Torres Strait Community GIS

Building the capacity of Torres Strait Islander communities in natural resource management through integration of Traditional Ecological Knowledge and Western Scientific Knowledge

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Acronyms Used In This Report

AQIS	Australian Quarantine and Inspection Service
CDEP	Community Development Employment Projects
DMU	Dugong management unit
DSS	Decision support system
ESRI	Environmental Systems Research Institute
GBRWHA	Great Barrier Reef World Heritage Area
GIS	Geographical Information System
GPS	Global Positioning System
IUCN	International Union for the Conservation of Nature
JCU	James Cook University
MTSRF	Marine and Tropical Sciences Research Facility
NAILSMA	North Australian Indigenous Land and Sea Management Alliance.
RRRC	Reef and Rainforest Research Centre Limited
SEQ	South East Queensland
TSRA	Torres Strait Regional Authority

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Introduction

The importance of northern Australia to the conservation of the world's biodiversity is increasingly important as other mega diverse areas become degraded. Much of northern Australia is under Indigenous tenure. Thus empowering Indigenous Australians, including Torres Strait Islanders, to make informed decisions about how to manage their natural resources is of local, national and international significance and accords with government policy.

Building the capacity of Torres Strait Islander communities through community GIS

In partnership with governments, remote Indigenous communities in the Torres Strait are challenged with making a variety of decisions about natural resource management, including the management of dugongs. Because of the primacy of Traditional Ecological Knowledge to Indigenous peoples and the primacy of Western Scientific Knowledge to governments, management of Indigenous country must be based on both knowledge systems. The capacity of these knowledge systems to better inform such decision making is enhanced if both types of information are presented in compatible formats. Unfortunately, in many areas Indigenous knowledge is being lost at an alarming rate and communities require technical support to assist them in maintaining and actively conserving this information.

Decision support systems (DSS) are computerised systems that can assist in making decisions between alternatives based on estimates of the values of those alternatives. Geographical information system (GIS)-based DSS have the benefit of being able to incorporate many different kinds of data spatially to support the estimation, evaluation and comparison of alternatives. A GIS-based DSS is a visual representation of information, and can provide a simple and clear way of creating, communicating and analyzing data in a manner accessible to audiences of different cultural backgrounds. Thus, GIS-based DSS have great capacity to incorporate communities in their development

Community developed solutions to problems that concern them tend to be reasonable, realistic and sustainable (Craig *et al.* 2002). A community's decision making process can be enhanced by GIS-based DSS as such systems provide information to help develop appropriate responses, and support the creation of map products and analysis. As a result of differential access to data and technology, remote communities often lack the advantages of GIS-based DSS to assist them in managing their natural resources

GIS-based DSS are able to bridge the gap between Indigenous Knowledge and Western Scientific Knowledge by collating a variety of information into a common format. An additional benefit of GIS-based DSS is their ability to store information and so support, maintain and conserve Indigenous Knowledge.

Spatial models of dugong distribution and relative density

The dugong is of the highest cultural value to the Indigenous peoples of Torres Starit where the globally significant dugong population supports an important Indigenous fishery for meat and oil. The fishery is protected by the *Torres Strait Treaty* between Australia and

Papua New Guinea which obliges the signatories to 'miminmise any restrictive effects on the traditional activities of traditional inhabitants'.

The dugong is listed as vulnerable to extinction at a global scale by the IUCN, on the Convention of Migratory Species of Wild Animals and on Appendix 1 of the Convention on the International Trade in Endangered Species. As a signatory to these conventions and to the Convention on Biological Diversity, the Australian government is obliged to protect dugong stocks in northern Australian waters. The dugong is listed both as a migratory species and as a listed marine species under the *Environment Protection and Biodiversity Conservation Act* 1999 (C'th), and as vulnerable under the *Queensland Nature Conservation Act* 1992. The *Native Title Act* 1993 (C'th) states that Indigenous peoples with a Native Title right do not need a permit to hunt under contemporary commonwealth and state/territory legislation. The Department of Environment and Heritage is now coordinating the implementation of policy entitled *Sustainable harvest of marine turtles and dugongs in Australia - A national partnership approach 2005* with the aim of working with Traditional Owners to ensure that hunting is sustainable.

Aerial surveys conducted since the mid 1980s using standardised methodology have provided the basis of the management of dugongs in the Torres Strait region. Population modelling based on the aerial survey data using two independent techniques, Population Viability Analysis (Heinsohn *et al.* 2004) and Potential Biological Removal (Marsh *et al.* 2004) suggests that the dugong fishery is not sustainable; a conclusion supported by the Draft Strategic Assessment of the Torres Strait Turtle and Dugong Fisheries (2006). The draft report recommends that a study be undertaken in association with Islander communities to identify/evaluate alternative mechanisms available at the community level to limit and monitor catch. Spatial models of dugong distribution and relative density developed by Grech and Marsh (2007) inform such a study by providing Islanders and management agencies with scientifically robust information on the spatial distribution of dugongs that take into account the large scale dugong movements resulting from changes in seagrass habitats, because their models are based on integrated data from multiple aerial surveys spanning more than two decades. Spatial models of dugong distribution and abundance can also provide the science base for assessing management options such as spatial closures to hunting or limiting the hunting of each community to their own sea country, through a spatial risk assessment approach (Grech and Marsh, 2008).

