt will not be reimbursed. Please note also that if you intend to self-drive, your vehicle must be registered with JCU (comprehensive insurance required) and its registration number provided on your JCU Travel Request form.

Once you have received notification of your booking on a dive trip(s), you will be responsible for organising your own travel to & from Cairns/Port Douglas, along with any accommodation, and **you must provide your complete travel details to Matt as soon as possible before you leave Townsville**. We will make our best efforts to ensure that any trips you take have the minimum waiting time between them, however in some cases a short stay in Cairns or Port Douglas in between trips may be preferable to travelling back to and from Townsville in a short period. You will need to make your own arrangements for any overnight stays and meals in Cairns or Port Douglas. Whilst on any live-aboard trips, meals (and sleeping arrangements) are provided by the operator free of charge (and we are very grateful to them for this).

When meeting the vessel

Please make sure to arrive at the specified departure point for your vessel on time, with neat and tidy appearance. **Office staff and vessel crew will be aware of your presence as a JCU Minke Whale Project researcher, and will identify you to other paying guests as such.**

You may be asked many questions about minke whales and the research project right from the beginning! We realise that you are not an expert whale biologist and you are not expected to be knowledgeable on all issues surrounding dwarf minke whales. It's okay to not know the answers to some questions (and not a lot is actually known by anyone about these mysterious whales), however you will have several resources to refer to in your field kit and you can direct passengers to these or to our website/emails for later follow ups. Your enthusiasm about the whales, the research and to the passengers' involvement (by completing questionnaires & Interaction Behaviour Diaries, providing photos/video and sharing observations) will be greatly appreciated by the passengers and crew alike.

Your role as a researcher on the vessel

Your primary role as a researcher on the vessel is to collect data on whale sightings, search effort and whale behaviours (onto the data sheets provided in your field kit). This involves:

1. Conducting a dedicated watch for whales during daylight hours

This involves spending as much time as possible (during daylight hours) watching out from a suitable vantage point on the vessel (usually the top deck) scanning the surrounding waters and horizon for any signs of minke whales.

What to look for:

Dwarf minke whales are quite small compared to other baleen whales and are therefore much harder to spot, especially in the rough seas typical of the northern GBR at this time of year. Whilst occasionally breaches can be seen from some kilometres away, their usual surface behaviour (single short breaths at the surface) can be very difficult to see at distances greater than 100m, due to the grey colouration of their skin on the upper side of their body, their small dorsal fin, and lack of a 'blow' or 'spout' when they exhale. Quite often the first sighting of a dwarf minke whale will be when it is already very close to the boat (data from Arnold's PhD study).

> *N.B. You may occasionally see a large splash of white water in the distance (sometimes repeated many times in the same location) – this is quite likely to be a dwarf minke whale (or more than one) breaching and we want you to record when and approximately where these occur (however, if in <u>exactly</u> the same place, it could be wave action on a reef or bommie). Sightings such as these should only be recorded as an 'encounter' with a minke if you and/or the crew are able to confirm the sighting definitely is a minke whale.*

On board the primary research vessel *Undersea Explorer* a dedicated watch is maintained consistently throughout the entire day, however there are usually two or more researchers on board to take shifts. If you're on another vessel as the only researcher, we understand that you can't be expected to stand watch all day without a break (e.g. lunch, toilet) and you are welcome to take time out occasionally to participate in a recreational dive (a single dive per day is fine with us, not including any potential night dives). We do however need you to keep a **detailed log of your time spent on watch**, including any additional search effort from passengers or crew (who might help to look for whales when the vessel is steaming between dive sites). Please remember that you are onboard free of charge as a JCU researcher, so **crew and passengers will be expecting you to keep watch** and record minke searches and sightings, and not just be taking part in a free dive trip.

What to do when a whale is sighted, (whether close to the boat or breaching in the distance):

(*Note: see the Whale Sighting Sheet (<u>Part A</u>) which outlines the most important information needed at the time when whales are first sighted.*)

1. Immediately record the time of first sighting.
2. Record the GPS location <u>of the vessel</u> (if a whale is breaching in the distance, the skipper or crew may also be able to help you work out an approximate GPS location of the breaching whale(s), but this should be noted as approximate only).
3. Record the approximate distance of the whale(s) to the vessel at the time of first sighting, and the time they first approached the boat to within approx. 30m (if they do approach). *(NB. for some encounters, the first sighting of a whale may be when it is already closer than 30m to the boat!)*

4. Inform the skipper and/or crew if they're not already aware.
5. Record your surface observations, along with times, of significant activities including whale, vessel and diver/snorkeller behaviours, numbers and relative sizes of whales.
6. If people are in the water (e.g. diving already when the whale arrives) or entering the water to swim with the whale(s), record swimmer entry times, deployment and use of ropes, use of the Code of Practice and any whale behaviours in relation to swimmers and the vessel. Drawing diagrams of the vessel, reef/site area, rope and swimmer positions can be useful for later clarification.
7. Get a good overview of the encounter by observing from the top deck of the vessel before entering the water yourself. Passengers will be very keen to see the whale(s) in the water and will probably rush to get in for the first time, and may even crowd each other and jostle for space on the line. It is important that you don't displace any passengers on the line. Just be patient – if the skipper doesn't have to move the vessel in a hurry (ask how much time you've got to spend at the site) then there's a good chance the whale(s) will stay with the boat for a while (the overall mean encounter time is around 1½ hours!).
8. **Make sure you follow the Code of Practice at all times!** You will be setting an example for other passengers and crew and they are likely to pay close attention to your behaviour in the water.
9. Recording underwater observations can be quite difficult in the typically rough conditions, especially when holding onto a rope at the same time (e.g. handwriting can be illegible, u/w slates/paper can drift away). We do not expect you to be able record your underwater observations in great detail. It is useful to keep track of numbers of whales (more may arrive or some may leave through the course of an encounter), any significant behaviours of whales in relation to swimmers or other whales, approach distances to swimmers, and any outstanding features on individual animals which might help identify them (e.g. unusual scarring or natural markings) and record this as soon as you exit the water.
10. If you have an underwater camera, any close-up photos you take of whales can be very helpful in identifying individual animals. Make sure you record the date, time and location for any photos taken. Also **encourage crew and passengers to donate their underwater photographs/video** (along with date, time & location information) to the Minke Whale Project to help expand the catalogue of identified whales and help track their movements.

At the end of the encounter

(*Note: see the Whale Sighting Sheet (Part B) which outlines the most important information needed immediately after whales can no longer be seen – either because the whales left the boat, or the boat left the whales to move to a new site.*)

1. Write down your in-water observations as soon as possible and return to the top deck to continue surface observations.
2. Record times for: (i) swimmers exiting the water,
   (ii) pulling in ropes, and
   (iii) the boat moving away from the site,
   all the while keeping track of the presence of whales to record the time of last sighting.
3. If the vessel moved during the course of the encounter (e.g. a drifting encounter), record the vessel location (GPS position) at the time of the last sighting of a whale.
4. Record whether the boat left the whales (i.e. to move to a different site) or if the whales left the boat. If the vessel breaks off the encounter, note the positions of the whales as the boat moves away from the site, and whether the whales follow the vessel.
5. Assist crew if they need any times/GPS locations for them to complete a Whale Sighting Sheet (WSS2008), but do not fill in the WSS for them (this is their responsibility and is a GBRMPA permit condition).
6. Resume surface watch. At the end of the day, transcribe your records to the appropriate encounter log sheets in your field kit (described below).

2. Recording all vessel movements, GPS locations, weather conditions and other observations

We would like you to log each time the vessel moves (during the day only), the time spent steaming between dive sites and the location after arrival at each site. You may need to get the permission of the skipper to access the wheelhouse periodically to check the GPS to record the vessel's location. The **Researcher Log Sheet (RLS2008)** outlines the other observations we would like you to record (e.g. weather conditions, dive times and the presence of other vessels in the area) as the vessel moves between dive sites.

Your watch time and observations should be recorded through the day using a pocket spiral notebook (loose pieces of paper tend to get blown overboard in the gusty winds), and transcribed to the Researcher Log Sheet either periodically through the day or in the evening at the end of your watch.

3. Minke whale passenger briefings

We would like you to observe and later record details of any minke briefings on your vessel (using the **Minke Briefing Log Sheet**). Details of briefings should be recorded afterwards when on your own, so that you don't put any 'pressure' on the crew or distract them from their job.

The crew might ask you to give the passengers an initial briefing on the Code of Practice, and they will pay attention to how you do this too. It is therefore important that you are very familiar with the Code of Practice, the **Best Practice Guidelines** (pink laminated sheet) and **Briefing Guidelines** (yellow double-sided laminated sheet) before your trip. The key points (required by law under the EPBC Regulations) are also highlighted in blue on p.5 of the CRC State of Knowledge brochure.

Note that the details you record on the Minke Briefing Log Sheet from crew minke briefings will not be used for any comparisons of individual operations or crew. Rather, we wish to evaluate the interpretive material presented by the industry as a whole (much of which we have developed and produced for them over the years), and make general comparisons between live-aboard operations and day-boats (which have quite different interpretive needs) so that we can continue to develop and improve interpretive material for the industry in future seasons.

4. Other important roles include:

- Helping crew in the collection of the (voluntary) **passenger questionnaires** (**MWQ2008**) at the end of the trip;
- Encouraging passengers to fill in the **Interaction Behaviour Diary** (**IBD2008**) after minke whale encounters (you can also fill this in yourself – multiple logs from a number of passengers and crew for an encounter are welcomed – they may see quite different behaviours and will have very different experiences/reactions);
- Encourage crew & passengers to **donate copies of their underwater minke pics/video footage**.
- Providing an evening **slide show presentation** (if requested by crew) to passengers (PowerPoint presentation and/or slides and notes are provided in your field kit);
- Talking to crew and passengers to learn about their experiences with minke whales;
- Answering (or directing appropriately) questions about the whales, the Minke Whale Project and the Code of Practice from crew and passengers (use especially the "State of Knowledge" brochure and our reports and papers as sources of info);
- Being familiar with the full Code of Practice and the Best Practice Guidelines (1pp. pink) and Briefing Guidelines (2pp. yellow) so you can observe and record any problems with their application;
- Observing and recording other interesting details of interactions between minke whales, the vessel and swimmers;
- Being friendly and enthusiastic with passengers and crew.

Roles you are not expected to perform:

- **Policing the Code of Practice** (if you observe any actions by your passengers, crew or other vessels that are not within the Code, which you feel may impact the whales, you should take detailed notes of this, but it is not your role to inform the skipper or crew or attempt to change their normal operations. If you observe any breaches of the EPBC Act or GBRMPA Regulations, inform Matt Curnock, A/Prof Peter Valentine or Dr Alastair Birtles, providing a detailed record of your observations, and we will discuss the matter privately with the operator concerned and/or pursue the matter further if necessary);
- **Any duties regarding operation of the vessel as performed by the crew** (you are not expected to help them with their day-to-day operations which may require specific qualifications, however it might be a nice gesture to help out with the dishes after dinner, or *make your own bed in the morning*);
- **Giving advice to the skipper/crew on the vessel's itinerary, management or operations** (It is important to recognise that some of the more experienced skippers and crew have been involved with minke whales for 15+ years and know a great deal about their behaviour and how to manage passengers in encounters. We have learned a great deal from such individuals and you can too);

- **Completing the Whale Sighting Sheet** (WSS2008 – this is a GBRMPA permit requirement of the vessel and must be completed by the skipper/crew) **or Vessel Movement Log** (VML2008 – a voluntary recording log for use by the skipper/crew).

The Minke Whale Project has built up a collaborative partnership with these operations over many years, and they are highly supportive of our research. We are greatly appreciative that they continue to offer us free berths for researchers to conduct research on their vessels each year and we hope to continue this close working relationship with them into the future. **You can help us build on this relationship by following the above guidelines and by having a great time on your trip!**

Field equipment and data sheets

Already on the boat, there should be:

- The Minke Whale Information Package (MWIP2008)
- The Minke Whale Project Interpretive DVD ("Meet the Minkes")
- Copies of the "State of Knowledge" CRC colour brochure
- Laminated copies of the Briefing Guidelines (yellow double-sided sheet)
- Laminated copies of the Best Practice Guidelines (pink single-sided sheet)
- **Data sheets:**
    - Whale Sighting Sheets (WSS2008)
    - Interaction Behaviour Diary (IBD2008)
    - Minke Whale Questionnaire (MWQ2008)
    - Vessel Movement Log (VML2008)

If any of the interpretive material or guidelines are missing, the crew can contact Matt Curnock to arrange further copies. The boat may also have a copy of the video documentary "Mystery of the Minkes" (if not, and if they want a copy they can be obtained from Digital Dimensions: 4771 5116). If any of the data sheets are missing, you can replenish them from spares in your kit.

The crew may give you completed data sheets and/or photos/video footage of whale encounters. These should be taken off the boat by you at the end of your trip and submitted to Matt as soon as possible when you return to JCU.

Field kit

In your field kit (white nally bin) you will find:

- Copy of Commonwealth DEH Research Permit
- Copy of GBRMPA Research Permit
- VHS/DVD copy of "Mystery of the Minkes" National Geographic Documentary Video
- Spare copy of the Minke Whale Project Interpretive DVD ("Meet the Minkes")
- Contact details for each permitted operator
- Binoculars
- Clipboards
- Pens & pencils
- Spiral notebooks (for daily observations)
- CD-ROM (PowerPoint presentation) + set of 40 slides if data projector is unavailable (for slideshow presentation if requested by crew: *Note in some cases the itinerary may not allow time for you to do this, or the crew may want to give their own presentation instead*.)
- CD-ROM of Minke Whale Identification Guide ("*Take a Closer Look*")
- Crib notes to accompany slides
- Blank DVDs, CDs and/or a USB drive to store copies of digital images for photo-ID
- **Spare copies of data sheets:**
    - Whale Sighting Sheets (WSS2008; for skipper/crew's use only)
    - Vessel Movement Log (VML2008; for skipper/crew's use only)
    - Interaction Behaviour Diary (IBD2008; for anyone after an encounter)
    - Minke Whale Questionnaire (MWQ2008; for passengers at end of trip)

  Distribute spares only if the vessel's copies have run out or can't be found on-board
- **Data sheets for you to complete:**
    - Researcher Log Sheet (RLS2008 – for you to complete for each vessel movement each day)
    - Topside encounter sheets (for topside observations: complete after each minke encounter)
    - Researcher Minke Whale Sighting Sheet (complete after each minke encounter)
    - Minke Briefing Log Sheet (one per trip)

If another researcher is replacing you on the vessel after your trip, please leave the complete kit on the vessel. If you are the last researcher on this vessel for the season (Matt will tell you in advance if you are), you will need to take the kit off the boat with you when you depart and return it to JCU with any completed data sheets. We can reimburse any extra freight charges for bringing these back on the bus.

Personal things you will need to bring

- Hat
- Sunscreen (please use this extensively as you will be spending a lot of time outdoors)
- Sunglasses (should be polarised to improve visibility of the whales under the water's surface)
- Wet weather gear (including a **good waterproof jacket** – at this time of year the weather is typically windy with brief showers of rain and the sea is rough. You will be spending a lot of time each day searching for whales usually from the top deck (outdoors) of the boat)
- Swimming costume
- Towel
- Camera / underwater camera (optional if you have one)
- Sufficient changes of clothes (including warm clothing), toiletries & any other personal items
- Personal wetsuit, mask, snorkel, fins, SCUBA gear, dive computer (If you own these - if you do not have any of your own dive/snorkel gear, these can be provided by the vessel, however they may charge you for hire. A cheaper alternative is to hire equipment from the JCU Dive Club before you depart Townsville.) The dive gear is your own responsibility for your private recreational dives.

Contact details & additional info

If you experience any problems, logistical or otherwise, or have any queries relating to your fieldwork, your first contact should be Matt Curnock (contact details below) and you are welcome to direct vessel crew/office staff enquiries during the season to Matt. (Alastair will also be available to be contacted back at JCU from 27th July, but will be in the field until then.)

Matt Curnock, PhD Candidate – Minke Whale Project
Tourism, School of Business, James Cook University, Townsville, QLD 4811
[redacted]

The Minke Whale Project websites are: http://www.minkewhaleproject.org (new site under development), and http://www.reef.crc.org.au//discover/plantsanimals/minke/index.html (older CRC Reef site). You are encouraged to familiarise yourself with their contents, and direct passengers & crew to them for further information. The Great Barrier Reef Marine Park Authority also has information about the MWP, at: http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/natural_values/whales_dolphins/dwarf_minke_whales.

Members of the MWP research team will be on board the vessel *Undersea Explorer* through most of the season and may be in radio contact with the skippers of vessels (and possibly you also) to share whale sightings and other information as we pass each other out on the Reef.