Objectives

Our first objective was to empower communities in the Torres Strait to work with government in accordance with the National Partnership Approach and make decisions about the management of natural resources by increasing their capacity to integrate their Indigenous Knowledge with information collected by western scientists. To achieve our objective, we conducted GIS and GPS training and community mapping workshops with eight communities participating in the NAILSMA and Torres Strait Regional Authorities (TSRA) Cross-regional Dugong and Marine Turtle Management Project: Mabuiag, Badu, Murray (Mer), Darnley (Erub), Yorke (Masig), Yam (Iama), Boigu, and Horn (Ngurapai) Islands (Figure 1). A workshop was also conducted for rangers of Hammond Island.

Our second objective was to produce spatial models of dugong distribution and relative density in Torres Strait from data integrated across six aerial surveys from 1987-2006. The resultant maps were provided to Islander communities and management agencies (such as TSRA) to inform negotiations about shared responsibility strategies for ensuring that the

Torres Strait dugong fishery is sustainable as part of the *National Approach to Sustainable Harvest of Marine Turtles and Dugongs in Australia*.

Figure 1: Locations of GIS and GPS training and community mapping workshops with eight communities participating in the NAILSMA and Torres Strait Regional Authorities (TSRA) Dugong and Turtle Project, and Hammond Island.

Methods and Results

Community GIS workshops in Torres Strait

With the assistance of TSRA's Land and Sea Management Unit, NAILSMA and TSRA's Cross-regional Dugong and Marine Turtle Management Project Dugong and Turtle Project Officers (Table 1), and local councils, community GIS workshops were arranged at Mabuiag, Boigu, Yam (Iama), Yorke (Masig), Darnley (Erub), Murray (Mer), Badu, and Horn (Ngurapai) Islands. Rangers from Hammond Island attended the Horn Island workshop. Workshops were conducted by PI Alana Grech, Indigenous counterpart Stephen Ambar of the Hammond Island Council, and Dugong and Turtle Project Officers.

Workshops were held in February, March and April 2008 (Table 1). The duration of the workshops varied depending upon the size of the community and the number of

participants. The minimum duration of a workshop was one day, and the maximum three days (Table 1). Participants at the workshops were recruited by Dugong and Turtle Project Officers and local councils. In total, the number of participants at the workshops was 136 (Table 1). Workshop *participants* had a variety of occupations, as summarized in Appendix 1.

Community	Dugong and Turtle Project Officer	Workshop duration	Number of participants
Mabuiag	Mr. Terrence Whap	6th – 8th February	28
Boigu	Mr. Ishmael Gibuma	11th – 12th February	21
Yam (Iama)	Mr. Charles David	18th – 19th February	17
Yorke (Masig)	Mr. Michael Morris	21st – 22nd February	12
Darnley (Erub)	Mr. Kenny Bedford	25 – 26th February	32
Murray (Mer)	Mr. Moses Wailu	28th – 29th February	8
Badu	Mr. Solomon Nona (Council Secretary)	3rd – 4th March	10
Horn Is. (Ngurapai)	Mr. Pearson Wigness	9th – 10th April	4
Hammond Is.	Mr. Stephen Ambar	9th – 10th April	3

Table 1: Itinerary of GIS and GPS training and community mapping workshops, including the name of Dugong and Turtle Project Officers and the number of participants recorded at the workshops. The total number of participants was 136.

At the beginning of each workshop, all participants were given an Information Page and Informed Consent Form to read and sign. Participants were encouraged to discuss the contents of the Information Page and Informed Consent Form with PI Alana Grech, Indigenous counterpart Stephen Ambar and Dugong and Turtle Project Officers before agreeing to participate in the workshop. Intellectual property and access to information (data sharing) protocols needed to be established to facilitate authorisation of data to be transferred or shown within a community and to external agencies, including other communities. At the beginning of each workshop, concerns regarding safe storage of spatial information, intellectual property and data sharing were discussed in an open forum. During the open forum, community members were asked to discuss: (1) spatial datasets collected by an individual or community during the workshop; (2) who should have access to these datasets (individual/community/TSRA/JCU etc.); and (3) how can those who access the dataset use it (eg. can it be used for research, fisheries management etc).

PI Alana Grech produced a GIS and GPS training manual (Appendix 2) for participants prior to the commencement of the workshops. All participants were provided with a hard copy version of the training manual; Dugong and Turtle Project Officers were provided with hard copy and digital versions. PI Alana Grech and Indigenous counterpart Stephen Ambar supplied GPS units, GIS software, laptops, and spatial data layers to workshop participants in the context of a comprehensive introduction to all aspects of GIS and GPS, as well as hands-on experience using GIS/GPS to address and solve natural resource management problems that affect Torres Strait Islanders.

There are many GIS software options available. Training was conducted using ESRI's ArcGIS® 9.2 which is the most popular GIS software available on the market. There are also many types of GPS units. Training was conducted using Garmin eTrex®, a physically robust GPS unit that is commonly used in Torres Strait.

Figure 2: An example of a digital map that combines Indigenous Knowledge with information collected by western scientists created by a workshop participant from Boigu (and published with their permission). Dugong sanctuary and hunting areas were mapped and identified using traditional names. This information was overlaid with the spatial model of dugong distribution and relative density (Grech *et al.*, this report).

Each workshop had two components: GPS training was conducted during the first half of the workshop, followed by GIS and community mapping training. GPS training consisted of an introduction to the Garmin eTrex and field exercises. During field exercises, participants were encouraged to record (with GPS units) information they consider relevant to the management of natural resources in their community, including sites of high marine turtle and dugong density, community infrastructure, weeds, and areas of habitat destruction. GPS and community mapping training consisted of exercises in ArcGIS® 9.2

as described in the training manual (Appendix 2 *Participants* used their own data collected in GPS training during GIS and community mapping training. Hard-copy maps were provided to participants to assist in the recording of spatial information. *Participants* learnt how to record spatial information in a digital format using ArcGIS® 9.2. *Participants* also learnt how to integrate their information with spatial information obtained from scientific organizations including James Cook University, Geoscience Australia, and the Australian Commonwealth Scientific and Research Organization (CSIRO). This information will form the GIS-based DSS that integrates Indigenous Knowledge with Western Scientific Knowledge for communities in Torres Strait. An example of a digital map that combines Indigenous Knowledge with information collected by western scientists created by a workshop participant from Boigu is given in Figure 2.

On the completion of the workshop, Indigenous counterpart Stephen Ambar and Dugong and Turtle Project Officers hosted a group forum giving *participants* an opportunity to discuss what they learnt during the workshop and provide PI Alana Grech with information to assist in improving the standard of future workshops. Participants were asked: what they liked about the workshop; what they didn't like; how they think it could be improved; and how they will use the skills they have learnt in the future. Indigenous counterpart Stephen Ambar recorded participant's responses, and a summary of each community's group forum is given in Appendix 1. No names, addresses or any other identifying information were recorded so responses to the questions cannot be traced to an individual.

Raw data (including responses of individuals during the group forum, and map outputs) were stored on a password protected laptop during the workshops, and are currently stored on a password protected PC in a locked office at School of Earth and Environmental Sciences of James Cook University in Townsville. This data will be retained for at least five years. A copy of all outputs (hard-copy and digital) derived from the workshops was given to Dugong and Turtle Project Officers and local councils who can distribute this information to participants. *Participants* who gave consent were photographed during the workshops. Copies of all photographs were given to Dugong and Turtle Project Officers and local councils. All participants were given a certificate acknowledging their presence at the workshops (Appendix 3). Dugong and Turtle Project Officers were also given a GPS unit (Garmin eTrex® h series) and multiple licenses to the GIS software ArcGIS® 9.2.

Spatial model of dugong distribution and relative density in Torres Strait

Dugong aerial surveys of Torres Strait

Aerial surveys conducted by Marsh and her group at James Cook University have systematically monitored dugong abundance and distribution in Torres Strait since the mid 1980s, providing empirical data on patterns of dugong distribution and abundance (Marsh and Saalfeld 1989, 1990; Marsh *et al.* 1993, 1996; Marsh and Lawler 2001, 2002).

Aerial surveys were conducted using the strip transect method described by Marsh and Sinclair (1989). The survey region was divided into blocks containing systematic transects of varying length, which were typically perpendicular to the coast across the depth gradient which supports seagrass in the region. Tandem teams with two observers on each side of the aircraft independently recorded sightings of dugongs, including information on group size and calf numbers, and the number at the surface. Transects were 200m wide at the

water's surface on either side of the aircraft. These surveys have been used to estimate absolute dugong abundance by correcting sightings for perception bias (animals that are available to but missed by observers) and availability bias (animals that are unavailable to observers because of water turbidity) *sensu* Marsh and Sinclair (1989) and Pollock *et al.* (2006). The corrections for these biases were applied at the spatial scale of entire surveys (thousands of square kilometers), an inappropriate spatial scale for our research. As a result, our model of dugong distribution and abundance is based on relative rather than absolute total density. Nonetheless, the relative densities among regions should be approximately comparable.

Figure 3: Model of dugong distribution and relative density in Torres Strait based on the dugong sightings from aerial surveys conducted in 1987, 1991, 1996, 2001, 2005 and 2006.

Data analysis was conducted as outlined in Grech and Marsh (2007). Dugong density was calculated at a grid size of 2km × 2km .This scale was chosen as (1) it corresponds with the scale of the aerial survey data allowing us to account for (a) slight changes in altitude of the aircraft (which affects transect width at the surface); and (b) the blind area under the aircraft.; and (2) it is the scale recommended for use by managers of wildlife under Criterion B of the *International Union for Conservation of Nature and Natural Resources Red List* (IUCN 2001). The results of six aerial surveys are available in digital format: 1987, 1991, 1996, 2001, 2005 and 2006.

The sampling intensity of each survey block was determined by calculating the proportion of area surveyed. There are some (relatively minor) differences in sampling intensity per block and area sampled between surveys. The sampling intensity within surveys varies between survey blocks because the survey intensity was stratified depending on dugong abundance, ranging from approximately 4% to 10%. In our analysis, four computations were required to correct for these differences as outlined in Grech and Marsh (2007). The resulting value was divided by the number of surveys conducted on each transect to obtain a mean index of dugong abundance that was then used in our geostatistical analysis.