I hope you have a wonderful and safe experience on your trip. I look forward to your contributions to the Minke Whale Project 2008 field season's data, and to sharing details of your minke whale encounters at the end of the season!

Best wishes,

Dr Alastair Birtles
Team Leader – Minke Whale Project
Tourism, School of Business,
James Cook University
Townsville, QLD 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

MINKE WHALE PROJECT

Vessel Movement Log 2008

FOR SKIPPER AND/OR CREW TO LOG VESSEL MOVEMENTS AND ANY WHALE SEARCH EFFORT

Vessel name: _____

Skipper name: _____

Trip dates: Start: _____/_____/2008 End: _____/_____/2008

Number of passengers: _____

Number of crew: _____

Email/contact details: _____

START EACH TRIP WITH A NEW BOOK

Minke Whale Project: Vessel Movement Log

For the past 12 years, scientists from James Cook University and the Museum of Tropical Queensland have been studying the biology of the Great Barrier Reef's dwarf minke whales. They have been able to do this thanks to the help of the live-aboard dive boats, their crews and the passengers themselves.

This Vessel Movement Log has been developed to help improve our understanding of the local distribution and abundance of the whales, by collecting information on the movements of your vessel so that we can compare industry 'effort' in the area with whale sightings.

If you would like to help us collect this information, please fill out this Log each day as the vessel conducts its itinerary and moves between dive sites. Please start each day on a new page.

Your records are very valuable to our study.

Please return completed forms to:

Matt Curnock
PhD Candidate
Tourism, School of Business
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

or

Dr Alastair Birtles
Senior Lecturer & Team Leader, Minke Whale Project
Tourism, School of Business
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

This project is supported by the Great Barrier Reef Marine Park Authority and the Cod Hole and Ribbon Reefs Operators Association (CHARROA): "Dwarf Minke Whale Tourism Research and Monitoring Programme."

Summaries of the season's data will be provided to operators.

Thank you for your help with this research.

JCU JAMES COOK UNIVERSITY

CHARROA
Cod Hole and Ribbon Reef Operators Association

Australian Government
Great Barrier Reef Marine Park Authority

museum of tropical queensland
queensland museum

Please start each day on a new page

Date: ……/……/ **2008** Skipper's name: ……

Vessel movements & locations during daylight hours:

Start of Day

Time at start of log: _____

If anchored / moored – please fill in details starting at Site 1 below.

If steaming: Location at start of log: Lat: ……**(S)** Long: …… **(E)**

- Intended destination (site/reef name) ……..

Site 1 – Name of site: _____

Lat: ……..…… **(S)** Long: ……..…….. **(E)**

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: Lat: ……..…….…… (S) Long: ……..…..…….. (E)

Time of departure: ……. Intended destination (site/reef name) ……..……..…..

While moving: Any crew/pax on watch for whales?….. □ No □ Yes - how many? ……..……..……..

Any deviations from a direct route when moving? ……

……

Site 2 – Name of site: _____

Lat: ……..…… **(S)** Long: ……..…….. **(E)**

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: Lat: ……..…….…… (S) Long: ……..…..…….. (E)

Time of departure: ……. Intended destination (site/reef name) ……..……..…..

While moving: Any crew/pax on watch for whales? □ No □ Yes - how many? ……..……..……..

Any deviations from a direct route when moving? ……

……

Site 3 – Name of site: _____

Lat: ……..…… **(S)** Long: ……..…….. **(E)**

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: Lat: ……..…….…… (S) Long: ……..…..…….. (E)

Time of departure: ……. Intended destination (site/reef name) ……..……..…..

While moving: Any crew/pax on watch for whales?….. □ No □ Yes - how many? ……..……..……..

Any deviations from a direct route when moving? ……

……

Site 4 – Name of site: _____

Lat: ……..…… **(S)** Long: ……..…….. **(E)**

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: Lat: ……..…….…… (S) Long: ……..…..…….. (E)

Time of departure: ……. Intended destination (site/reef name) ……..……..…..

While moving: Any crew/pax on watch for whales?….. □ No □ Yes - how many? ……..……..……..

Any deviations from a direct route when moving? ……

……

If additional sites are visited in one day, please continue on a new sheet.

Appendix 10: Researcher Log Sheet 2008

Researcher Log Sheet: Vessel Movements, Search Effort & Site Use Monitoring

Please start each day on a new front page, continue on multiple pages as necessary

Date: ……../……../ 2008 **Researcher's name**: ……

Sheet number (start at 1 for each day): …… **Day of trip:** (*e.g. 1st, 2nd*) ……

Vessel name: ……

Start of Day (*complete this box for the first sheet of each day only*)

Observation start time: _____ □ Anchored / □ Moored / □ Steaming / □ Drifting

If anchored / moored / drifting – please fill in details starting at Site 1 below.

If steaming: - Location at start of log: **Lat**: **……(S)** **Long**: **…… (E)**

- please fill in details starting at Move 1 below.

Site 1 – Name of site: _____

Lat: …….. (S) **Long**: …….. (E)

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: **Lat**: …… (S) **Long**: …….. (E)

Sea State: …..…… Wind direction: …… Wind speed: …… **kn.** Cloud Cover: ……..… / **8ths**

Before departure: Any whales seen whilst at this site? (*please circle one*): **Y / N** ; In-water interaction? **Y / N**

No. of people on watch for whales during stay at this site? (*number, times, including yourself*): ……

……

No. of dives conducted at this site? ……

Other vessels in the vicinity during your stay? (*name of vessel(s), time of arrival and/or departure*) ……

……

Move 1 – Intended destination (*site/reef name*): _____ Time of departure: ……..

Watch direction (*by you*): □ Bow / □ Stern / □ Port / □ Starboard **Watch location** (position on boat) ……

While moving: Any deviations from a direct route when moving? **Y / N** (*If yes, give details*)……

……

No. of people on watch for whales? (*number, times, including yourself*): ……

……

Any whales seen while moving? (*please circle one*): **Y / N** (*If yes, and the vessel stops to interact, record this as the next site*)

Other vessels observed whilst moving?... **Y / N** (*If yes: Vessel **ID**, **L**ocation, **T**ime, **A**ctivity*): ……

……

Site 2 – Name of site: _____

Lat: …….. (S) **Long**: …….. (E)

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: **Lat**: …… (S) **Long**: …….. (E)

Sea State: …..…… Wind direction: …… Wind speed: …… **kn.** Cloud Cover: ……..… / **8ths**

Before departure: Any whales seen whilst at this site? (*please circle one*): **Y / N** ; In-water interaction? **Y / N**

No. of people on watch for whales during stay at this site? (*number, times, including yourself*): ……

……

No. of dives conducted at this site? ……

Other vessels in the vicinity during your stay? (*name of vessel(s), time of arrival and/or departure*) ……

……

Move 2 – Intended destination (*site/reef name*): _____ Time of departure: ……..

Watch direction (*by you*): □ Bow / □ Stern / □ Port / □ Starboard **Watch location** (position on boat) ……

While moving: Any deviations from a direct route when moving? **Y / N** (*If yes, give details*)……

……

No. of people on watch for whales? (*number, times, including yourself*): ……

……

Any whales seen while moving? (*please circle one*): **Y / N** (*If yes, and the vessel stops to interact, record this as the next site*)

Other vessels observed whilst moving?... **Y / N** (*If yes: Vessel **ID**, **L**ocation, **T**ime, **A**ctivity*): ……

……

Site 3 – Name of site: _____

Lat: ……..……. (S) **Long**: ……..…….. (E)

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: **Lat**: ……..…….…… (S) **Long**: ……..…..…….. (E)

Sea State: …..…… Wind direction: …… Wind speed: …… **kn.** Cloud Cover: ……..… / **8ths**

Before departure: Any whales seen whilst at this site? (*please circle one*): **Y / N** ; In-water interaction? **Y / N**

No. of people on watch for whales during stay at this site? (*number, times, including yourself*): ……..……

……

No. of dives conducted at this site? ……..…..……..

Other vessels in the vicinity during your stay? (*name of vessel(s), time of arrival and/or departure*) ….……..…...

……

Move 3 – Intended destination (*site/reef name*): _____ Time of departure: ……..

Watch direction (*by you*): □ Bow / □ Stern / □ Port / □ Starboard **Watch location** (position on boat) ……..…..……..

While moving: Any deviations from a direct route when moving? **Y / N** (*If yes, give details*)……..……...

….……..……

No. of people on watch for whales? (*number, times, including yourself*): ……..…….

……

Any whales seen while moving? (*please circle one*): **Y / N** (*If yes, and the vessel stops to interact, record this as the next site*)

Other vessels observed whilst moving?... **Y / N** (*If yes: Vessel **ID**, **L**ocation, **T**ime, **A**ctivity*): ……..……

……

Site 4 – Name of site: _____

Lat: ……..……. (S) **Long**: ……..…….. (E)

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: **Lat**: ……..…….…… (S) **Long**: ……..…..…….. (E)

Sea State: …..…… Wind direction: …… Wind speed: …… **kn.** Cloud Cover: ……..… / **8ths**

Before departure: Any whales seen whilst at this site? (*please circle one*): **Y / N** ; In-water interaction? **Y / N**

No. of people on watch for whales during stay at this site? (*number, times, including yourself*): ……..……

……

No. of dives conducted at this site? ……..…..……..

Other vessels in the vicinity during your stay? (*name of vessel(s), time of arrival and/or departure*) ….……..…...

……

Move 4 – Intended destination (*site/reef name*): _____ Time of departure: ……..

Watch direction (*by you*): □ Bow / □ Stern / □ Port / □ Starboard **Watch location** (position on boat) ……..…..……..

While moving: Any deviations from a direct route when moving? **Y / N** (*If yes, give details*)……..……...

….……..……

No. of people on watch for whales? (*number, times, including yourself*): ……..…….

……

Any whales seen while moving? (*please circle one*): **Y / N** (*If yes, and the vessel stops to interact, record this as the next site*)

Other vessels observed whilst moving?... **Y / N** (*If yes: Vessel **ID**, **L**ocation, **T**ime, **A**ctivity*): ……..……

……

Site 5 – Name of site: _____

Lat: ……..……. (S) **Long**: ……..…….. (E)

Time of arrival: …… □ Anchored / □ Moored / □ Drifting

- If drifting – Location at end of drift: **Lat**: ……..…….…… (S) **Long**: ……..…..…….. (E)

Sea State: …..…… Wind direction: …… Wind speed: …… **kn.** Cloud Cover: ……..… / **8ths**

Before departure: Any whales seen whilst at this site? (*please circle one*): **Y / N** ; In-water interaction? **Y / N**

No. of people on watch for whales during stay at this site? (*number, times, including yourself*): ……..……

……

No. of dives conducted at this site? ……..…..……..

Other vessels in the vicinity during your stay? (*name of vessel(s), time of arrival and/or departure*) ….……..…...

……

Appendix 11:

MINKE WHALE QUESTIONNAIRE 2006

Dwarf minke whale
Balaenoptera acutorostrata

JCU JAMES COOK UNIVERSITY

CHARROA
Cod Hole and Ribbon Reef Operators Association

Australian Government
Great Barrier Reef Marine Park Authority

museum of tropical queensland
queensland museum

MINKE WHALE PROJECT

Introduction

The little known dwarf minke whale was only discovered in Great Barrier Reef waters during the 1980s. Researchers involved in the Minke Whale Project have been studying various aspects of its biology and ecology over the last few years including establishing a catalogue of identified individuals. Growing numbers of people are swimming with these whales in the Cairns/Cooktown Management Areas of the Great Barrier Reef. We want to ensure that visitors have high quality experiences while minimising the impact on the whales and ensuring the long-term ecological sustainability of these interactions. **In this questionnaire, we seek to understand people's experiences, and to assess management implications for this industry**. The information you provide in this questionnaire will contribute to three PhD student projects at James Cook University (Matt Curnock, Arnold Mangott and Susan Sobtzick) and will assist with the planning and management of sustainable swim-with-whales tourism both locally and in other areas.

Information regarding individual participants is strictly confidential. Your participation is entirely voluntary. This questionnaire will take approximately 10-15 minutes to complete. If you can help this research by completing this questionnaire it will be greatly appreciated. Please answer all questions as best you can. We look forward to your comments.

For further information please visit the Minke Whale Project website:
http://www.reef.crc.org.au//discover/plantsanimals/minke/index.html

Or the Great Barrier Reef Marine Park Authority website:
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/dwarf_minke_whales.html

Or contact:

Matt Curnock, Arnold Mangott & Susan Sobtzick
PhD Candidates
Tourism Program, Western Campus
James Cook University, Townsville 4811
Ph: [redacted] Fax: [redacted]
Email: [redacted]

Dr Alastair Birtles
Senior Lecturer & Team Leader, Minke Whale Project
Tourism Program, Western Campus
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

NOTE TO OPERATORS

You are welcome to request a summary of these questionnaire results for your boat. Information concerning specific named boats is STRICTLY CONFIDENTIAL. It will neither be published, nor released to managers or other operators. Your support in conducting this survey is greatly appreciated and we hope that the information collected will be of use to you in your operation and lead to the long-term sustainability of the industry.

This research project is being undertaken with the support of local tourism operators, the Cod Hole And Ribbon Reefs Operators Association (CHARROA), the Great Barrier Reef Marine Park Authority (GBRMPA), and the Queensland Parks and Wildlife Service (Environmental Protection Agency). We gratefully acknowledge the long-standing participation in this project of *Undersea Explorer*. The sampling period of this study is over the main minke whale season (May to August, 2006).

When you have completed this questionnaire, please return it to the crew of your boat.

You are welcome to tear off and keep this cover page.

Thank you for your participation.

1. Dates of trip: **Start:**……. **Finish:**…….. **2006** **2**. Name of boat: _____
(for this trip)

3. ☐ Male ☐ Female **4**. Year of Birth ___ ___ ___ ___

5. Name of your usual country of residence ? _____
~ If Australia, please include postcode: ___ ___ ___ ___

6. Is this your first trip to the Great Barrier Reef ? ☐ Yes ☐ No … Number of previous visits? _____

7. What scuba diving qualifications do you hold ? (*Please tick one*)

☐ None ☐ Open Water ☐ Advanced ☐ Rescue ☐ Dive Master ☐ Instructor ☐ Other:_____

8. What year did you begin scuba diving? __ __ __ __ **9**. How many dives have you made in your life (approx): _____dives

10. Had you ever heard about minke whales on the Great Barrier Reef before this trip? ☐ Yes ☐ No

- If yes, where did you first hear about them? _____
- Had you seen or swum with minke whales on the Great Barrier Reef before this trip? ☐ No ☐ Yes - number of times and where? _____

11. Have you swum with whales or dolphins anywhere else before? ☐ No ☐ Yes - Where? _____

_____

12. Have you participated in whale watching in other places? ☐ No ☐ Yes - number of times and where? _____

_____

13. Was your visit to Far North Queensland primarily to see minke whales? ☐ No ☐ Yes

14. What was your primary reason for taking this dive trip to the Great Barrier Reef? (*Please tick one box only*)

☐ Diving the Great Barrier Reef (in general) ☐ Diving specific sites on the Ribbon Reefs
☐ Diving Osprey Reef in the Coral Sea ☐ To see and/or swim with minke whales
☐ Other reason?: _____

15. What are the most important reasons you chose this particular vessel for your dive trip?

_____

16. Did you swim with minke whale(s) on SCUBA during this trip? ☐ Yes ☐ No

17. Did you swim with minke whales(s) on snorkel during this trip? ☐ Yes ☐ No

18. How many minke whales did you see on this trip? _____ **19**. What was the closest approach to you by a whale? _____

20. Did you take any underwater photographs or video of minke whales on this trip? ☐ Yes ☐ No

- *If Yes* – are you willing to donate copies of your minke whale images to a photo-ID study? ☐ Yes ☐ No
  – please see contact details on cover page to send copies of photos/video

21. Did you write an entry into the Interaction Behaviour Diary after a minke whale encounter on this trip? ☐ Yes ☐ No

If Yes, for how many encounters did you do this? _____ (*Thank you!*)

22. Overall, how well did your minke whale experience(s) meet your expectations?
(Please tick one box and give a brief explanation of why you feel this way)

☐	☐	☐	☐	☐
well below my expectations	somewhat below my expectations	met my expectations	somewhat above my expectations	well above my expectations

_____

_____

23. How would you rate your overall satisfaction with your minke whale experience(s) ? *(Please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

- *Please explain why:*

_____

24. Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew ? *(please circle one number)*

Very poorly managed **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Extremely well managed