Geostatistical Analysis

The analysis was conducted in the following sequence. (1) The spatial autocorrelation of the dugong data was investigated by a variogram analysis using the Geostatistical Analyst extension of ArcGIS® 9.1 and a circular model chosen to estimate semivariance. (2) The data was interpolated using a geostatistical interpolation technique (universal kriging). Universal kriging is robust to common attributes of ecological data (Ver Hoef 1993, McKenney 1998) as it returns unbiased linear estimates of point values where trends in data vary and regression coefficients are unknown. The Spatial Analyst© extension of ArcGIS® 9.1 was used to spatially interpolate the data to a 2km × 2km grid (Figure 3). Each grid cell in the final models is regarded as a dugong management unit (DMU). (4) A re-substitution approach was used to validate the model resulting from the geostatistical analysis.

Categorising dugong management units

We used the same range of values of dugong density as Grech and Marsh (2007) to categorise dugong management units as low, medium or high ecological value for dugongs in Torres Strait (Figure 4). Our approach assumes that dugong density is a robust index of a region's conservation value for dugongs. This assumption is justified because: (1) density estimates are regarded as suitable surrogate measurements of habitat use, and (2) no critical habitats for dugongs have been identified other than the seagrass meadows where they spend most of their time. By using the time series of data collected over 19 years, the model accounts for temporal changes in the use of various regions by dugongs including movements resulting from events such as seagrass dieback.

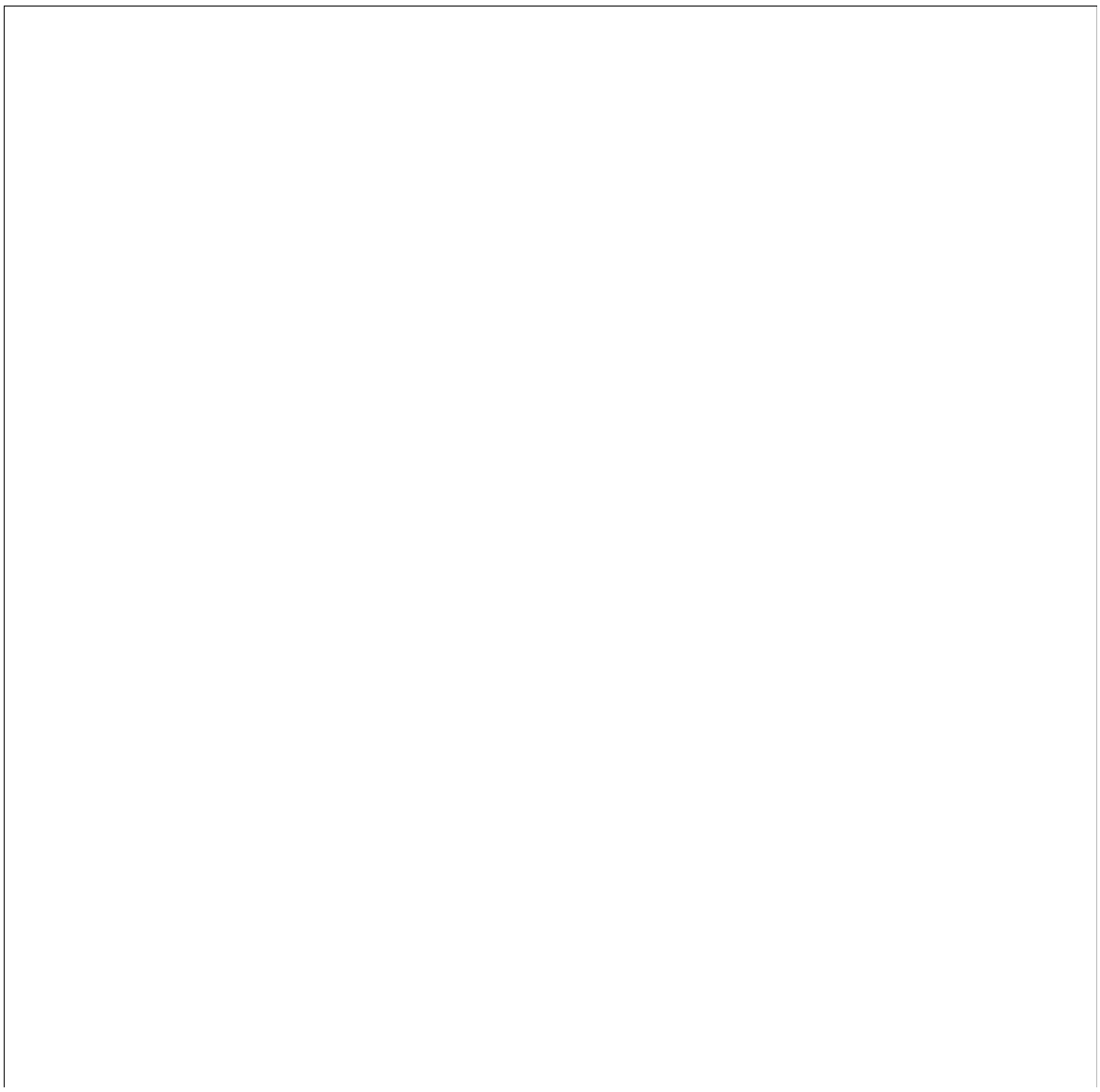

Figure 4: Model of the ecological value of dugong habitats in Torres Strait based on the dugong sightings from aerial surveys conducted in 1987, 1991, 1996, 2001, 2005 and 2006.