- *Please explain why:*

_____

_____

25. Do you feel you were adequately prepared for your encounter(s) with minke whales? ☐ Yes ☐ No

- *Please explain:*

_____

_____

26. Did any of the following impact negatively on your minke whale experience? *(Please tick as many as apply)*

- ☐ Other divers chasing/following whale(s)
- ☐ Too many divers/snorkellers in the water
- ☐ Whales not coming close enough
- ☐ Divers taking flash photos
- ☐ Potentially dangerous marine animals (sharks/sea snakes)
- ☐ Nervousness about being in the water with whale(s)
- ☐ Splashing/kicking by other passengers
- ☐ Food scraps in water
- ☐ Whale(s) being scared away
- ☐ Encounters with whales too short
- ☐ Not enough whales
- ☐ Rope was too crowded
- ☐ Seas too rough
- ☐ Bad visibility
- ☐ Being scared by the whale(s) behavior
- ☐ Bubbles from SCUBA disturbing the whale(s)
- ☐ Other _____

_____

27. Do you feel any concern that this kind of whale-watching (swimming with minkes) might result in some negative impacts on the whales ? ☐ Yes ☐ No

- *Please comment:*

_____

_____

28. Overall, how would you rate the quality of the information you received about minke whales on this trip ? (*please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

29. What information about minke whales did you have access to on this trip ? (*Please tick as many as apply*)

- ☐ Pre-departure minke whale briefing by crew
- ☐ Pre-dive briefing mention of minke whales
- ☐ Specific pre-minke encounter briefing
- ☐ Informal discussions (with staff or other passengers)
- ☐ Minke Whale Identification Guide CD-ROM
- ☐ Minke Whale Identification Guide Booklet *("Take a Closer Look")*
- ☐ Reference books about whales provided on boat
- ☐ Minke Whale Information Package (white folder)
- ☐ Minke Whale Project Reports & Publications
- ☐ "Mystery of the Minkes" video/DVD documentary
- ☐ Presentation / talks by guest whale researcher(s)
- ☐ CRC Reef Current State of Knowledge May 2002 *(colour information brochure)*
- ☐ "Swimming with dwarf minke whales" laminated poster(s)
- ☐ "Protecting Whales & Dolphins" minke whale poster
- ☐ Other: _____

30. What was the best source of information for you about minke whales on this trip?

_____

31. Was there anything specific about which you would have liked more information?

_____

32. Are there any other comments you would like to make about the issues covered by this survey ?

_____

_____

If you would like to join an emailing list for the Minke Whale Project (to receive annual newsletters and research updates), please write your email address here:

_____

THANK YOU FOR YOUR HELP WITH THIS RESEARCH

Appendix 12:

MINKE WHALE QUESTIONNAIRE 2006

(Day boats)

Dwarf minke whale
Balaenoptera acutorostrata

JCU JAMES COOK UNIVERSITY

CHARROA
Cod Hole and Ribbon Reef Operators Association

Australian Government
Great Barrier Reef Marine Park Authority

museum of tropical queensland
queensland museum

MINKE WHALE PROJECT

Introduction

The little known dwarf minke whale was only discovered in Great Barrier Reef waters during the 1980s. Researchers involved in the Minke Whale Project have been studying various aspects of its biology and ecology over the last few years including establishing a catalogue of identified individuals. Growing numbers of people are swimming with these whales in the Cairns/Cooktown Management Areas of the Great Barrier Reef. We want to ensure that visitors have high quality experiences while minimising the impact on the whales and ensuring the long-term ecological sustainability of these interactions. **In this questionnaire, we seek to understand people's experiences, and to assess management implications for this industry**. The information you provide in this questionnaire will contribute to three PhD student projects at James Cook University (Matt Curnock, Arnold Mangott and Susan Sobtzick) and will assist with the planning and management of sustainable swim-with-whales tourism both locally and in other areas.

Information regarding individual participants is strictly confidential. Your participation is entirely voluntary. This questionnaire will take approximately 10-15 minutes to complete. If you can help this research by completing this questionnaire it will be greatly appreciated. Please answer all questions as best you can. We look forward to your comments.

For further information please visit the Minke Whale Project website:
http://www.reef.crc.org.au//discover/plantsanimals/minke/index.html

Or the Great Barrier Reef Marine Park Authority website:
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/dwarf_minke_whales.html

Or contact:

Matt Curnock, Arnold Mangott & Susan Sobtzick
PhD Candidates
Tourism Program, Western Campus
James Cook University, Townsville 4811
Ph: [redacted] Fax: [redacted]
Email: [redacted]

Dr Alastair Birtles
Senior Lecturer & Team Leader, Minke Whale Project
Tourism Program, Western Campus
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

NOTE TO OPERATORS

You are welcome to request a summary of these questionnaire results for your boat. Information concerning specific named boats is STRICTLY CONFIDENTIAL. It will neither be published, nor released to managers or other operators. Your support in conducting this survey is greatly appreciated and we hope that the information collected will be of use to you in your operation and lead to the long-term sustainability of the industry.

This research project is being undertaken with the support of local tourism operators, the Cod Hole And Ribbon Reefs Operators Association (CHARROA), the Great Barrier Reef Marine Park Authority (GBRMPA), and the Queensland Parks and Wildlife Service (Environmental Protection Agency). We gratefully acknowledge the long-standing participation in this project of *Undersea Explorer*. The sampling period of this study is over the main minke whale season (May to August, 2006).

When you have completed this questionnaire, please return it to the crew of your boat.

You are welcome to tear off and keep this cover page.

Thank you for your participation.

1. Date of trip: …… /…..…….. / **2006** **2.** Vessel name: _____

3. ☐ Male ☐ Female **4**. Year of Birth ___ ___ ___ ___

5. Name of your usual country of residence? _____

… If Australia, please include postcode: ___ ___ ___ ___

6. Is this your first trip to the Great Barrier Reef? ☐ Yes ☐ No ..… Number of previous visits? _____

7. Have you visited other coral reefs elsewhere? ☐ Yes ☐ No If yes, how many times? _____

8. What in-water activities did you participate in on this trip today? (*please tick appropriately*)

☐ SCUBA diving ☐ Snorkeling ☐ Swimming ☐ Other …….. ☐ Did not enter the water

9. How would you rate the level of your snorkeling skills? ☐ High ☐ Medium ☐ Low ☐ Do not snorkel

10. What SCUBA diving qualifications do you hold? (*Please tick one*)

☐ None ☐ Open Water ☐ Advanced ☐ Rescue ☐ Dive Master ☐ Instructor ☐ Other:_____

11. If you are a certified SCUBA diver:

(a) What year did you begin scuba diving? __ __ __ __ (b) How many dives have you made in your life (approx)?_____dives

12. Had you ever heard about minke whales on the Great Barrier Reef before this trip? ☐ Yes ☐ No

- If yes, where did you first hear about them? _____
- Had you seen or swum with minke whales on the Great Barrier Reef before this trip? ☐ No ☐ Yes - number of times and where? _____

13. Have you participated in whale watching in other places? ☐ No ☐ Yes - number of times and where? _____

_____

14. What was your primary reason for taking this trip to the Great Barrier Reef today?

_____

15. What are the most important reasons you chose this particular vessel for your dive trip?

_____

16. Did you expect to see any minke whales on this trip today? ☐ Yes ☐ No

17. Did you see a minke whale(s) today - From on board the boat? ☐ Yes ☐ No

- From in the water: - while you were on SCUBA? ☐ Yes ☐ No
  - while you were on snorkel ? ☐ Yes ☐ No
  - If yes, were you holding onto a rope ? ☐ Yes ☐ No

18. How many minke whales did you see today? _____ **19.** What was the closest approach to you by a whale? _____

20. Did you take any underwater photographs or video of minke whales on this trip? ☐ Yes ☐ No

- *If Yes* – are you willing to donate copies of your minke whale images to a photo-ID study? ☐ Yes ☐ No
  – please see contact details on cover page to send copies of photos/video

21. Did you write an entry into the Interaction Behaviour Diary after a minke whale encounter on this trip? ☐ Yes ☐ No

If Yes, for how many encounters did you do this? _____ (*Thank you!*)

22. Overall, how well did your minke whale experience(s) meet your expectations?
(Please tick one box and give a brief explanation of why you feel this way)

☐	☐	☐	☐	☐
well below my expectations	somewhat below my expectations	met my expectations	somewhat above my expectations	well above my expectations

_____

_____

23. How would you rate your overall satisfaction with your minke whale experience today ? *(Please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

- *Please explain why:*

_____

24. Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew ? *(please circle one number)*

Very poorly managed **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Extremely well managed

- *Please explain why:*

_____

_____

25. Do you feel you were adequately prepared for your encounter(s) with minke whales? ☐ Yes ☐ No

- *Please explain*

_____

_____

26. Did any of the following impact negatively on your minke whale experience today? *(Please tick as many as apply)*

- ☐ Other divers chasing/following whale(s)
- ☐ Too many divers/snorkellers in the water
- ☐ Whales not coming close enough
- ☐ Divers taking flash photos
- ☐ Potentially dangerous marine animals (sharks/sea snakes)
- ☐ Nervousness about being in the water with whale(s)
- ☐ Splashing/kicking by other passengers
- ☐ Food scraps in water
- ☐ Whale(s) being scared away
- ☐ Encounters with whales too short
- ☐ Not enough whales
- ☐ Rope was too crowded
- ☐ Seas too rough
- ☐ Bad visibility
- ☐ Being scared by the whale(s) behavior
- ☐ Bubbles from SCUBA disturbing the whale(s)
- ☐ Other _____

_____

27. Do you feel any concern that this kind of whale-watching (swimming with minkes) might result in some negative impacts on the whales? ☐ Yes ☐ No

- *Please comment:*

_____

_____

28. Overall, how would you rate the quality of the information you received about minke whales on this trip ? (*please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

29. What information about minke whales did you have access to ? (*Please tick as many as apply*)

- ☐ Pre-departure minke whale briefing by crew
- ☐ Pre-dive briefing mention of minke whales
- ☐ Specific pre-minke encounter briefing
- ☐ Informal discussions (with staff or other passengers)
- ☐ Minke Whale Identification Guide CD-ROM
- ☐ Minke Whale Identification Guide Booklet *("Take a Closer Look")*
- ☐ Reference books about whales provided on boat
- ☐ Minke Whale Information Package (white folder)
- ☐ Minke Whale Project Reports & Publications
- ☐ "Mystery of the Minkes" video/DVD documentary
- ☐ Presentation / talks by guest whale researcher(s)
- ☐ CRC Reef Current State of Knowledge May 2002 *(colour information brochure)*
- ☐ "Swimming with dwarf minke whales" laminated poster(s)
- ☐ "Protecting Whales & Dolphins" minke whale poster
- ☐ Other: ……..

30. What was the best source of information for you about minke whales on this trip?

_____

31. Was there anything specific about which you would have liked more information?

_____

_____

32. Are there any other comments you would like to make about the issues covered by this survey?

_____

_____

If you would like to join an emailing list for the Minke Whale Project (to receive annual newsletters and research updates), please write your email address here:

_____

THANK YOU FOR YOUR HELP WITH THIS RESEARCH

Appendix 13:

MINKE WHALE

QUESTIONNAIRE 2008

Dwarf minke whale
Balaenoptera acutorostrata subspecies

For passengers to complete at or near the end of their trip.

Please return completed questionnaires to a crew member for submitting to:

Matt Curnock, PhD Candidate

Tourism, School of Business

James Cook University, Townsville, QLD 4811

JCU JAMES COOK UNIVERSITY

CHARROA Cod Hole and Ribbon Reef Operators Association

Australian Government Great Barrier Reef Marine Park Authority

SUSTAINABLE TOURISM CRC

museum of tropical queensland queensland museum

MINKE WHALE PROJECT

Introduction

The little known dwarf minke whale was only recorded by scientists in Great Barrier Reef waters during the 1980s. Researchers involved in the Minke Whale Project have been studying various aspects of the biology and ecology of this undescribed subspecies of whale over the last eleven years, including establishing a catalogue of identified individuals. Growing numbers of people are swimming with these whales in the Cairns/Cooktown Management Areas of the Great Barrier Reef. We want to ensure that visitors have high quality experiences while minimising the impact on the whales and ensuring the long-term ecological sustainability of these interactions. **In this questionnaire, we seek to understand people's experiences, and to assess management implications for this industry**. **We are also interested in finding out the economic value of this form of tourism to the local community.** The information you provide in this questionnaire will contribute to three PhD student projects at James Cook University (Matt Curnock, Arnold Mangott and Susan Sobtzick) and will assist with the planning and management of sustainable swim-with-whales tourism both locally and in other areas.

Information regarding individual participants is strictly confidential. Your participation is entirely voluntary. This questionnaire will take approximately 15-20 minutes to complete. If you can help this research by completing this questionnaire it will be greatly appreciated. Please answer all questions as best you can. We look forward to your comments.

For further information please visit the Minke Whale Project website:
http://www.minkewhaleproject.org

Or the Great Barrier Reef Marine Park Authority website:
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/dwarf_minke_whales.html

Or contact:

Matt Curnock, Arnold Mangott & Susan Sobtzick
PhD Candidates
Tourism, School of Business
James Cook University, Townsville 4811
Ph: [redacted] Fax: [redacted]
Email: [redacted]

Dr Alastair Birtles
Senior Lecturer & Team Leader, Minke Whale Project
Tourism, School of Business
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

NOTE TO OPERATORS

You are welcome to request a summary of these questionnaire results for your boat. Information concerning specific, named boats is STRICTLY CONFIDENTIAL. It will neither be published, nor released to managers nor to other operators. Your support in conducting this survey is greatly appreciated and we hope that the information collected will be of use to you in your operation and lead to the long-term sustainability of the industry.

This research project is being undertaken with the support of local tourism operators, the Cod Hole And Ribbon Reefs Operators Association (CHARROA), the Great Barrier Reef Marine Park Authority (GBRMPA), and the Queensland Parks and Wildlife Service (Environmental Protection Agency). We gratefully acknowledge the long-standing participation in this project of *Undersea Explorer*. The sampling period of this study is over the main minke whale season (May to August, 2008).

When you have completed this questionnaire, please return it to the crew of your boat.

You are welcome to tear off and keep this cover page.

Thank you for your participation.

SECTION ONE: YOUR BACKGROUND & EXPERIENCES ON THIS DIVING TRIP

1. Date (end of trip): …….. **2008** **2**. Name of boat (for this trip): _____

3. □ Male □ Female **4**. Year of Birth ___ ___ ___ ___

5. Name of your usual country of residence ? _____

- *For Australian residents*: please include your postcode: ___ ___ ___ ___

6. *For international visitors*: What was your primary reason for this visit to **Australia**? _____

_____

7. With whom are you travelling? (*please tick one box*)

q travelling independently q with a partner q with a group of friends (# of people?) _____ q as a family (# of people?) _____

8. Thinking of your entire holiday, was this specific dive/boat trip: (*please mark* [✓] *one box only*)

• *The main purpose of your trip away from home?* ……..	q
• *One of several activities &/or destinations on your trip away from home?* …	q
• *Not a pre-planned activity on this trip?* ……..	q

9. What was your primary reason for visiting the Cairns/Port Douglas region? _____

_____

10. What was your primary reason for taking this dive trip to the Great Barrier Reef?

_____

11. What are the most important reasons you chose this particular vessel for your dive trip?

_____

12. Is this your first trip to the Great Barrier Reef ? q Yes q No – Number of previous visits? _____

13. What scuba diving qualifications do you hold ? (*Please tick one*)

q None q Open Water q Advanced q Rescue q Dive Master q Instructor q Other:_____

14. What year did you begin scuba diving? __ __ __ __ **15**. How many dives have you made in your life (approx): _____dives

16. Had you ever heard about minke whales on the Great Barrier Reef before this trip? q Yes q No

- If yes, where did you first hear about them? _____

17. Had you seen or swum with minke whales on the Great Barrier Reef before this trip? q No q Yes - # times? _____

18. Did you swim with minke whale(s) on SCUBA during this trip? q Yes q No

19. Did you swim with minke whales(s) on snorkel during this trip? q Yes q No

20. Did you take underwater photos or video of minke whales on this trip? q Yes q No

- *If Yes* – are you willing to donate copies of your minke whale images to a photo-ID study? q Yes q No
  – please see contact details on cover page to send copies of photos/video q I have already donated copies (on board).