Dugong distribution and relative density in Torres Strait and eastern Queensland

The areas of highest relative dugong density in the Torres Strait are between Buru and Mabuiag Islands and along the Warrior Reefs (Figures 3 and 4). In contrast to previous assessments, our model indicates that the Torres Strait dugong sanctuary encompasses a large region of high and medium conservation value to dugong (Figure 4), indicating the potentially significant value of the spatial closure of this region, provided it is effectively enforced. Nonetheless, it must be noted that a potentially significant proportion of the sanctuary (54 %) has not been surveyed as the region cannot be safely surveyed using light aircraft. The remaining 46 % of the sanctuary that are within the limits of the spatial model include 2,460, 1,337 and 1,254km^2 of high, medium and low conservation value areas respectively. High conservation value areas encompass 45 % of the sanctuary that are within the limits of the spatial model. The dugong model shows areas of high and medium conservation value at the western limits of the survey region including parts of the sanctuary (Figure 4). This suggests that there are more high and medium conservation value areas within the sanctuary that are not identified in the model. Thus, we believe that:

(1) dugong aerial surveys do not cover the entire distributional range of dugongs in the region, and (2) a significant proportion of high value dugong habitat probably already functions as a *de facto* spatial closure because it is beyond the range of Indigenous hunting. It will be important for the Australian government to ensure that dugong poaching by foreign fishing vessels does not occur in this region.

We have previously developed models of dugong distribution and relative density for the Great Barrier Reef World Heritage Area (GBRWHA) and south-east Queensland (Moreton Bay and Hervey Bay). We combined these models with the Torres Strait model to create a continuous distribution map for the east coast of Queensland (Figure 5). We compared the amount of dugong habitats of high, medium and low conservation value along the east coast of Queensland and found the Torres Strait comprises 74 % of the total high conservation value dugong habitats and 63 % of the total medium value habitats (Table 2). A greater proportion of the Torres Strait region is comprised of high value dugong habitats (36 %; Table 3) than in the inshore Great Barrier Reef region or south-east Queensland. This analysis shows that dugong habitats in the Torres Strait are the most important along the east-coast of Queensland, and almost certainly the world.

	Total Area (km^2)*	High	Medium	Low
Torres Strait	*27232*	74	63	26
GBRWHA	*32066*	16	23	67
SEQ	*5496*	9	14	7

*areas surveyed and rated as high, medium and low ecological value for dugongs, respectively.

Table 2: Proportion (%) of the area surveyed for dugongs on the east coast of Queensland which was classified as high, medium or low ecological value to dugongs, and that occurs in Torres Strait, inshore Great Barrier Reef World Heritage Area (GBRWHA) and south-east Queensland (SEQ), respectively.

	Total Area (km^2)*	High	Medium	Low	No Value
Torres Strait	*30482*	36	19	34	11
GBRWHA	*70355*	3	3	39	54
SEQ	*6715*	20	19	43	18

*total area surveyed

Table 3: Proportion (%) of Torres Strait, inshore Great Barrier Reef World Heritage Area (GBRWHA) and south-east Queensland (SEQ) habitats that have been surveyed for dugongs and classified as high, medium and low conservation value dugong habitats.

Figure 5: Models of dugong distribution and relative density (A) and ecological value (B) based on dugong aerial surveys condcuted since the mid 1980s along the east coast of Queensland.

Discussion and Conclusions

The workshops we conducted on using GIS and GPS and community mapping in nine Torres Strait communities had two major outcomes: (1) they increased the capacity for 136 Islanders (126 men and 10 women) to collect spatial information; and (2) they increased the capacity of these people to interpret and apply the spatial information collected by western scientists. A comprehensive introduction to collecting and storing information using GIS and GPS was provided to workshop participants. Participants also learnt how to integrate their Indigenous Knowledge with Western Scientific Knowledge using GIS. Spatial information collected by government organizations was provided to Dugong and Turtle Project Officers and workshop participants to produce components of a preliminary GIS-based DSS that integrates Indigenous Knowledge with Western Scientific Knowledge for each of the participating communities in Torres Strait. Most of this information is confidential to the communities in accordance with the data sharing agreements that we developed and which were integral to the acceptability of the workshops to the Islanders.

Workshop participants came from 19 occupations and included rangers, Landcare officers, AQIS officers, Environmental Health officers, SES officers, Council members, and fisherman (see Appendix 1), demonstrating the potentially wide range of applications of these technologies for Torres Strait Islanders. Participants identified multiple ways in which they can use the training provided to them during the workshops including: navigation, fishing, dugong and turtle management (including the design of spatial closures), weed management, mapping of sacred sites, safety, weed management, pest management, town planning, and presentations and communication of information (a comprehensive list is provided in Appendix 1).

The involvements of Indigenous counterpart Stephen Ambar was integral to the overall positive response to the workshops because of his: (1) understanding of cultural protocols; (2) enthusiasm for the technology and opportunities provided by holding such training in Torres Strait communities; and (3) ability to communicate with Torres Strait Islanders in their own language. The major limitation to the success of the workshops was equipment availability: the small number of laptops (2) and GPS units (4) available for training. Equipment availability and maintenance would be the major impediments to the long-term use of such technology in the outer islands of Torres Strait.

The diversity and number of participants who gave up their time to attend a workshop highlights the demand for adult education and capacity building in technologies such as GPS, GIS and community mapping from Torres Strait Islanders. The workshops also provided an opportunity for building trust and improving communication between Indigenous communities and western scientists. The long-term effectiveness of the workshops was undoubtedly limited by the time and financial constraints, but we believe that they were very cost-effective as a small contribution to what needs to be a very significant and long-term capacity building program for adults in the Torres Strait. Participants were generally very positive about the GPS and GIS training (see Appendix 1), and many communities requested additional training.

Digital and hard-copy versions of the spatial model of dugong distribution and relative density were provided to Dugong and Turtle Project Officers, workshop participants and TSRA to inform their regional resource management initiatives. It was appropriate to deliver the model of dugong distribution and relative density to each community through our workshops as they provided an opportunity for community members to have their concerns addressed directly and learn how to use the model in conjunction with their own

Traditional Ecological Knowledge via a GIS-based DSS. Results from the 2006 dugong aerial survey conducted by Helene Marsh and her Group (MTSRF Program 4 – Project 1.4.2) were also discussed with community members. We found that presenting the results of the dugong aerial surveys as a continuous spatial model was an effective method of communicating the aerial survey results. Islanders found the maps of dugong distribution and relative density very easy to understand and many said that this Western Science information was congruent with their Indigenous Knowledge. The Islanders' positive reactions to the maps of our continuous spatial model contrasted with their much less positive reactions to our previous presentations of the aerial survey results as maps showing dugong sightings as point data, a format preferred by some western environmental managers. In our experience, Indigenous people find the point data difficult to comprehend and to relate to their own knowledge.

The spatial model will inform the ongoing negotiations about shared responsibility strategies for ensuring that the Torres Strait dugong fishery is sustainable. Eight communities are in an advanced stage of preparing Dugong and Turtle Management Plans. The draft Strategic Assessment of the Torres Strait Turtle and Dugong Fisheries Report (2006) commissioned by the Australian government, recommends that 'a study be undertaken in association with Islander communities to identify/evaluate alternative mechanisms available at the community level to limit and monitor catch' (Kingston, 2006). Our spatial model of dugong distribution in Torres Strait contributes to the fulfillment of this recommendation by providing Islanders and management agencies with scientifically robust information on the spatial distribution of dugongs in Torres Strait, as the part of the science base for assessing management options such as spatial closures to hunting or limiting the hunting of each community to their own sea country.

We plan to extend this work on the spatial distribution of dugongs in Torres Strait and the associated training in the use of GIS at a workshop on Thursday Island scheduled for October 2008, which will explore the benefits of and challenges associated with using spatial closures as one of the tools for community-based management of dugongs and turtles in Torres Strait. If funding is available, we plan to develop spatial models of turtles for Torres Strait from CRC Torres, MTSRF and JCU historical aerial survey data prior to the workshop and to present the results at the workshop. The workshop will further develop the collective capacity and mutual understanding of TSRA Land and Sea Managers, Dugong and Turtle Project Officers, Government agency staff and researchers conducting projects on dugongs and turtles in Torres Strait.

Recommendations

(1) That capacity building in the use of GPS and GIS technology is continued as an integral part of the National Partnership Approach for managing the turtle and dugong harvest of Indigenous Australians.

(2) That consideration is given to developing a comprehensive and long-term capacity building program that encompasses all communities of the Torres Strait and involves GPS and GIS education and training and community (Indigenous Knowledge) mapping exercises. A program such as this requires the development of formal data protocols, will take many years to complete, and requires major financial investment. The program currently in operation with the Rainforest Aboriginal people of the Wet Tropics World Heritage Area could be investigated as a possible model.

(3) That Indigenous people be integrally involved in the design and presentation of adult education programs on natural resource management in the Torres Strait.

(4) That MTSRF adopt a policy of requiring information collected by researchers to be returned to Torres Strait Islanders through workshops in Torres Strait communities to provide opportunities for informal discussions between community members and researchers.

(5) That MTSRF and TSRA discuss ways of ensuring that Torres Strait Islanders are given the opportunity to assist in the organization and delivery of such workshops.

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Appendix 1

Responses from participants to questions asked by Indigenous counterpart Stephan Ambar on GPS and GIS training and community mapping workshops. The various occupations of participants are also given.