21. How many minke whales did you see on this trip? _____ **22**. What was the closest approach to you by a whale? _____

23. How would you rate your overall satisfaction with your minke whale experience on this trip ? *(Please circle one number)*

Very poor **1** - - - - **2** - - - - **3** - - - - **4** - - - - **5** - - - - **6** - - - - **7** - - - - **8** - - - - **9** - - - - **10** Excellent

- *Please explain why:*

_____

_____

24. Overall, how well did your minke whale experience meet your expectations?
(Please tick one box and give a brief explanation of why you feel this way)

q	q	q	q	q
well below my expectations	somewhat below my expectations	met my expectations	somewhat above my expectations	well above my expectations

_____

_____

25. Was there anything that impacted negatively on your minke whale experience? (*If so, please describe below*)

_____

_____

SECTION TWO: MINKE WHALE INFORMATION & ENCOUNTER MANAGEMENT

26. Overall, how would you rate the quality of the information you received about minke whales on this trip ?
(*please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

- *Please explain why:*

_____

_____

27. What sources of information about minke whales did you receive/have access to on this trip? (*Please tick as many as apply*)

- q Pre-departure minke whale briefing by crew
- q Dive site briefing with mention of minke whales
- q Specific pre-minke encounter briefing
- q Informal discussions (with staff or other passengers)
- q Minke Whale Identification Guide CD-ROM
- q Minke Whale Identification Guide Booklet *("Take a Closer Look")*
- q Reference books about whales provided on boat
- q Minke Whale Information Package (white folder)
- q Minke Whale Project Reports & Publications
- q "Mystery of the Minkes" *National Geographic* documentary
- q Presentation / talks by guest whale researcher(s)
- q CRC Reef Current State of Knowledge May 2002 *(colour information brochure)*
- q "Swimming with dwarf minke whales" laminated poster
- q "Protecting Whales & Dolphins" minke whale poster
- q "Meet the Minkes" Interpretive DVD (2007)
- q Other: _____

28. What was the best source of information for you about minke whales on this trip?

_____

29. What was the most interesting thing you learned about minke whales on this trip?

_____

30. Was there anything specific about which you would have liked more information?

_____

31. Are you familiar with the Code of Practice for dwarf minke whale interactions in the GBRWHA? q Yes q No

- *Are there any comments you would like to make about this Code of Practice?*

_____

_____

32. Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew ? *(please circle one number)*

Very poorly managed **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Extremely well managed

- *Please explain why:*

_____

_____

33. Do you feel you were adequately prepared for your encounter(s) with minke whales? q Yes q No

- *Please comment:*

_____

_____

34. Did you observe anything during your trip that might have caused a negative impact on the whale(s)?

_____

_____

35. Do you have any concerns about the sustainability of this kind of tourism?
q Yes q No

- *Please explain why:*

_____

_____

36. Do you feel that your minke whale experience on this trip has changed you in any way?

_____

_____

37. Have you taken any steps to reduce or offset the ecological footprint or carbon emissions of your trip to the GBR?
q No q Yes

- *If yes, please describe what steps you have taken:*

_____

38. How likely is it that you will visit the GBR again, for the purpose of seeing minke whales? (*Please tick one box*)

q **Very unlikely** q **Possibly in the future** q **Very likely in future** q **Definitely will visit again** (to see minke whales)

- *Any comments about this?*

_____

39. *If you are considering returning to the GBR to see minke whales in the future*, would you be prepared to contribute an additional fee for research and monitoring of the whales and the swim-with interactions? q No q Yes

- *If yes, how much would you be willing to contribute?* (in Australian dollars): $_____
- *Would you be willing to contribute an additional fee to offset the carbon emissions of your dive trip?* q No q Yes
  ~If yes, how much would you be willing to contribute? (in Australian dollars): $_____
- *Would you be willing to contribute an additional fee to offset the carbon emissions of your entire journey away from home? (e.g. including air travel)* q No q Yes…
  ~ If yes, how much would you be willing to contribute? (in Australian dollars): $_____

SECTION THREE: RELATIVE IMPORTANCE OF MARINE WILDLIFE SPECIES

This section is about the relative importance of particular marine species to your experiences on the Great Barrier Reef, and which individual species are 'valued' most. We thank you for your patience in completing this questionnaire. Your answers are very important to this research project.

40. How much did your interactions with each of the following types of marine wildlife contribute to your overall satisfaction with your trip:

(*Please circle one number for each wildlife group, listed below; 1= didn't contribute at all; 10 = contributed a great deal to my overall satisfaction*) **Didn't contribute at all to my satisfaction** — **Contributed a great deal to my satisfaction**	Please tick **if you did not see** these animals / types of marine wildlife
Dwarf minke whales: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10**	q
Other whales/dolphins: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Potato cod: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10**	q
Other large fishes: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Sharks: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Turtles: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Corals: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Sea birds: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Other wildlife: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Seeing many different types of marine wildlife (i.e. high diversity): **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any particular species &/or locations ? _____	q

41. **The following question is based on a hypothetical scenario**. Please answer as best you can, considering your willingness to pay to see these different types of marine wildlife:

IMAGINE that it is possible for dive boat operators to provide a 100% GUARANTEE of seeing different types of wildlife. If they could do that, how much EXTRA (above what you have already paid for this trip) would you be prepared to pay for a 100% guarantee to see each of the following? (*Please tick one box for each wildlife category*)

(Categories represent Australian Dollars)

Wildlife	$0	$1-20	$21-50	$51-100	$101-150	$151-200	$201-300	More than $300
Dwarf minke whales	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Other whales/dolphins Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Potato cod	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Other large fishes Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Sharks Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Turtles Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Corals Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Sea birds Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Other wildlife Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
A high diversity of marine life Which species in particular? _____	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____

SECTION FOUR (FINAL SECTION): ABOUT YOUR EXPENDITURE ASSOCIATED WITH THIS TRIP

This section of the questionnaire is important for evaluating the economic benefits of this form of tourism for the local community. Thanks again for your patience – you have nearly finished!

42. Approximately how much did this dive/boat trip cost you? (*in Australian dollars*) $_____

43. Did you spend any additional money while on board the boat? (*e.g. hire of gear, additional dive courses, etc*)

- If so, please indicate approximately how much, and on what items: _____

_____

44. * *For LOCAL RESIDENTS of the Cairns/Port Douglas region:* ***(International and domestic visitors please go to Q.45)***

- If you were unable to go on this dive trip, would you have stayed in the local region for this time? (*please tick one box*)

q Yes, I would have stayed in the local region q No, I would have traveled elsewhere.

****LOCAL RESIDENTS* please now go to Q.49 (final question).**

45. ***** *For INTERNATIONAL and DOMESTIC VISITORS to the Cairns/Port Douglas region (PLEASE ANSWER REMAINING QUESTIONS):*

- How many days will you have spent ***in total*** in the Port Douglas area (before and after this dive trip)? _____ days
- How many days will you have spent ***in total*** in the Cairns area (before and after this dive trip)? _____ days

46. If you had not been able to go on this dive trip, would you have still taken this trip to the Cairns/Port Douglas region? (*please mark* [✓] *the appropriate box below for the scenario that best fits your travel choices*)

q **Yes**, and I would have spent the same amount of time in the Cairns/Port Douglas region (*If so, please choose from box below*):

> q **But** I would have gone on a different dive/boat trip instead
> - What type of dive/boat trip would you have taken instead? _____
>
> q **But** I would have done something else in the Cairns/Port Douglas region instead
> - What type of activity would you have done instead? _____

q **Yes**, but I would have spent less time/fewer days in the Cairns/Port Douglas region:

- *If so*, how much? I would have spent _____ fewer days in this region.

q **No**, I would have travelled elsewhere.

q **No**, I would not have taken the trip away from home at all.

q I don't know.

47. While in the Cairns/Port Douglas region (both before and after your dive trip, as applicable) what is the approximate amount that you have spent (or will spend) **PER DAY** on the following? (*Please do NOT include money spent outside the region).*
IF YOU ARE ANSWERING THIS QUESTION FOR MORE THAN ONE PERSON, then please tell us how many people this expenditure is for (e.g. a couple, family of 4, etc.)? :

Please tick the appropriate box for each row: ----------

Item – Cost PER DAY	$0	$1-20	$21-50	$51-100	$101-150	$151 - 200	$201-300	>$300
Food or drinks from a takeaway	q	q	q	q	q	q	q	q
Meals in a café or restaurant	q	q	q	q	q	q	q	q
Groceries	q	q	q	q	q	q	q	q
Drinks at a bar, hotel or nightclub	q	q	q	q	q	q	q	q
Accommodation	q	q	q	q	q	q	q	q
Hire cars	q	q	q	q	q	q	q	q
Fuel	q	q	q	q	q	q	q	q
Other supplies (e.g. film, maps, camera hire, snorkelling equipment, etc).	q	q	q	q	q	q	q	q
Tickets to other local attractions/tours (do not include price of this trip)	q	q	q	q	q	q	q	q
Souvenirs	q	q	q	q	q	q	q	q
Internet access	q	q	q	q	q	q	q	q
Other (please specify):	q	q	q	q	q	q	q	q

48. Approximately what proportion of your expenditure in the table above was spent: - in Port Douglas? _____ %
- in Cairns? _____ %

49. Are there any other comments you would like to make about the issues covered by this survey?

_____

_____

_____

If you would like to join an emailing list for the Minke Whale Project (to receive annual research newsletters), please write your email address here:

_____

THANK YOU FOR YOUR HELP WITH THIS RESEARCH

Appendix 14:

GREAT BARRIER REEF MARINE WILDLIFE QUESTIONNAIRE 2008

(Day boats)

Pictured: dwarf minke whale, green turtle, grey reef shark and potato cod

For passengers to complete at or near the end of their trip.

Please return completed questionnaires to our Research Volunteer, or a crew member, for submitting to:

Matt Curnock, PhD Candidate

Tourism, School of Business

James Cook University, Townsville, QLD 4811

Australian Government
Department of the Environment and Water Resources

Reef & Rainforest RESEARCH CENTRE

JCU JAMES COOK UNIVERSITY

CHARROA
Cod Hole and Ribbon Reef Operators Association

Australian Government
Great Barrier Reef Marine Park Authority

SUSTAINABLE TOURISM CRC

museum of tropical queensland
queensland museum

Social & Economic Values of Key Marine Species Survey

Introduction

Populations of iconic Australian marine wildlife, including marine turtles, sharks and whales are under pressure from various human-related threats. They are also becoming increasingly important resources for tourism operators catering for domestic and international wildlife enthusiasts. Such use must be managed in an ecologically sustainable manner and should contribute to the overall conservation of the species involved. This research project, based at James Cook University, aims to improve our understanding of the values of marine wildlife species, people's experiences interacting with them and how to manage these interactions to be ecologically sustainable.

In this questionnaire, we seek to understand your wildlife experiences from this Reef trip as well as your perceptions and values of these wildlife species. We are also interested in finding out the economic value of this form of tourism to the local community. Your responses to this questionnaire will help contribute to the sustainable management of marine tourism in the Great Barrier Reef (GBR) and in other places.

Information regarding individual participants is strictly confidential. Your participation is entirely voluntary. This questionnaire will take approximately **10-15 minutes** to complete. If you can help our research by completing this questionnaire it will be greatly appreciated. Please answer all questions as best you can. We look forward to your comments.

James Cook University Ethics Approval No.: H-1941

For further information please contact:

Dr Alastair Birtles
Tourism, School of Business
James Cook University
Townsville, QLD 4811
Tel: [redacted]
Fax: [redacted]

A/Prof Peter Valentine
Earth & Environmental Sciences
James Cook University
Townsville, QLD 4811
Tel: [redacted]
Fax: [redacted]

Dr Natalie Stoeckl
Economics, School of Business
James Cook University
Townsville QLD 4811
Tel: [redacted]
Fax: [redacted]

NOTE TO OPERATORS

You are welcome to request a summary of these questionnaire results for your boat. **Results identifying specific named boats will be treated as confidential** and would only be released to State or Commonwealth Government management agencies with written permission from the operator concerned. Confidentiality of all individual respondents will be maintained. Your support in conducting this survey is greatly appreciated and we hope that the information collected will be of use to you in your operation and lead to the long-term sustainability of the industry.

This project is funded through the Australian Government's Marine and Tropical Science Research Facility represented in North Queensland by the Reef and Rainforest Research Centre, and is supported by the Great Barrier Reef Marine Park Authority (GBRMPA), the Queensland Parks and Wildlife Service (QPWS) and the Cod Hole and Ribbon Reef Operators Association (CHARROA). It would not be possible without the support of operators such as *Aristocat Reef Cruises, Poseidon Cruises, Silver Series, Haba Dive & Snorkel, Calypso Reef Cruises* and *Wavelength*. The sampling period for this survey is from June to August 2008.

When you have completed this questionnaire, please return it to the research volunteer who gave it to you, or a member of the vessel crew.

You are welcome to tear off and keep this cover page.

Thank you for your participation.

SECTION ONE: YOUR BACKGROUND & EXPERIENCES ON THIS REEF TRIP

(DAY VESSELS)

1. Date of trip: …… /…..…….. / **2008** **2.** Vessel name: _____

3. □ Male □ Female **4**. Year of Birth ___ ___ ___ ___

5. Name of your usual country of residence ? _____

- *For Australian residents*: please include your postcode: ___ ___ ___ ___

6. *For international visitors*: What was your primary reason for this visit to **Australia**? _____

_____

7. With whom are you travelling? (*please tick one box*)

q travelling independently q with a partner q with a group of friends (# of people?) _____ q as a family (# of people?) _____

8. Thinking of your entire holiday, was this specific Reef/boat trip: (*please mark* [✓] *one box only*)

• *The main purpose of your trip away from home? ……..…….*	q
• *One of several activities &/or destinations on your trip away from home? …*	q
• *Not a pre-planned activity on this trip? ……..…….*	q

9. What was your primary reason for taking this trip to the Great Barrier Reef today?

_____

10. What are the most important reasons you chose this particular vessel for your dive trip?

_____

11. Is this your first trip to the Great Barrier Reef? q Yes q No ..… Number of previous visits? _____

12. Have you visited other coral reefs elsewhere? q Yes q No If yes, how many times? _____

13. What in-water activities did you participate in on this trip today? (*please tick appropriately*)

q SCUBA diving q Snorkeling q Swimming q Other ……..…….. q Did not enter the water

14. How would you rate the level of your snorkeling skills? q High q Medium q Low q Do not snorkel

15. Are you a certified scuba diver? q No q Yes

- ***If Yes***, what SCUBA diving qualifications do you hold? (*Please tick one*)
  q None q Open Water q Advanced q Rescue q Dive Master q Instructor q Other:_____
- What year did you begin scuba diving? __ __ __ __ (b) How many dives have you made in your life (approx)?_____

16. How would you rate your overall satisfaction with your Reef trip today ? *(Please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

17. What were your three best experiences on your Reef trip today?

_____

_____

_____

18. How would you rate your overall satisfaction with the marine wildlife you saw on this trip today ? *(Please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

- *Please explain why:*

_____

_____

19. Was there anything that impacted negatively on your overall experience on this Reef trip today? (*If so, please describe below*):

_____

_____

SECTION TWO: ABOUT MINKE WHALES IN THE GREAT BARRIER REEF

Dwarf minke whales are sometimes seen in the reefs offshore from Cairns and Port Douglas during the winter months. We are particularly interested in learning more about peoples' experiences when interacting with these whales.

20. Had you ever heard about minke whales on the Great Barrier Reef before boarding the vessel this morning? q Yes q No

- If yes, where and when did you first hear about them? _____

21. Had you seen or swum with minke whales on the Great Barrier Reef before this trip? q No q Yes - # times? _____

22. Did you expect to see any minke whales on this trip today? q Yes q No

23. Did you see any minke whales today? q Yes q No… ***If no*, please now go to Question 35 (*Section Three on p.5*)**

~~~~~~

~ If you did see minke whales today, please answer the questions below:

24. Did you see a minke whale(s) today - From on board the boat? q Yes q No

- From in the water: - while you were on SCUBA? q Yes q No
- while you were on snorkel ? q Yes q No
- If yes, were you holding onto a rope ? q Yes q No

25. If you were on a rope how many people were on the rope with you? (approx.) _____

- How did you feel about this number of people on the rope? (*please tick one*) q Too many q OK q Not enough
- Why did you feel this way? _____

26. How many minke whales did you see today? _____ **27.** What was the closest approach to you by a whale? _____ (*please indicate feet or metres*)

28. How would you rate your overall satisfaction with your minke whale experience today ? *(Please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

29. Overall, how well did your minke whale experience meet your expectations?
(Please tick one box and give a brief explanation of why you feel this way)

q	q	q	q	q
well below my expectations	somewhat below my expectations	met my expectations	somewhat above my expectations	well above my expectations

_____

_____

30. Overall, how would you rate the quality of the information you received about minke whales on this trip ? (*please circle one number)*

Very poor **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Excellent

- *Please explain why:*

_____

31. Are you familiar with the Code of Practice for swimming with dwarf minke whales ? q Yes q No

- *Are there any comments you would like to make about this Code of Practice?*

_____

_____

32. Overall, how well do you feel your minke whale encounter(s) was managed by the boat crew ? *(please circle one number)*

Very poorly managed **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Extremely well managed

- *Please explain why:*

_____

_____

33. Do you feel you were adequately prepared for your encounter(s) with minke whales? q Yes q No

- *Please comment:*

_____

34. Did you observe anything during your trip that might have caused a negative impact on the whale(s)?

_____

_____
~~~~~~

SECTION THREE: RELATIVE IMPORTANCE OF MARINE WILDLIFE SPECIES

This section is about the relative importance of particular marine species to your experiences on the Great Barrier Reef, and how individual species are 'valued'. We thank you for taking the time to complete this questionnaire.