Community	What did you like about today?	What didn't you like about today?	What would have made today better?	How will you use the skills you learnt today in the future?	Participant's occupations
Mabuiag (GPS)	Learning GPS. Simplicity of the GPS units and learning. Training compatible with other GPS units. Fun and exciting. Team work.	Wasting time. Sun was hot outside when collecting waypoints. There was no GPS units for sale. Liaison worker (Stephen) needs to explain more clearly.	There should have been GPS units to sell because it is hard for us to get them.	Find fishing spots and cray stones. Using GPS will help in navigation and help to cut down fuel use. Community planning.	Dugong and turtle project officer Environmental Health officer Sports and Recreation officer Council office administrator Rangers Cray fisherman Community members
Mabuiag (GIS)	Get to use laptop. Learning how to use ArcMap. Figuring out how to use laptop.	Not good catering. Too much breaks. Need more laptops (need to do training at a place with more laptops).	Bigger projector to the white board. Shorter break periods.	Will need for cray fishing Land site planning Dugong and turtle management Map traditional sites Community planning (land divisions)	
Boigu (GPS)	Leant to use GPS – this was the first time for everyone. Good and new experience.	Need to break down explanation more and make it clearer.	More computers and more GPS. Need to go out on the water to practice marine GPS Course needs to be longer – teacher needs to come back to Boigu	Working in the bush Fishing Travel to Thursday Island	Dugong and turtle project officer Police officer Fisherman Librarian Ladies (CDEP workers) Community members Elders
Boigu (GIS)	It was good creating maps and identifying the tools.	The course was to short – because of the current education status of the community, the teacher needs to return and run the course for a longer period of time (two weeks – month).	If there were more GPS waypoints collected on Monday – more of Boigu could have been mapped.	Fishing Mapping the island Gardens Wet area Use in travelling from island to island	

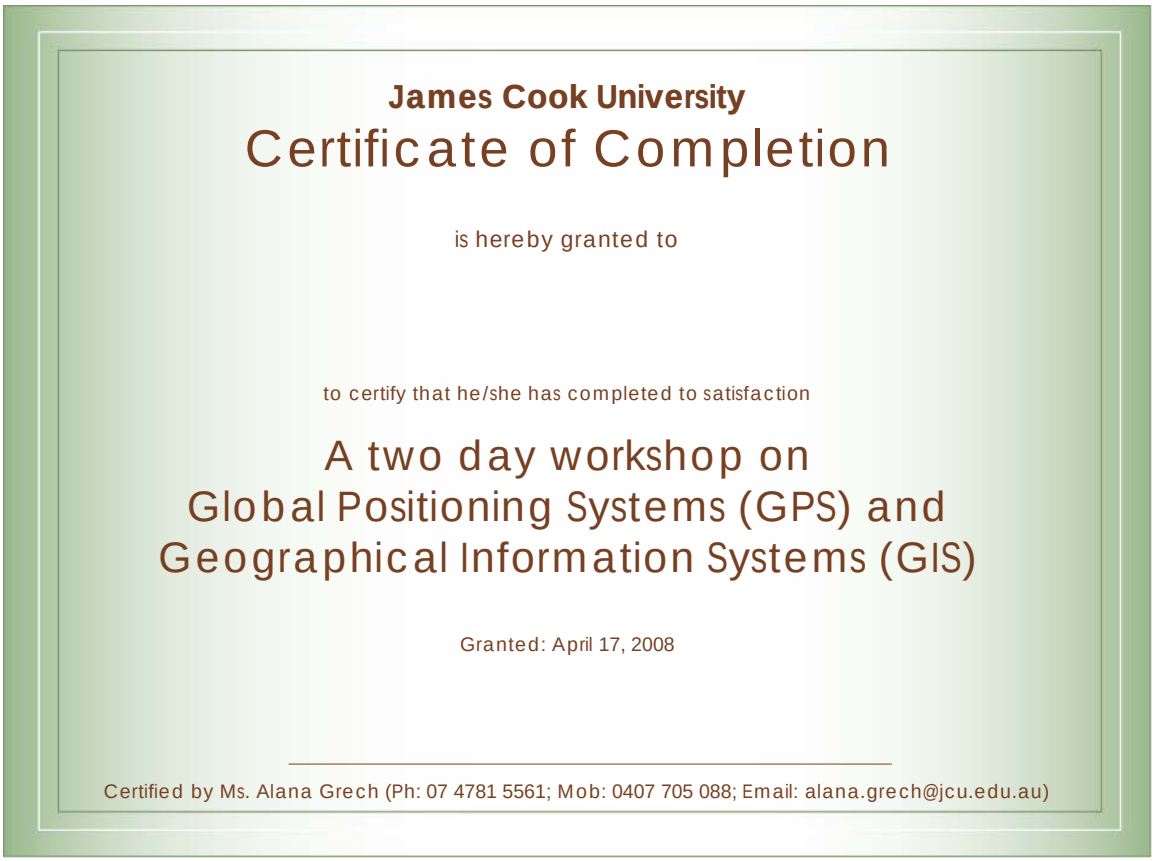
Community	What did you like about today?	What didn't you like about today?	What would have made today better?	How will you use the skills you learnt today in the future?	Participant's occupations
Yam (GPS)	Learnt how to operate GPS. Teaching was nice and clear – we could understand the answers to our questions. Good to have hands on experience with GPS.	Computer error. We needed to collect more GPS waypoints (marine GPS and outside the community).	Bigger projector whiteboard. More laptop and GPS. More planning would have allowed us to use the workboat to go out and collect waypoints on the water.	Safety At work (water officer) Helping each other (liaise with one another) Children will learn how to use it. AQIS officer said when he sets fly trap; he could collect fly trap and brickets for dengue mosquito's waypoints. Help cray fishing. Mapping sacred sites.	Dugong and turtle project officer Water officer Environmental Health officer AQIS officer Landcare officer Policeman SES officer Cray fisherman
Yam (GIS)	Learning how to use a computer. Learning how to put a legend on a map. Community liked the way teachers conducted the course – they made it very simple and easy to learn. Training was very good (best ever on the island).	Everything was good about today.	More computers (5 or 6).	Everyday life Work Trying to get the young kids interest GIS knowledge will be handy for future SES officer said GIS knowledge would be handy for future jobs (cargo boats) Land division	
Yorke (GPS)	We liked the GPS course because we found out how easy using GPS is.	Everything was ok. Not many GPS.	More GPS – bring some to sell.	Plotting fishing spot. Save petrol Manage tourism. Save fuel when taking visitors out.	Second dugong and turtle project officer SES officer/councillor Pastor School teacher Cray fisherman