35. How much did your interactions with each of the following types of marine wildlife contribute to your overall satisfaction with your trip:

(*Please circle one number for each group, listed below; 1= didn't contribute at all; 10 = contributed a great deal to my overall satisfaction*) **Didn't contribute at all to my satisfaction** **Contributed a great deal to my satisfaction**	Please tick **if you did not see** these animals / types of marine wildlife
Whales: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Large fishes: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Sharks: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Turtles: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Corals: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Other wildlife: **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any species in particular ? _____	q
Seeing many different types of marine wildlife (i.e. high diversity): **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** Any particular species &/or locations ? _____	q

36. Please IMAGINE that it is possible for dive boat operators to provide a 100% GUARANTEE of seeing different types of wildlife. If they could do that, how much EXTRA (above what you have already paid for this trip) would you be prepared to pay for a 100% guarantee to see each of the following? (*Please tick one box for each wildlife category*)

(Categories represent Australian Dollars)

Wildlife	$0	$1-20	$21-50	$51-100	$101-150	$151-200	$201-300	More than $300
Whales	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
Large fishes	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
Sharks	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
Turtles	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
Corals	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
Other wildlife	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								
A high diversity of marine life	☐	☐	☐	☐	☐	☐	☐	☐ Please specify how much_____
Which species in particular? _____								

SECTION FOUR (FINAL SECTION): ABOUT YOUR EXPENDITURE ASSOCIATED WITH THIS TRIP

This section of the questionnaire is important for evaluating the economic benefits of this form of tourism for the local community. Thank you for your patience – you have nearly finished!

37. Approximately how much did this Reef/boat trip cost you? (*in Australian dollars*) $_____

38. Did you spend any additional money while on board the boat? (*e.g. hire of gear, dive courses, souvenirs, etc*)

~ If so, please indicate approximately how much, and on what items: _____

_____

39. * *For LOCAL RESIDENTS of the Cairns/Port Douglas region:* ***(International and domestic visitors please go to Q.40)***

- If you were unable to go on this dive trip, would you have stayed in the local region for this time? (*please tick one box*)

q Yes, I would have stayed in the local region q No, I would have traveled elsewhere.

******LOCAL RESIDENTS* **of the Cairns/Port Douglas region please now go to Q.44 (2nd last question).**

40. * *For INTERNATIONAL and DOMESTIC VISITORS to the Cairns/Port Douglas region (PLEASE ANSWER REMAINING QUESTIONS):*

- How many days will you have spent ***in total*** in the Port Douglas area (before and after this dive trip)? _____ days
- How many days will you have spent ***in total*** in the Cairns area (before and after this dive trip)? _____ days

41. If you had not been able to go on this dive trip, would you have still taken this trip to the Cairns/Port Douglas region? (*please mark* [✓] *the appropriate box below for the scenario that best fits your travel choices*)

q **Yes**, and I would have spent the same amount of time in the Cairns/Port Douglas region (*If so, please choose from box below*):

q **But** I would have gone on a different Reef trip instead
- What type of dive/boat trip would you have taken instead? _____

q **But** I would have done something else in the Cairns/Port Douglas region instead
- What type of activity would you have done instead? _____

q **Yes**, but I would have spent less time/fewer days in the Cairns/Port Douglas region:
- *If so*, how much? I would have spent _____ fewer days in this region.

q **No**, I would have travelled elsewhere.

q **No**, I would not have taken the trip away from home at all.

q I don't know.

42. While in the Cairns/Port Douglas region (both before and after your dive trip, as applicable) what is the approximate amount that you have spent (or will spend) **PER DAY** on the following? (*Please do NOT include money spent outside the region).*
IF YOU ARE ANSWERING THIS QUESTION FOR MORE THAN ONE PERSON, then please tell us how many people this expenditure is for (e.g. a couple, family of 4, etc.):

Please tick the appropriate box for each row: ----------

Item – Cost PER DAY	$0	$1-20	$21-50	$51-100	$101-150	$151 - 200	$201-300	>$300
Food or drinks from a takeaway	q	q	q	q	q	q	q	q
Meals in a café or restaurant	q	q	q	q	q	q	q	q
Groceries	q	q	q	q	q	q	q	q
Drinks at a bar, hotel or nightclub	q	q	q	q	q	q	q	q
Accommodation	q	q	q	q	q	q	q	q
Hire cars	q	q	q	q	q	q	q	q
Fuel	q	q	q	q	q	q	q	q
Other supplies (e.g. film, maps, camera hire, snorkelling equipment, etc).	q	q	q	q	q	q	q	q
Tickets to other local attractions/tours (do not include price of this trip)	q	q	q	q	q	q	q	q
Souvenirs	q	q	q	q	q	q	q	q
Internet access	q	q	q	q	q	q	q	q
Other (please specify):	q	q	q	q	q	q	q	q

43. Approximately what proportion of your expenditure in the table above was spent: - in Port Douglas? _____ %
- in Cairns? _____ %

44. Please indicate your total annual household income (*equivalent in Australian dollars*; *please tick one box*):

q Under $20,000 q $20,000 to $39,000 q $40,000 to $59,000 q $60,000 to $79,000
q $80,000 to $99,000 q $100,000 to $149,000 q $150,000 to $199,000 q $200,000 or more

45. Are there any other comments you would like to make about the issues covered by this survey?

_____

_____

THANK YOU FOR YOUR HELP WITH THIS RESEARCH

Appendix 15: Japanese language version of 2006 passenger questionnaire.

ミンククジラに関するアンケート

２００６年版

Dwarf minke whale
Balaenoptera acutorostrata

JAMES COOK UNIVERSITY

CHARROA
Cod Hole and Ribbon Reef
Operators Association

Australian Government
Great Barrier Reef
Marine Park Authority

museum of tropical queensland
queensland museum

ミンククジラ・プロジェクト

はじめに

まだあまり知られてないドワーフ・ミンククジラは、グレートバリアリーフにおいては 1980 年代に初めて発見されました。私たちミンククジラの研究者たちは、その生態系を過去数年間にわたって様々な角度から研究し、確認された個体の目録を出版するなどの成果をあげてきました。クジラと一緒に泳ぐ人々も、グレートバリアリーフのケアンズ/クックタウン管理区域において年々増加しています。私たちの目的は、旅行者の皆様にすばらしい体験を経験していただくと共に、クジラに対する影響を最小限に抑え長期的な環境保護を保証していくことです。**このアンケート調査は、皆様がこの旅行で体験された事、またこの産業の経営影響を把握する目的で作成されました。**皆様のご意見はジェームズ・クック大学の３人の博士号生徒(Matt Curnock, Arnold Mangott and Susan Sobtzick)に提供され、この地域と、またそれ以外の地域におけるホエール・スイム・ツアーをどのように環境にやさしい方法で計画・管理していくかに役立てられます。

ご参加頂いた皆様の情報・ご意見はすべて内密です。また、皆様のご参加はボランティアによります。このアンケートは約 10～15 分の時間を要します。是非このアンケートにお答えいただき私たちの研究をサポートしていただければとても幸いです。アンケートにはできるだけ全ての質問にお答えいただくようお願いいたします。みなさまのご意見・ご感想、楽しみにお待ちしております。

より詳しい情報に関しては下記のウェブサイトをご覧下さい。
ミンククジラ・プロジェクト
http://www.reef.crc.org.au//discover/plantsanimals/minke/index.html
グレートバリアリーフ・マリンパーク管理局
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/threatened_species/dwarf_minke_whales.html

又は、下記までご連絡下さい。

Matt Curnock, Arnold Mangott & Susan Sobtzick
PhD Candidates
Tourism Program, Western Campus
James Cook University, Townsville 4811
Ph: [redacted] Fax: [redacted]
Email: [redacted]

Dr Alastair Birtles
Senior Lecturer & Team Leader, Minke Whale Project
Tourism Program, Western Campus
James Cook University
Townsville 4811
Ph: [redacted]
Fax: [redacted]
Email: [redacted]

NOTE TO OPERATORS

You are welcome to request a summary of these questionnaire results for your boat. Information concerning specific named boats is STRICTLY CONFIDENTIAL. It will neither be published, nor released to managers or other operators. Your support in conducting this survey is greatly appreciated and we hope that the information collected will be of use to you in your operation and lead to the long-term sustainability of the industry.

この研究プロジェクトはこの地域の観光管理組合、ゴッドホール・リボンリーフ管理組合(CHARROA)、グレートバリアリーフ・マリンパーク管理局(GBRMPA)、ならびにクイーンズランド州公園・野生動物管理局（環境保全庁）の協力のもとで行われています。また、*Undersea Explorer* の長期にわたるプロジェクトへの献身的な協力に感謝申し上げます。このアンケート調査はミンククジラが現れる最適なシーズン（2006 年 5 月～8 月）を通して行われます。

お答えいただきましたアンケート用紙は、ボートのスタッフにお渡し下さい。

この表紙はアンケートから切り離してお持ち帰りいただいて結構でございます。

ご協力ありがとうございました。

1. 旅行をされた日にち 2006年　　月　　日から　　月　　日まで

2. 乗船されたボートの名前 _____

3. 性別： ☐男性　☐女性

4. 生年月日：_____年　月　日（西暦でお答え下さい。）

5. お住まいの国：_____（オーストラリアの場合は郵便番号をご記入下さい：___ ___ ___ ___）

6. ｸﾞﾚｰﾄﾊﾞﾘｱﾘｰﾌに来られたのは今回が初めてですか？ ☐ はい ☐ いいえ (過去の訪問回数_____回)

7. ダイビングライセンスのレベル（おひとつお選び下さい。）

☐ なし　☐ ｵｰﾌﾟﾝｳｫｰﾀｰ　☐ ｱﾄﾞﾊﾞﾝｽ　☐ ﾚｽｷｭｰ　☐ ﾀﾞｲﾌﾞﾏｽﾀｰ　☐ ｲﾝｽﾄﾗｸﾀｰ　☐ その他:_____

8. 初めてのスキューバダイビングはいつですか？：＿＿＿＿ 年（西暦でお答え下さい。）

9. ダイビングの経験本数： 約_____本

10. 今回の旅行をされる前にミンククジラに関する情報を聞かれた事はありますか？☐はい ☐いいえ

- はいと答えた方は、どこで初めてその情報を聞かれましたか？_____
- 以前グレートバリアリーフでミンククジラを見た、又はミンククジラと一緒に泳がれたことはありますか？

☐ いいえ ☐ はいー回数：_____回 場所：_____

11. 今までにクジラ又はイルカと一緒に泳がれたことはありますか？

☐ いいえ ☐はいー場所：_____

12. 今までにホエールウォッチングに参加されたことはありますか？

☐ いいえ ☐はいー回数：_____回 場所：_____

13. クイーンズランド北部を訪れた一番の目的はミンククジラを見ることですか？ ☐ はい ☐いいえ

14. ｸﾞﾚｰﾄﾊﾞﾘｱﾘｰﾌでのダイビング旅行を選ばれた一番の理由は何ですか？（おひとつお選び下さい。）

☐ グレートバリアリーフでのダイビング ☐ リボンリーフでのダイビング
☐ コーラルシー（Coral Sea）のオスプレイリーフでのダイビング
☐ ミンククジラを見る、又はミンククジラと泳ぐため
☐ その他：_____

15. このダイビングショップを選ばれた一番の理由は何ですか？
_____

16. この旅行中にミンククジラと一緒にスキューバダイビングで泳がれましたか？ ☐ はい ☐ いいえ

17. この旅行中にミンククジラと一緒にシュノーケルで泳がれましたか？ ☐はい ☐ いいえ

18. この旅行中に何回ミンククジラを見ましたか？ _____回

19. クジラからの接近で一番近かったのはどのくらいの距離でしたか？ 約_____m

20. この旅行中にミンククジラの水中写真や水中ビデオを撮られましたか？ ☐ はい ☐ いいえ

- はいと答えた方は、その写真やビデオのコピーを写真 ID の研究に提供することをご希望されますか？

☐ はい ☐ いいえ （写真又はビデオのコピーを送って下さる方は表紙の裏の連絡先までお送り下さい。）

21. ミンククジラを見た後、Interaction Behaviour Diary に記載しましたか？ ☐ はい ☐ いいえ

はいと答えた方は、何回記載しましたか？ _____回 （ご協力ありがとうございます！）

22. 今回のミンククジラとの出会いは全体的にどの適度あなたの期待に添いましたか？（お一つお選び下さい。また、その理由について簡単にご説明下さい。）

☐ かなり期待はずれ ☐ 期待外れ ☐ 期待通り ☐ 期待以上 ☐ かなり期待以上

理由：_____

23. 今回のミンククジラとの出会いに関する満足度は全体的にどの程度評価していますか？（数字に○をお付け下さい。また、その理由について簡単にご説明下さい。）

最悪だった **1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10** 最高だった

理由：_____

24. ボートのスタッフ達は全体的にどの程度ミンククジラ体験を管理していましたか？（数字に○をお付け下さい。また、その理由について簡単にご説明下さい。）

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10

全く管理していなかった　　非常に良く管理していた

理由：_____

25. あなたはミンククジラに出会う準備は十分に出来ていたと思いますか？　☐ はい　☐ いいえ

理由：_____

26. 下記の項目の中で、ミンククジラに出会う経験に悪影響を与えた要因はありますか？　（当てはまるもの全てにお答え下さい。）

☐ 別のダイバーがクジラを追いかけていた。　☐ クジラが怯えて逃げていった。
☐ ダイバー、スノーケラーの人数が多すぎた。　☐ クジラとの出会いが短すぎた。
☐ クジラが十分に近づいてこなかった。　☐ クジラの数が少なかった。
☐ ダイバーがフラッシュ撮影をしていた。　☐ ロープに人が混み合いすぎていた。
☐ 危険性のある海洋生物がいた。（サメ、ウミヘビ等）　☐ 海が荒れていた。
☐ 水中でクジラと一緒にいるのが怖かった。　☐ 透明度が低かった。
☐ 別のダイバー、シュノーケラーが足をバチャバチャしていた。　☐ クジラの行動が怖かった。
☐ 水中に食べ物が捨てられていた。　☐ スキューバダイビングの泡がクジラに不快感を与えた。
☐その他 _____

27. このようなﾎｪｰﾙｳｫｯﾁﾝｸﾞ（又はホェールスイム）がクジラの生態に悪影響を及ぼすかもしれないと思いますか？
☐ はい　☐ いいえ

・コメントをお願いします。

_____

28. この旅行中に得たﾐﾝｸｸｼﾞﾗに関する情報の価値を、全体的にどの程度評価しますか？（数字に○をお付け下さい。）

全く役に立たなかった　**1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 - - - - 9 - - - - 10**　非常に役に立った

29. 今回の旅行中、下記のうち、どの情報源を参考にしましたか？（当てはまるもの全てにお答え下さい。）

☐ 出発前のスタッフによる説明　☐ 船内のクジラに関するガイドブック
☐ ダイビング前のブリーフィング　☐ Minke Whale Information Package (白いファイル)から
☐ ミンククジラ観察前の特別な説明　☐ Minke Whale Project のリサーチレポートと出版物から
☐ スタッフや他の乗客との会話　☐ “Mystery of the Minkes” というﾄﾞｷｭﾒﾝﾀﾘｰから
☐ ミンククジラの見分け方ガイド CD-ROM　☐ クジラの研究者による発表や会話
☐ ミンククジラの見分け方ガイドブック *(“Take a Closer Look”)*　☐ CRC Reef Cornet State of Knowledge （カラー刷りのパンフレット）
☐ “Swimming with dwarf minke whales”ポスター　☐ “Protecting Whales & Dolphins” というポスター
☐ その他：_____

30. 上記のうち、一番役に立った、又は参考になった情報源は何ですか？

_____

31. ミンククジラに関してこの情報が知りたかった、という事柄はありましたか？

_____

32. このアンケート調査で取り扱われている内容に関して他に何かコメントはありますか？是非お聞かせ下さい。

_____

_____

このミンククジラの研究の E メールリストに参加をご希望の方は E メールアドレスをご記入下さい。（年刊誌と研究報告をお送りします。）

_____

アンケートにご協力頂きありがとうございました。

THANK YOU FOR YOUR HELP WITH THIS RESEARCH

Appendix 16:

STAKEHOLDER KEY INFORMANT SURVEY

Before beginning interview:

1. **Researcher to give respondent a copy of:**
   a. **List of Proposed Sustainability Indicators (in advance of interview)**
   b. **Flyer with details of Online Workshop**
   c. **Business card / telephone & email contact details.**

2. **Respondents must be informed of the confidentiality agreement (researcher read details on front page) and is to sign this voluntary consent form.**

3. **Researcher to keep this cover sheet (consent form).**

Interview #_____

Name of respondent: _____Date: _____ Time:_____

Location of interview: _____ Interviewer: _____

VOLUNTARY CONSENT FORM

Interviewee is to read, understand, agree with and sign the following statement:

I have been informed about the nature of this interview, its confidentiality arrangements and anonymous design, and I agree to participate. I also agree to this interview being recorded.

Signature:_____ Date:_____

Name:_____

Begin recording, quote: time & date of interview.

Note: Dot points are prompts – use only if points not already discussed

***1. Tell me a little bit about your background in relation to this industry.**

For industry:

- How long have you owned/worked for this company?
- What is the length of your experience on the GBR?
- How long have you been in the dive industry?
- How long do you plan to stay in this industry?
- How many minke whale seasons have you taken part in?

For managers / other stakeholders:

- What is your current role with _____?
- How long have you worked for _____?
- What is the nature of your experience with tourism on the GBR?
    - How long have you been involved in GBR tourism?
- How long have you been aware of the swim-with dmw tourism industry on the GBR?
- What is _____'s main objective concerning dmw on the GBR?

***2. What do dwarf minke whales mean to you?**

- For your business / organisation
    - (how important are dwarf minke whales to your organisation)?
- On a personal level?
    - (Have you ever / how many times have you - swum with minkes yourself?)

***3. What do you think about the current management of swim-with-dmw tourism on the GBR?**

- Why do you believe this?
- Are you happy with the Code of Practice?
- How do you think it could be improved?

***4. Do you have any concerns about the future of swim-with-dmw tourism on the GBR?**

- Do you have any concerns for the whales themselves?
    - Are you concerned about the potential threat of commercial whaling to these whales?
    - How about the potential effects of climate change? (*for example, shifting ocean currents, productivity & food availability*)
- Do you have any concerns about the future of the swim-with-minke whales tourism industry?
    - Any concerns about what might happen after 2008? (*When GBRMPA reviews the management of the activity at the end of the Dwarf Minke Whale Tourism Monitoring Programme*)

***5. How would you like the GBR swim-with-minke whales tourism industry to look in the future?**

- What outcomes are desirable for you?
- Are there any changes you'd like to see?

6. What does the term 'sustainability' mean to you?

For the purposes of this interview it is important that we share a similar understanding of the concept. Here is a definition for sustainable development that I am using for this study:

> ***1. The Australian National Strategy on Ecologically Sustainable Development (NSESD), definition for ESD:***
> "Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends"

Recently there has been an increasing recognition in sustainable development literature that 'sustainability' should be evaluated using a Quadruple-Bottom-Line, based on economic, ecological, social and managerial elements. This is something I'd like to explore with you in relation to swim-with-minke whales tourism on the GBR. ***Is that ok with you?***

7. What do you think a 'sustainable' swim-with-minke whales tourism industry would look like?

- Do you think that the current industry fits the bill?
- Why/Why not?

My PhD research project aims to evaluate some specific Sustainability Indicators and develop a model to assist future management of swim-with-dwarf minke whales tourism. Part of this process involves first establishing the broad Sustainability Objectives, which need to address the needs and aspirations of all the stakeholders, including the industry, the management agencies and the wider community.

***8. <u>FOR 2002 SI WORKSHOP PARTICIPANTS</u>* – Do you remember the workshop that was held in 2002 to develop Sustainability Indicators for swim-with-minke whales tourism?**

- IF YES – What were your impressions of this Workshop?

<u>FOR PEOPLE WHO DIDN'T ATTEND</u>: *A Workshop was held in 2002 to develop Sustainability Indicators for swim-with-minke whales tourism…*

One of the outcomes of this Workshop was the adoption of a broad objective for sustainable management, which was:

The primary objective for managing this swim-with-whales industry (established at the 2002 Workshop) is "*to achieve ecologically sustainable swim-with-minke whale activities within the GBRWHA*". Sub-objectives include:

1. To maintain the dwarf minke whale population in the GBRWHA, and
2. To allow sustainable tourism interaction with dwarf minke whales in the GBRWHA.

9. What do you think about this objective?

- Is it compatible with <u>your organisation's</u> objectives?
- Does it fit with your <u>own</u> objectives?

*The MWP research team have drafted a series of "**Potential Sustainability Objectives**" <**Copy provided in advance of interview**> which we'd like stakeholders, including you, to help develop and refine. We would like to incorporate the values and aspirations of the full range of stakeholders (including the industry, managers, researchers and wider community), to help guide the future management of this industry. These proposed objectives will also be made available online and I'd like to encourage you to provide your feedback, comments, corrections and thoughts about it via a new Online Workshop*
*<**OW flyer on reverse side of interview handout**>.*

***10. Have you had a chance to read through these proposed Sustainability Objectives?**

- If yes – what is your reaction to them, overall? (Why?)

For the rest of this interview I'd like to **get your feedback on these proposed Sustainability Objectives in this document. This interview will **not be your only opportunity** to have input into the development of them – you're welcome to provide comments at any time in the **Online Workshop**. You're also welcome to give feedback by **email or telephone**, and in December there will be a **Stakeholder Workshop** to review them as well as screen some potential Sustainability Indicators. I'll also present the summary results of these interviews at this Workshop.*

*These proposed Objectives are sorted into **four categories** – Ecological, Social, Economic and Managerial Sustainability Objectives. Rather than read them all out one at a time, I have a copy of them here on a scoresheet for you. <Give sheet>*

- ***GO THROUGH INTERVIEW SCORESHEET***

*I'd like you to read through each of these proposed ECOLOGICAL Sustainability Objectives and think about how **appropriate** they are and how **useful** they would be as a Sustainability Objective for the GBR swim-with-minke whales tourism industry.*

Some of these proposed objectives may be familiar to you, but there are some newer ideas there that you may not have seen before.

*I'd then like you to give an indication on the scoresheet about **whether or not you would support** this Sustainability Objective to help guide the future management of this industry, and the extent to which you think they are appropriate and useful.*

- ***RATING – 1 to 5 for SUPPORT***

*Please tick one of the boxes that best describes your level of support for the proposed Objective. <**READ THRU SUPPORT CATEGORIES + 'I DON'T KNOW' OPTION'**>*

Feel free to make comments or suggestions about each of the proposed objectives as you go through this scoresheet – I'll leave the recorder running.

***The <u>ECOLOGICAL OBJECTIVES</u> in this draft document so far include:**

1.1 The GBR dwarf minke whale population:

a. Is maintained (i.e. the population is not decreased).
b. Is not displaced from its normal habitat (e.g. feeding, breeding grounds, migratory paths) as a result of interactions with humans.

1.2 Individuals and groups of dwarf minke whales:

a. Are not physically harmed as a result of interactions with humans.
b. Control the nature and extent of interactions with vessels and swimmers.
c. Do not have their behaviour negatively impacted as a result of interactions with humans.
d. Do not have their key activities (such as feeding, breeding, nursing, resting, socialising) interfered with as a result of interactions with humans.
e. Are not at a greater risk of being hunted (e.g. by whaling vessels) as a result of habituation to vessels from human interactions in the GBR.

1.3 Dwarf minke whales' habitat:

a. Is not degraded by human activities.
b. Continues to support the GBR dwarf minke whale population.

***11. Is there anything we've missed here?**

- Is there any wording that needs to be changed?

REMINDER: It's okay to take a copy of this away, think about them and provide comments later, via the Online Workshop or by email/telephone…

Ok, I've got just a couple of questions in relation to these ECOLOGICAL Objectives, before we move on to the other categories.

12. Do you think the current swim-with-dmw industry is having any impacts on the whales?

- Why/why not?

13. Do you think ongoing scientific research into the potential impacts of swim-with-dmw tourism is necessary?

14. Are you supportive of (*<u>your</u>*) vessel crew(s) contributing to research and monitoring of potential impacts? (e.g. by completing WSS, donating photos/video).

15. Do you think there's value in involving passengers in research and monitoring of minke whale interactions? (e.g. by completing MWQ, IBD, donating photos/video).

16. INDUSTRY ONLY:

If research showed that there were negative impacts on the whales from dive vessels or swimmers, would you be willing to change the way your operation conducts minke interactions?

- For example, how would you react if time limits on interactions were introduced?
- How about a limit to the number of people allowed in the water at one time?

17. Objective 1.3 (a) is about dwarf minke whales' habitat, which very likely covers a large area extending beyond the GBRMP. However, within the GBR, dwarf minke whales' habitat clearly includes the dive sites and surrounding waters used by your operation/the operators. **What steps do you think the industry should be taking to ensure their impacts on these sites are minimised?**

- For example, regarding dumping of sullage into the GBR lagoon?
  - *Do you have any concerns about this?*
  - *Any suggestions how this might be addressed?*
- How about dumping of food scraps overboard?

Okay, I'd like you to now read through each of the proposed SOCIAL Sustainability Objectives and think about how appropriate they are and how useful they would be as a Sustainability Objective for the GBR swim-with-minke whales tourism industry.

Please indicate your support for each of them on the scoresheet.

***The SOCIAL OBJECTIVES in this draft document so far include:**

2.1 Swim-with-dwarf minke whales tourism operators in the GBR:

a. Provide a consistently high-quality experience for international and domestic tourists.
b. Promote further understanding and appreciation of dwarf minke whales to their clients using high quality interpretation.
c. Foster broader conservation awareness and a commitment to sustainability among their crew and passengers.
d. Contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research.
e. Achieve and maintain the support of the local community, such that it values the whales and the industry appropriately.

2.2 Swim-with-dwarf minke whales participants:

a. Are aware of the relevant EPBC Regulations and protocols in the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions* before they encounter dwarf minke whales.
b. Are sufficiently prepared for their swimming-with-dwarf minke whales experience, with realistic expectations of in-water interactions.
c. Follow the Code of Practice.
d. Are not at risk of death, injury or disease by swimming with dwarf minke whales.
e. Contribute to research and monitoring of dwarf minke whales and potential impacts of their interactions.
f. Have an outstanding experience interacting with the whales.

***18. Is there anything we've missed here?**

- Is there any wording that needs to be changed?

19- 21. *INDUSTRY ONLY* *Ok, I've got just a couple of questions in relation to these SOCIAL Objectives, before we move on to the other categories.*

19. How do you think the minke whale experience for your clients compares with other experiences your vessel offers at different times of the year?

20. Is providing high quality interpretation to your passengers about minke whales important to you?

21. Do you think that your vessel crew are equipped with appropriate information and knowledge to prepare your passengers for swimming with minkes each season?

- Why/why not?
- Does your vessel have a high turn over of crew each year?
- If Yes - Does that pose a challenge for you, in ensuring your crew have enough knowledge and experience to prepare and manage your passengers when interacting with minkes?
- Do you think that some specialised 'minke whale encounter' training for your crew might be beneficial?

22. Does your operation have any ecotourism accreditation?

- If Yes – what level? (*Nature-based*, *Ecotourism* or *Advanced Ecotourism*)
- what benefits does this provide to your operation?
- If No – is this something your operation has considered applying for?

I'd like you to now read through each of the proposed ECONOMIC Sustainability Objectives and think about how appropriate they are and how useful they would be as a Sustainability Objective for the GBR swim-with-minke whales tourism industry.

Please indicate your level of support for each of them on the scoresheet.

***The ECONOMIC OBJECTIVES in this draft document so far include:**

3. Swim-with-dwarf minke whales tourism in the GBR returns an adequate profit to the industry.

Sub-objectives include:

Swim-with-dwarf minke whales permitted operators in the GBR:

a. Have sufficient access to the resource and share the resource equitably.
b. Contribute to the maintenance of the resource on which they depend.
c. Have appropriate environmental offsets factored into their cost-benefit analyses.
d. Provide an adequate economic return to the local community (e.g. through local sourcing, employment).

***23. Is there anything we've missed here?**

- Is there any wording that needs to be changed?

***24. INDUSTRY ONLY*.** Objective 3 is about profitability**. Given that the minke season is for only a brief period each year, to what extent, if any, is your operation financially dependent on minke whale sightings in June and July?**

- Compared with the rest of the year, does your boat run as full (with as many passengers) during the minke season?
- Would your business suffer if interactions with minke whales no longer occurred?
- What is the importance of the swim-with-minke whales experience to the marketing of your operation?
- Do you currently charge higher prices for trips during the minke season?
- *If NOT* – Is this something your operation is likely to consider in future? Why/Why not?

- **MBDE, UE & NEX**: How many 'dedicated' minke whale trips do you currently run each year?
    i. (*By dedicated, I mean advertising and conducting special trip itineraries with a specific focus on finding and interacting with minke whales.*)
    - Is the number of dedicated minke whale itineraries conducted by your operation likely to increase in future?
    - Do you have any plans to increase the size or passenger capacity of your vessel in the near future?
- **TAKA & DAY BOATS**: Is your operation likely to start conducting dedicated minke whale itineraries in future?
- Do you have any plans to increase the size or passenger capacity of your vessel in the near future?

25. As you know, the GBRMPA-permitted swim-with-minke whales industry is presently capped, with permits issued to nine operators. **Do you think that the present number of minke permits is appropriate?** Why/why not?

PROMPTS:

- In terms of competition between operators?
- In terms of maintaining high-quality passenger experiences?
- In terms of managing potential impacts on the whales?
- In terms of management and enforcement of the industry?

26. INDUSTRY ONLY: The GBRMPA will be reviewing the industry in 2009. **How do you think your business will be affected if more minke permits are issued?**

- How do you think your passenger experience would be affected if more vessels began conducting swim-with-minke whales activities in your area of operation?

27. INDUSTRY ONLY. Sub-objective 3.(a) is about access and sharing of the resource. **As a swim-with-dmw permit holder, do you feel your operation has sufficient access to sites where minke whales are likely to be encountered, so that you're able to meet the expectations of your clients?**

- *LIVE ABOARDS ONLY: For example Lighthouse Bommie*
- **Do you think your operation benefits from having a swim-with-minke whales permit?**
    - *If Yes: How?*

28. Sub-objective 3.(b) is about contributing to the maintenance of the resource. At the recent Pre-Season Workshop, a number of permitted operators agreed to help collect passenger donations to support the Minke Whale Project's research costs – which is great. **Do you think this sort of contribution should become a formal obligation for permitted operators?**

- **For example – if permitted operators were required to contribute to a '*swim-with-dwarf minke whales tourism management fund*' to support research and management of the resource?**
- If yes - What do you think such a management fund should be used for?
  - ***MANAGERS/OTHERS:*** How much do you think permitted operators should contribute to such a fund?
  - ***INDUSTRY ONLY:*** As a permitted operator, how much would you be willing to contribute towards such a fund? (e.g. annually)
- Could this extra cost be passed on to your passengers?
- How do you think this should be administered?
  i. Who should collect it?
  ii. On what basis should it be collected from operators? (*e.g. per passenger, number of dedicated 'minke trips', a fixed amount for the season*)
  iii. Who should decide how it is spent?

29. INDUSTRY ONLY Sub-objective 3.(c) is about broader environmental offsets. **Does your operation voluntarily offset its ecological footprint in any way?** *(By ecological footprint, I mean your operation's carbon emissions and any other contributions to human impacts on the environment, both locally and on a global scale).*

- For example, by contributing to carbon offsets or purchasing carbon credits?
  - (*Definition: Carbon offsetting involves reducing emissions by investment in projects that save energy, such as investment in technology which allows industry to be more efficient, increasing the generation of renewable energy or planting trees to absorb and store carbon dioxide*.)
- How about other contributions toward the conservation of the natural environment, or the Reef in particular (apart from the EMC)?
- *IF NO*: Is this something you've considered?

30. INDUSTRY ONLY: Are you supportive of your operation providing in-kind vessel berths to researchers during the minke season?

- Do you think that the presence of researchers on the vessel contributes to the experiences of your passengers? (*IF YES*: In what way?)
- **(*MBDE, NEX & TAKA only*)** How about research volunteers?
- Do you have any suggestions to improve the benefits to your operation from having independent researchers on board your trips?

31. INDUSTRY ONLY. Sub-objective 3.(d) is about providing an economic return to the local community . As you may be aware, members of the MWP research team are involved in a new research project (*funded by MTSRF*) which is investigating the social and economic values of iconic marine species to Far North Queensland, including minke whales. This project is conducting a survey of Reef tourism operators to determine the industry's contribution to the local economy (***including your operation if you're happy to participate***), so I won't go into this in detail.