Community	What did you like about today?	What didn't you like about today?	What would have made today better?	How will you use the skills you learnt today in the future?	Participant's occupations
Yorke (GIS)	Interesting. Using a computer was exciting. Questions were answered clearly. Happy with the number of people that turned out. Excellent catering.	Time was too short – need a longer period. Bring more laptop. Come more often to refresh the mind.	Four days training. Planning full days. Planning not to interfere with other trainers visiting.	Map the reef and fishing spots. Mapping safe route from island to island. Implement in sponge project. Use as a management tool Management of SES emergency.	
Darnley (GIS)	GPS was interesting. GPS was clear to understand. Working in groups was effective.	Hot.	More information about GPS and how to use it. More GPS and different models of GPS.	Fishing Exercise Travelling to other islands safely Landcare Sacred site management AQIS for trapping fruit fly Marking traditional owner boundaries	Dugong and turtle project officer Environmental Health officer Fisherman (professional) Construction workers/road workers Ergon person Landcare officers AQIS
Darnley (GPS)	GIS program interesting. It was good experience. Good (Stephen and Alana working with indigenous people – liked how they projected themselves and their teaching style). Very good to learn about computers. Beautiful catering.	Not enough computers. Air-con needed. Time on computers wasn't long enough. Smaller group required – one day per group. Need more time on computers. Need more basic computer training before GIS workshop starts.	More computers. Smaller groups. Need to have workshop on lat and long. Bring a map with lat and long to explain.	Cray fishing Exercise Use to manage land boundaries Town planning Landcare work Ergon work Navigating reefs Search and rescue	
Murray (GPS)	Got experience with GPS. Very clear explanations about GPS.	GPS 1 wasn't working very well. Time was too short. Didn't accomplish GIS mapping. One participant had asthma and didn't want to walk.	Some support from local council (transport). More GPS units. Up to date GPS units. Longer period (couple more days).	Fishing. Using with other skilled jobs in the community.	Dugong and turtle project officer Fisherman (professional) Water officer Landcare

Community	What did you like about today?	What didn't you like about today?	What would have made today better?	How will you use the skills you learnt today in the future?	Participant's occupations
Badu (GPS)	Learnt something new. Makes life easier. Nice catering for food. Alana and Stephen were very good at explaining.	Nothing – everything was good about today.	More council support (at least one attendant). Need transport to go out and get waypoints. More up to date GPS. More GPS units.	Work. Travelling to and from islands. Safety. Animal management work.	Animal management (2 officers) Fisherman Pastor Lang and sea ranger CDEP workers
Badu (GIS)	Learnt about GIS technology. It's a good technology for us. It was interesting – first time on GIS. Catering was excellent. Alana and Stephen were very good at explaining the GIS.	Everything was ok.	More days training. Have GPS units to sell.	Diving Cray fishing Travelling to other island Pig hunting Town planning	
Hammond/Horn (GPS)	A good refresher course in GPS. Good to use different types of GPS. Catering was very good. Everything was very well planned.	No air conditioning. Better to have hot food for lunch.	We should have been told more about what we were going to do today. We would like to go out in the field to plot more waypoints. Longer workshop.	Conservation land management Recreation Fishing SES	Rangers from Horn and Hammond Islands
Hammond/Horn (GIS)	The GIS program was very interesting. Alana's teaching was very good and clear and slow – easy to understand		Need finger food. Small space were we did training More laptops Longer workshop More detail on some of the exercises.	Weed management Ghost net Presentations Local news letter Water line management Ergon pole Land management Planning for the future Help for funding applications Mapping of sacred sites Fire management Emergency management (SES) Management of bush tucker	Rangers from Horn and Hammond Islands

Appendix 3

Certificate acknowledging completion of the two day training course given to participants that attended the workshops.



James Cook University

Certificate of Completion

is hereby granted to

to certify that he/she has completed to satisfaction

A two day workshop on
Global Positioning Systems (GPS) and
Geographical Information Systems (GIS)

Granted: April 17, 2008

Certified by Ms. Alana Grech (Ph: 07 4781 5561; Mob: 0407 705 088; Email: alana.grech@jcu.edu.au)