- Does your operation benefit the local community in other ways, besides economically?

Okay, I'd like you to now read through each of the proposed MANAGEMENT Sustainability Objectives and think about how appropriate they are and how useful they would be as a Sustainability Objective for the GBR swim-with-minke whales tourism industry. This is the fourth and last category.

Please indicate your level of support for each of them on the scoresheet.

***The <u>MANAGEMENT OBJECTIVES</u> in this draft document so far include:**

4.1 Management of the GBR swim-with dwarf minke whales tourism industry:

a. Is World's Best Practice and establishes a leading model for whale watching and wildlife tourism management in Australia and internationally.
b. Is genuinely collaborative and participatory, involving all stakeholders.
c. Contributes to capacity building and knowledge sharing.
d. Is transparent in all decision making processes.
e. Is informed and guided by the use of the highest quality scientific research.
f. Wherever a lack of scientific certainty exists, applies the Precautionary Principle to proactively prevent potential negative impacts on the resource.
g. Is able to adapt and respond promptly to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale).

4.2 The GBR swim-with dwarf minke whales tourism industry:

a. Demonstrates a consistently high level of compliance with EPBC Regulations, the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions*.

***32. Is there anything you think needs to be changed or added to these Management Objectives?**

***33.** Objective 4.1b is about collaborative management involving all stakeholders. **How important do you think it is for <u>the following stakeholder groups</u> to be involved in management decisions affecting this industry?** *<go through rating scale on scoresheet>*

Not at all Important	Somewhat important	Moderately important	Very important	Absolutely essential

- <u>Permitted operators</u>?
- How about tourism <u>industry representative bodies?</u> (e.g. CHARROA, AMPTO, TTNQ)
- <u>GBRMPA?</u>
- <u>Commonwealth DEW?</u>
- <u>QPWS / Marine Parks?</u>
- <u>Local Government?</u>
- <u>Researchers</u>? (e.g. JCU Minke Whale Project scientists)
- <u>National & International NGOs for Conservation and Animal Welfare</u>? (e.g. WDCS, IFAW)
- <u>Local community</u> and environment groups? (e.g. CAFNEC, WPSQ, LIPS)
- Are there any other groups that you think should be involved in management decisions affecting this industry?

34. Objective 4.1f is about applying the Precautionary Principle. **What does this term mean to you?**

For the purposes of this interview it is important that we share a similar understanding of the concept. The definition I am referring to is provided by the World Conservation Union (IUCN), which states that the Precautionary Principle:

> "*is a response to uncertainty, in the face of risks to health or the environment. In general, it involves acting to avoid serious or irreversible potential harm, despite lack of scientific certainty as to the likelihood, magnitude, or causation of that harm." (IUCN Precautionary Principle Project, 2003)*

- Do you think that the application of the Precautionary Principle in this sense is appropriate for the GBR swim-with-minke whales tourism industry?

35. The new Operational Policy on Whale and Dolphin Conservation in the GBRMP (p.18) says that "*To encourage compliance with codes of practice, mechanisms to allow user groups to be self-regulating will be developed, where appropriate, and will be underpinned by regulations or other legislative tools*." **Do you think that self-regulation of the swim-with-dmw tourism industry is appropriate?** (Why/why not?)

- What sorts of conditions would need to be met for industry self-regulation to work?

36. *INDUSTRY ONLY*: Are you familiar with the GBRMPA Incident Reporting Forms?

Live-aboards

Okay, I've got a hypothetical question for you: I'd like you to imagine it's the middle of the minke season, you're on board your vessel and you're moored at Lighthouse Bommie for the entire afternoon. There are minke whales around the boat and your passengers are in the water on ropes swimming with them. Another vessel, that you're familiar with, which also has a minke permit, has been moored at a site nearby, and it moves off its mooring and approaches your vessel. They have obviously noticed that you've got whales around your vessel, and they appear to be coming in to have a closer look. They approach slowly, to a distance of around 200m, and without coming any closer, stop their engine and drift in the area, watching the whales. The whales seem to have noticed their approach and have now moved away from your vessel towards theirs. You watch the boat drift away from your vessel, as they put ropes and passengers in the water and they are followed by the all of the whales that had just been around your boat. You are now left with no whales and some disappointed passengers.

Day-boats

Okay, I've got a hypothetical question for you: I'd like you to imagine it's the middle of the minke season, you're on board your vessel and you're moored at a dive site with passengers in the water, diving and snorkelling, and some minke whales arrive and start swimming around the vessel. Another vessel, that you're familiar with, which also has a minke permit, has been moored at a site nearby, and it moves off its mooring and approaches your vessel. They have obviously noticed that you've got whales around your vessel, and they appear to be coming in to have a closer look. They approach slowly, to a distance of around 200m, and without coming any closer, stop their engine and drift in the area, watching the whales. The whales seem to have noticed their approach and have now moved away from your vessel towards theirs. You watch the boat drift away from your vessel, and they are followed by the all of the whales that had just been around your boat. You are now left with no whales and some disappointed passengers.

Questions:

- How would you respond to this?
  - What if they're not answering their radio?
  - Would you report them using a GBRMPA Incident Report Form?
- Ok, now what if the vessel is one that doesn't have a minke permit, but is a vessel that you know, and it operates regularly around the same dive sites that you use?
- How about if the vessel was unknown to you, and obviously didn't have a permit?

37. Objective 4.2a is about compliance with management protocols. **Do you think that there are (***/Are you aware of***) any problems with compliance in the industry at present?**

- Why/why not?
- How about for non-permitted vessels?
- How about among the nine permitted operators? ***INDUSTRY only****: How about your own operation?*
- Do you think there are likely to be any problems with compliance in the future?
- What do you think is the best way of monitoring compliance with Regulations and the Code of Practice?
- Should this monitoring be a permit condition?
- Can you think of any incentives for the industry to improve or maintain high compliance?

38-40: MANAGERS ONLY

38. At previous Dwarf Minke Whale Tourism Monitoring Workshops, there have been presentations from Day-to-Day Management staff about enforcement of regulations, and the range of management responses to breaches of the EPBC regulations**. How would your agency respond if a permitted swim-with-dwarf minke whales operator was not fulfilling its permit conditions?** (*Permit conditions are (1) to complete WSS & (2) adhere to the CoP*).

- How about, for example, the operator has not submitted Whale Sighting Sheets? (*And there is evidence they have had minke whale interactions*)
- How about if they are reported to have breached the Code of Practice?
    - (but not EPBC regulations)
    - For example, if passengers are not being adequately briefed before swimming with minkes?

39. At the 2006 Pre-Season Minke Workshop, participants agreed to amend the Code of Practice to include the new Protocol for Behaviour with a Cow and Calf, and the Vessel Approach Distances and Departure Protocol. This motion was passed unanimously by the 9 permitted operators. **If a permitted operator didn't comply with these voluntary protocols, what kind of enforcement process would apply?**

- *For example*: If a permitted operator approached another permitted vessel that was engaged in a minke interaction to closer than 0.6nm, and was reported via an Incident Report Form – **would this be considered a breach of their permit conditions?**

40. Are there any circumstances that would lead to the suspension or revocation of an operator's permit to swim-with-dmw?

- How would this be done?

41. In December 2005, GBRMPA hosted an 'Incidental Encounter Management Workshop' which featured a brainstorming session on the issues, values and possible solutions to problems associated with management of the swim-with-dmw tourism industry and the move towards self-regulation. **One of the ideas put forward at this workshop was the establishment of a 'Minke Whale Tourism Board'**.

- What do you think of this idea?
- What do you think the scope of its decision-making should be?
- Do you think it should have any enforcement powers? (Why/Why not?)
    - To what extent?
- How do you think this Board would become recognised as a legitimate body by all of the stakeholder groups?
- How do you think GBRMPA would work with this Board?
- Who do you think should be on such a Board?

42. **Do you think some additional swimming-with-dmw accreditation is appropriate for the permitted operators?** (Why/Why not?)

- What sorts of standards do you think should be met for such accreditation?
- **For the operation itself?**
  - How about, for example, a requirement for appropriate marketing and advertising of the minke whale experience?
  - How about a requirement for contributing to research and monitoring of the whales?
  - Can you suggest any other possible accreditation standards for permitted operations?
- **For the vessel?**
  - *For example*: a requirement for appropriate interpretation and educational materials?
  - Can you suggest any other possible accreditation standards for a permitted swim-with-minke whales vessel?
- **For individual members of crew?**
  - *For example*: having at least one 'Minke Whale Guide' on board, who has completed an approved training course?
    - Should existing crew who are recognised as being very experienced at managing minke whale interactions become accredited via a 'Grandfather' clause?
  - Can you suggest any (other) possible accreditation standards for individual crew?

43. Do you think it would be appropriate for 'swim-with-dmw' accreditation to be a permit condition for operators? (Why/why not?)

***44.** Objective 4.1 (g) is about adaptability. **What is your understanding of Adaptive Management?**

- *Adaptive Management involves collaborative decision-making, incorporating the needs and objectives of all stakeholders.*
- *It involves deliberate and ongoing experimentation with the management tools and parameters to test their effects on the system, while the potential impacts are carefully monitored, so that the causal relationships in the system are better understood and any undesirable trends or impacts are addressed promptly.*
- *There is also a strong emphasis on all stakeholders being engaged in learning more about the resource, as well as transparency of information and high levels of communication between the stakeholders.*

45. What do you think about the swim-with-dmw industry moving towards an Adaptive Management approach? (Why / how come***?)**

- Do you think there are likely to be any problems from **the industry** in moving towards this style of management?
  <For operators> How about your operation?

- Do you think there are likely to be any problems from **the management agencies** in moving towards an Adaptive approach with the industry?
  <For managers> How about your agency?

- How about for **other stakeholders** (e.g. conservation and wildlife NGOs concerned with minke whales)?
  <For NGO/other stakeholders> How about your organisation?

Only a few more questions to go…

***46. What role do you think you should play, as a _____ of <u>your organisation</u>, within an Adaptive Management Framework for this industry?**

- What do you see as your responsibilities in this role?

47. What do you think about the current level of communication between stakeholders?

- Why?
- Do you think the Pre- and Post-Season Workshops provide enough opportunities to discuss management issues?
- Are these workshops useful to <u>you? / To your operation</u>?
- How do you think communication and discussion of management issues between stakeholders could be improved?
- Are you happy with amendments to the Code of Practice being made from decisions in these Pre- & Post-Season Workshops?
- How much do you think you are likely to participate in the Online Workshop?
    - *Did you participate in the Dugong & Turtle Tourism Project Online Workshop? (If yes – what were your impressions of this? - Any suggestions to improve on this?)*
- *Are you likely to access and discuss research results uploaded to the OW?*
    - *How about summaries and outcomes from other workshops?*

48. What do you think about the current level of transparency of information shared between different stakeholder groups?

- E.g. Information passed from the industry to other stakeholders?
- From managers?
- From researchers?
- From other stakeholders? (e.g. conservation NGOs)

49. Do you feel that you're well informed about current management issues for the swim-with-dmw tourism industry?

- Is this important to you?

Question 50 (Almost finished)

FOR INDUSTRY

Would you be willing to share more information about your vessel's minke whale encounters with other stakeholders, to assist collaborative management?

- How about results from the Minke Whale Questionnaire? *<As you know, vessel names have so far been kept confidential>*
- How about GPS logs of sites used during the minke season, to help monitor industry effort?
- Do you have any concerns about other stakeholders (*for example the GBRMPA*) having access to this information?
- Is there a process that you feel might increase your confidence about sharing such information with other stakeholders in this industry?
    - *For example, a Memorandum of Understanding between the stakeholder groups (concerning handling of data and management responses to results)?*
- How about if it were a permit condition that MWQs were collected and the results from individual operators made available to managers and other stakeholders?
- Do you think that sharing this sort of information can help improve management of minke whale encounters by the industry as a whole?

FOR MANAGERS

Would you be willing to share more information about dmw tourism management issues with other stakeholders, to assist collaborative management?

- How about the annual reports from the DMW Tourism Monitoring Program?
- Do you have any concerns about other stakeholders (for example the industry) having access to this information?
- Is there a process that you feel might increase your confidence about sharing such information with other stakeholders in this industry?
    - *For example, a Memorandum of Understanding between the stakeholder groups (concerning handling of data and management responses to results)?*
- Do you think that sharing this sort of information can help improve management of minke whale encounters by the industry as a whole?

FOR NGOs/OTHER STAKEHOLDERS

Is there any information from your organisation you'd be willing to share with other stakeholders, to assist collaborative management of the swim-with-dmw tourism industry?

- Do you have any concerns about other stakeholders having access to any particular information? (for example the industry or management agencies).
    - IF YES – Is there a process that you feel might increase your confidence about sharing this sort of information between stakeholders in this industry?
    - *For example, a Memorandum of Understanding between the stakeholder groups (concerning handling of data and management responses to results)?*
    - IF YES - Do you think that sharing this sort of information can help improve management of minke whale encounters by the industry as a whole?

51. LAST QUESTION: Are there any comments you'd like to make about the issues or questions we've covered here today?

Thank you very much for your time, and for your support of this research. I'd like to reassure you that all statements made by interviewees will be de-identified and no comments will be attributable to any individuals or organisations.

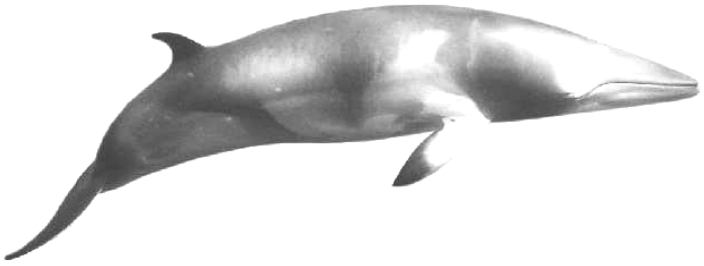
If you'd like a copy of the transcription of your interview for your records and for verification, I'll be happy to send this to you as soon as I've finished typing it up (but this may take a few weeks!)

<COLLECT COMPLETED SCORESHEET WHEN FINISHED>

Appendix 17: Information leaflet for stakeholder key informant survey participants.

Mechanisms for assessing the sustainability of swim-with-dwarf minke whales tourism in the Great Barrier Reef

STAKEHOLDER KEY INFORMANT SURVEY



Over August-November 2007, interviews with key stakeholders of the GBR swim-with-dwarf minke whales tourism industry are being conducted as part of a PhD research project by Matt Curnock (James Cook University, Schools of Business and Earth & Environmental Sciences), supervised by Dr Alastair Birtles and A/Prof Peter Valentine. The aims of this interview survey are to:

(1) **Identify Sustainability Objectives** for the GBR swim-with-dwarf minke whales tourism industry,
(2) Explore the range of **stakeholders' values**, identify relevant **management issues** and **possible solutions** to assist the future management of this industry, and
(3) Explore the potential for development and implementation of an **Adaptive Management Model** for swim-with-dwarf minke whales tourism in the GBRMP.

A total sample of 15-20 key stakeholders is anticipated, including owners and/or managers of permitted swim-with-dwarf minke whales vessels, staff of Commonwealth and Qld State government management agencies (the GBRMPA, Qld EPA/QPWS and Commonwealth DEH) and members of non-government conservation organisations (Whale and Dolphin Conservation Society, International Fund for Animal Welfare). Respondents will be contacted individually by Matt Curnock and invited to participate.

Your participation in this interview survey is entirely voluntary. **Your experience as a key stakeholder and your in-depth knowledge of the issues covered in this survey are highly valued**. The outcomes of this study will benefit greatly from your expert input, and we hope that these outcomes will benefit you and other stakeholders is collaboratively managing dwarf minke whale tourism in the GBR in the future.

Interviews are semi-structured, face-to-face, and will be recorded for the purpose of transcription and analysis by the Primary Investigator (M. Curnock). Interviews are expected to take **about ¾ of an hour** to complete. In some cases interviews may take longer, with the total interview time dependant upon the respondent's willingness and their level of detail in answers to interview questions. Interview recordings and transcriptions will be kept confidential in accordance with JCU Human Ethics Policy. Interview participants can request a copy of their own interview transcript (as soon as it's typed up) for their records and for checking the accuracy of the transcription.

This project has been approved by the JCU Human Research Ethics Committee (Ethics Approval No: H-2376). **All information concerning individual participants is STRICTLY CONFIDENTIAL** and will neither be published, nor released to organisations or individuals beyond those immediately involved in the conduct and supervision of this PhD research project (i.e. the Primary Investigator and PhD supervisors). All statements made by respondents will be de-identified for analyses and subsequent reporting of results. Results from this study will not be attributable to any individual person, agency or operation, and only summary information will be used in the PhD thesis, reports to the stakeholders and in subsequent peer-reviewed publications.

Your support by participating in this interview is greatly appreciated and we hope that the information collected will assist the long-term sustainability of swim-with-dwarf minke whales tourism in the Great Barrier Reef.

For further information please contact:

Matt Curnock
Tel: [redacted]
Email: [redacted]

Dr Alastair Birtles
Tel: [redacted]
[redacted]

A/Prof Peter Valentine
Tel: [redacted]
[redacted]

Appendix 18: Crew interview questions

Front cover page to be kept for records – give crew copy of MWP newsletter #9 + wrist band + business card for contact details

---

Name: _____ Date: _____ Time:_____

Location of interview: _____ Interviewer: _____

Interviewee is to read, understand, agree with and sign the following statement:

I have been informed about the nature of this interview, its confidentiality arrangements and anonymous design, and I agree to participate. I also agree to this interview being recorded.

Signature:_____ Date:_____

Name:_____

Begin recording, quote: time, date & location of interview.

Note: Dot points are prompts only

1. Tell me a little bit about your experience in the dive industry.

- What is the length of your experience on the GBR? ☐
- Have you worked on dive boats anywhere else?
- How long have you been in the dive industry?
- How long have you been with (*this company*)?
- What's your role on this vessel?

    - How long do you plan to stay working in the dive industry?

2. When was the first time you became aware of minke whales on the GBR?

- When was the first time you saw them? ☐
- When was the first time you heard about them?

3. Approximately on how many trips have you seen minke whales?

    - On this vessel? ☐
- On any other vessels?

4. Are you aware of the Australian National Guidelines for Whale and Dolphin Watching (2005)? ☐

    - **<u>If yes</u>** – what do you think of these?

5. Are you aware of the Code of Practice for managing interactions with minke whales on the GBR? ☐

- How effective do you think the CoP is?
- Is there anything you think could be improved in it?

(*copy of CoP available in white folders on vessel*)

6. What is your usual role during an interaction with minke whales on this boat?

- What specific tasks do you do when there are minkes around the boat? ☐
- Do you always do the same job?
- Who usually briefs the passengers about minkes?
- How useful have you found the 'Briefing Guidelines'? (*show copy of yellow laminated BGs*)

7. How well do you feel minke encounters are managed on this vessel?

- Why?
- Do you think this could be improved in any way? - How?

8. Have you ever observed any actions of passengers or crew which you feel may have had negative effects on the whales?

- **<u>If yes</u>** - Could you describe how?
- Have you ever observed any actions from other vessels which you felt might have had a negative impact on the whales?

9. Do you feel any concern that this kind of whale watching (swimming with minkes) might result in some negative impacts on the whales?

- Why? / Why not?

10. How well prepared do you feel the passengers are before they snorkel or dive with minkes for the first time?

- Why?
- Do they know much about the whales at that stage?
- Do they know about the Code of Practice?
- Do they generally follow the instructions you give them?
- Is there anything you'd suggest to prepare them better?

11. How useful do you feel the information materials about minke whales on your boat are for preparing passengers?

- What do you think could be improved?

12 How useful do you think the new Minke Whale Project Interpretive DVD is for preparing passengers?

- Is there anything you'd suggest to improve this DVD?

13. Do you think any extra training about minke whales would be helpful for crews?

- What kind of training for crews do you think would help them manage minke whale encounters?
- Would **you** like to receive some specific training for managing minke encounters?
- What about additional research training for collecting sightings & monitoring data? (*e.g. individual recognition for photo-ID; recording behavioural observations*)

- Do you think some sort of minke whale training certification or accreditation would be of benefit to **you**?
    - How?
    - What would **you** like to get out of such training?

As you know, the Minke Whale Project is studying several aspects of the minke whales' biology and behaviour as well as management of encounters to ensure they're sustainable in the long term.

15. Are you familiar with the Whale Sighting Sheet? (show e.g.) ☐

- Are you aware that that completing these for every minke whale sighting is a compulsory requirement for vessels with a swim-with-whales permit?
- How do you feel about this?
- Have you ever filled in one of these yourself?
- Who usually completes them?
- Do you think completing this should be the responsibility of a particular crew member?

16. What do you think about the WSS itself? ☐

- Do you think there are any problems with the WSS that make it difficult to complete?
- What would you suggest to improve it?

17. Are you familiar with the (voluntary) Minke Whale Questionnaire for passengers? ☐

- Do you think there are any problems with it that make it difficult for passengers to complete?
- Do you think it could be improved? - How?

As you know, we've also been encouraging crew and passengers to donate photos & video footage of minke whales to help build a catalogue of identified whales, and the contributions we've received have grown considerably in the past few years.

18. Do many passengers/crew on your vessel take underwater pictures of minkes? ☐

- Do you think they are happy to donate copies of those pictures? <u>If not, why</u>?
- Do most passengers donate their images?

19. What do you think is the best way of collecting and organising donated pictures? (e.g. possibility for pax and crew to download pictures on vessel pc; distribute blank cds/dvd...)

- Do you think there's a better way to encourage crew/pax to donate more pictures?

The Interaction Behaviour Diary has been in use for the past two seasons to collect crew and passenger observations of minke whale behaviour.

20. Are you familiar with the IBD?

- Have you ever filled in a log?
- Do you think crew and passengers are happy to fill these in after a minke encounter?
- What do you think of it?
- Any suggestions to improve it?

The Vessel Movement Log is another data sheet that we're using to collect information to compare vessel 'effort' with whale sightings

21. Do you think crew/skipper are happy to fill these in each time the vessel moves to a new dive site?

- What do you think of it?
- Any suggestions to improve it?

Okay – final question

22. Do you have any concerns about the long-term future of minke whale interactions in the GBR?

- Why? / Why not?
- What do you think could happen?

Thank you for your time and help with this research project.

If you'd like to be put on a mailing list to receive email updates about the MWP, please give your email:

Appendix 19: Pre-interview handout for stakeholder key informant survey.

Please read through the following proposed Sustainability Objectives before your interview, giving consideration to how <u>appropriate</u> you think they are, and <u>whether or not they would be useful</u> as a Sustainability Objective for the GBR swim-with-minke whales tourism industry. Feel free to write any comments below against any of the Objectives. Please bring any written comments/ ideas that you would like to discuss along to your interview.

<u>PROPOSED ECOLOGICAL OBJECTIVES</u>

	Is this Objective appropriate?	*Is it useful?*
1.1 The GBR dwarf minke whale population:		
a. Is maintained (i.e. the population is not decreased). …….	……..……..	
b. Is not displaced from its normal habitat (e.g. feeding, breeding grounds, migratory paths) as a result of interactions with humans. …….....	……	
1.2 Individuals and groups of dwarf minke whales:		
a. Are not physically harmed as a result of interactions with humans.	……..……..	
b. Control the nature and extent of interactions with vessels and swimmers.	……..……..	
c. Do not have their behaviour negatively impacted as a result of interactions with humans. ……..……	……..……..	
d. Do not have their key activities (such as feeding, breeding, nursing, resting, socialising) interfered with as a result of interactions with humans ……...	……...…….	
e. Are not at a greater risk of being hunted (e.g. by whaling vessels) as a result of habituation to vessels from human interactions in the GBR.	……	
1.3 Dwarf minke whales' habitat:		
a. Is not degraded by human activities. …….....	……	
b. Continues to support the GBR dwarf minke whale population. ……..…..	……	

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED SOCIAL OBJECTIVES

Is this Objective appropriate? *Is it useful?*

2.1 Swim-with-dwarf minke whales tourism operators in the GBR:

a. Provide a consistently high-quality experience for international and domestic tourists. …….. ……..……..

b. Promote further understanding and appreciation of dwarf minke whales to their clients using high quality interpretation. ……..……. …….

c. Foster broader conservation awareness and a commitment to sustainability among their crew and passengers. ……...…. …….

d. Contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research. ……..... ……..……..

e. Achieve and maintain the support of the local community, such that it values the whales and the industry appropriately …… ……..…..……..

2.2 Swim-with-dwarf minke whales participants:

a. Are aware of the relevant EPBC Regulations and protocols in the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions* before they encounter dwarf minke whales. ……. ……...…….

b. Are sufficiently prepared for their swimming-with-dwarf minke whales experience, with realistic expectations of in-water interactions. ……. ……..…….

c. Follow the Code of Practice. …… ……..……..

d. Are not at risk of death, injury or disease by swimming with dwarf minke whales. …….. ……..…….

e. Contribute to research and monitoring of dwarf minke whales and potential impacts of their interactions. …… ……..…….

f. Have an outstanding experience interacting with the whales. ……. …….

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED ECONOMIC OBJECTIVES

Is this Objective appropriate? *Is it useful?*

3. Swim-with-dwarf minke whales tourism in the GBR returns an adequate profit to the industry …….. ……..…….……..

Sub-objectives:

Swim-with-dwarf minke whales permitted operators in the GBR:

a. Have sufficient access to the resource and share the resource equitably.... ……..……..

b. Contribute to the maintenance of the resource on which they depend. ….. ……..…..……..

c. Have appropriate environmental offsets factored into their cost-benefit analyses. ……..…….…... ……

d. Provide an adequate economic return to the local community (e.g. through local sourcing, employment) ..……..……...… ……...…….

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED MANAGEMENT OBJECTIVES

Is this Objective appropriate? *Is it useful?*

4.1 Management of the GBR swim-with dwarf minke whales tourism industry:

a. Is World's Best Practice and establishes a leading model for whale watching and wildlife tourism management in Australia and internationally. ……..….. ……

b. Is genuinely collaborative and participatory, involving all stakeholders… ……

c. Contributes to capacity building and knowledge sharing …….……. ……..……..

d. Is transparent in all decision making processes …….....….... ……..…..……..

e. Is informed and guided by the use of the highest quality scientific research. ……..… ……

f. Wherever a lack of scientific certainty exists, applies the Precautionary Principle to proactively prevent potential negative impacts on the resource. ……..…… ……...…….

g. Is able to adapt and respond promptly to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale). ……..… ……..……

4.2 The GBR swim-with dwarf minke whales tourism industry:

a. Demonstrates a consistently high level of compliance with EPBC Regulations, the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions*. ……..… ……..……

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

Appendix 20: PROPOSED ECOLOGICAL OBJECTIVES – INTERVIEW SCORESHEET: - *"Do you support the following Sustainability Objective?"*

(Respondent No:_____)

*Please **tick one box** for each of the proposed Objectives, indicating your level of support for that Objective.*

	Do Not support	**Weak support**	**Moderate support**	**Strong support**	**Very Strong support**	*Don't know*
1.1 The GBR dwarf minke whale population:						
a. Is maintained (i.e. the population is not decreased). …….	…□	□	□	□	□	□
b. Is not displaced from its normal habitat (e.g. feeding, breeding grounds, migratory paths) as a result of interactions with humans. …..	…□	□	□	□	□	□
1.2 Individuals and groups of dwarf minke whales:						
a. Are not physically harmed as a result of interactions with humans.	…□	□	□	□	□	□
b. Control the nature and extent of interactions with vessels and swimmers.	…□	□	□	□	□	□
c. Do not have their behaviour negatively impacted as a result of interactions with humans. ……..……	…□	□	□	□	□	□
d. Do not have their key activities (such as feeding, breeding, nursing, resting, socialising) interfered with as a result of interactions with humans ……...	…□	□	□	□	□	□
e. Are not at a greater risk of being hunted (e.g. by whaling vessels) as a result of habituation to vessels from human interactions in the GBR.	…□	□	□	□	□	□
1.3 Dwarf minke whales' habitat:						
a. Is not degraded by human activities. …….....	…□	□	□	□	□	□
b. Continues to support the GBR dwarf minke whale population. ……..…..	…□	□	□	□	□	□

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED SOCIAL OBJECTIVES – INTERVIEW SCORESHEET: - *"Do you support the following Sustainability Objective?"*

(Respondent No:_____)

	Do Not support	**Weak support**	**Moderate support**	**Strong support**	**Very Strong support**	*Don't know*
2.1 Swim-with-dwarf minke whales tourism operators in the GBR:						
a. Provide a consistently high-quality experience for international and domestic tourists. ……..	…□	…….... □	…….…. □	……..… □	……..…. □	□
b. Promote further understanding and appreciation of dwarf minke whales to their clients using high quality interpretation. …….	…□	…….... □	…….…. □	……..… □	……..…. □	□
c. Foster broader conservation awareness and a commitment to sustainability among their crew and passengers. …….	…□	…….... □	…….…. □	……..… □	……..…. □	□
d. Contribute to improving our knowledge and understanding of the biology, behaviour and ecology of dwarf minkes (and hence potentially other whale species) by supporting scientific research. ……...	…□	…….... □	…….…. □	……..… □	……..…. □	□
e. Achieve and maintain the support of the local community, such that it values the whales and the industry appropriately …….	…□	…….... □	…….…. □	……..… □	……..…. □	□
2.2 Swim-with-dwarf minke whales participants:						
a. Are aware of the relevant EPBC Regulations and protocols in the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions* before they encounter dwarf minke whales. …….	…□	…….... □	…….…. □	……..… □	……..…. □	□
b. Are sufficiently prepared for their swimming-with-dwarf minke whales experience, with realistic expectations of in-water interactions. …….	…□	…….... □	…….…. □	……..… □	……..…. □	□
c. Follow the Code of Practice. ……	…□	…….... □	…….…. □	……..… □	……..…. □	□
d. Are not at risk of death, injury or disease by swimming with dwarf minke whales. ……..	…□	…….... □	…….…. □	……..… □	……..…. □	□
e. Contribute to research and monitoring of dwarf minke whales and potential impacts of their interactions. ……	…□	…….... □	…….…. □	……..… □	……..…. □	□
f. Have an outstanding experience interacting with the whales. …….	…□	…….... □	…….…. □	……..… □	……..…. □	□

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED ECONOMIC OBJECTIVES – INTERVIEW SCORESHEET: - *"Do you support the following Sustainability Objective?"*

(Respondent No:_____)

*Please **tick one box** for each of the proposed Objectives, indicating your level of support for that Objective.*

	Do Not support	**Weak support**	**Moderate support**	**Strong support**	**Very Strong support**	*Don't know*
3. Swim-with-dwarf minke whales tourism in the GBR returns an adequate profit to the industry ……..	…□	□	□	□	□	□
Sub-objectives: **Swim-with-dwarf minke whales permitted operators in the GBR:**						
a. Have sufficient access to the resource and share the resource equitably..	…□	□	□	□	□	□
b. Contribute to the maintenance of the resource on which they depend. ...	…□	□	□	□	□	□
c. Have appropriate environmental offsets factored into their cost-benefit analyses. ……...	…□	□	□	□	□	□
d. Provide an adequate economic return to the local community (e.g. through local sourcing, employment) ..……...…	…□	□	□	□	□	□

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____

PROPOSED MANAGEMENT OBJECTIVES – INTERVIEW SCORESHEET: - *"Do you support the following Sustainability Objective?"*

*Please **tick one box** for each of the proposed Objectives, indicating your level of support for that Objective.*

(Respondent No:_____)

	Do Not support	**Weak support**	**Moderate support**	**Strong support**	**Very Strong support**	*Don't know*
4.1 Management of the GBR swim-with dwarf minke whales tourism industry:						
a. Is World's Best Practice and establishes a leading model for whale watching and wildlife tourism management in Australia and internationally. ……..	…□	……..... □	……..…. □	……..… □	……..…. □	□
b. Is genuinely collaborative and participatory, involving all stakeholders..	…□	……..... □	……..…. □	……..… □	……..…. □	□
c. Contributes to capacity building and knowledge sharing …….	…□	……..... □	……..…. □	……..… □	……..…. □	□
d. Is transparent in all decision making processes …….....…...	…□	……..... □	……..…. □	……..… □	……..…. □	□
e. Is informed and guided by the use of the highest quality scientific research. ……	…□	……..... □	……..…. □	……..… □	……..…. □	□
f. Wherever a lack of scientific certainty exists, applies the Precautionary Principle to proactively prevent potential negative impacts on the resource. ……	…□	……..... □	……..…. □	……..… □	……..…. □	□
g. Is able to adapt and respond promptly to changes in the social-ecological system (i.e. the environment or resource, the industry and society at a broader scale). ……	…□	……..... □	……..…. □	……..… □	……..…. □	□
4.2 The GBR swim-with dwarf minke whales tourism industry:						
a. Demonstrates a consistently high level of compliance with EPBC Regulations, the *Australian National Guidelines for Whale and Dolphin Watching 2005* (and subsequent revisions) and the *Code of Practice for Dwarf Minke Whale Interactions*. ……	…□	……..... □	……..…. □	……..… □	……..…. □	□

- Is there anything we've missed here? _____
- Is there any wording that needs to be changed? _____