Marine Conservation Finance: strategies and finance mechanisms to improve the amount and efficacy of investment into marine conservation

PhD Thesis

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25 May 2017

Acknowledgements

Thank you to all of the friends, family, and colleagues that made this dissertation possible. Thank you to Natalie Stoeckl and Bob Pressey for providing support and guidance to me over the last several years. Thank you to the Conservation Planning group (Bob's Mob) and the ARC Centre of Excellence in Coral Reef Studies at James Cook University for your support, feedback, and friendships. Thank you to my colleagues at the Great Barrier Reef Marine Park Authority for the valuable input, feedback, and support for many of the chapters in this thesis. Thank you to the National Environmental Science Programme and the ARC Centre of Excellence in Coral Reef Studies for the funding to support this research. Last but not least, thank you to my husband and children for your never ending support.

Statement of the Contribution of Others

Supervisors

Dr. Bob Pressey and Dr. Natalie Stoeckl

Publications

Chapter 2 is published as Bos, Pressey, and Steockl. 2015. Ocean & Coastal Management (114): 116-128. All co-authors contributed intellectual input.

Chapter 3 is published as Bos, Pressey, and Stoeckl. 2014. Environmental Science & Policy (42): 1-15. All co-authors contributed intellectual input.

Chapter 4 has been submitted for review to the Australian Journal of Environmental Management. Melissa Walsh is the lead author and co-authors include Allan Dale, Bob Pressey, Natalie Stoeckl, and Jon Brodie. All co-authors contributed intellectual input.

Chapter 5 will be submitted to Solutions Journal. Melissa Walsh is the lead author and Dr. Nicolas Pascal is a co-author.

Additional Co-Authored Manuscripts

1. Stoeckl, Natalie, Farr, Marina, Jarvis, Diane, Larson, Silva, Esparon, Michelle, Sakata, Hana, Chaiechi, Taha, Lui, Hongbo, Brodie, Jon, Lewis, Stephen, Mustika, Putu, Adams, Vanessa, Chacon, Adriana, Bos, Melissa, Pressey, Bob, Kubiszewski, Ida, and Costanza, Bob (2014) *The Great Barrier Reef World Heritage Area: its 'value' to residents and tourists, and the effect of world prices on it. Final report to the National Environmental Research Program.* Report. Reef and Rainforest Research Centre, James Cook University, Cairns, QLD, Australia.

2. Grech, A., Bos, M., Brodie, J., Coles, R., Dale, A., Gilbert, R., Hamann, M., Marsh, H., Neil, K., Pressey, R.L., Rasheed, M.A., Sheaves, M., and Smith, A. (2013) *Guiding principles for the improved governance of port and shipping impacts in the Great Barrier Reef.* Marine Pollution Bulletin, 75 (1). pp. 8-20.

Abstract

Global natural capital - including marine ecosystem goods and services - sustain human wellbeing. The economic cost of environmental degradation is greater than the investment into conservation and management, resulting in a large and growing conservation finance gap. There is ongoing research in sustainable development and environmental finance, but much of this is focused on terrestrial ecosystems. Due to unique features of the marine environment, explicit focus on marine conservation finance is also needed. At the same time, literatures describe factors that constrain the success of marine conservation, e.g. governance, but a key constraint not adequately addressed in research or practice is finance.

Gaps in the literatures include a systematic analysis of the reasons for and solutions to resolve the marine conservation finance gap, a rigorous analysis of how to engage with businesses to close the marine conservation finance gap, and how to integrate finance into marine conservation planning. The aim of this thesis is to investigate strategies and financial mechanisms to decrease impacts on marine resources and increase effective investment into marine resource management. This research is both interdisciplinary and cross-sector, and addresses the issue at both the global scale and at the scale of individual case studies.

Chapter 2 reviews the relevant literature and articulates the need for and scope of the new and emerging field of marine conservation finance. The paper identifies five challenges associated with marine conservation finance, and proposes five potential ways forward. This piece of research illustrates how government, private, academic, and non-profit sectors can better collaborate to reduce the marine conservation finance gap, identifies specific priority research which was pursued in Chapters 3-5, and lays the foundation for many years of further research in this field.

Chapter 3 focuses one example tool for engaging with profit-maximising businesses: marine biodiversity offsets in the Great Barrier Reef. Offsets are a regulatory mechanism to make companies compensate for permitted damage to the environment. The potential for and efficacy of marine biodiversity offsets is investigated in the case study site of the Great Barrier Reef World Heritage Area, Queensland, Australia.

Chapter 4 investigates the use of a revolving loan fund to incentivise improvements in water quality in the Great Barrier Reef. Revolving loan funds are a mechanism whereby debt is used to create both environmental benefits and profits, which can be reinvested into new loans. This study investigated if and how the creation of a concessionary (low-interest) loan fund could incentivise changes to agricultural practices, resulting in improved water quality for the Great Barrier Reef World Heritage Area.

Chapter 5 assesses the opportunities and challenges for using impact investing to achieve marine conservation outcomes. This chapter is a global review of the opportunities for and challenges to using impact investments to create marine conservation outcomes. A review of the impact investing literature is followed by a summary of existing marine impact investments and then an analysis of if and how the marine impact investing industry could grow to achieve both ecological and financial outcomes.

Chapter 6 synthesises the findings from Chapters 2-5. This chapter summarises the orginal contributions and effectiveness of research for each chapter, followed by an analysis of two cross-cutting themes that emerged across all chapters. Limitations of the research and general conclusions are also presented herein.

Results indicate that the marine conservation finance gap is large and growing, and that a systematic and rigorous focus on this "new and emerging field" is warranted. There are numerous finance mechanisms available to increase investment into marine conservation, but the type of mechanism must be suited to the ecological, social, political, and economic context of the site. When engaging with businesses, the finance mechanism or strategy must be suited to the objective of the business. Biodiversity offsets, for example, can be an effective tool to make businesses compensate for permitted damage to the marine environment, but numerous improvements to the assessment and implementation of offsets are needed to make them more effective, as illustrated by the Great Barrier Reef case study. As another example, loans can be used to deliver both marine outcomes and private profits for businesses so that they can account for the natural capital in their value chains. Impact investing - producing social or environmental outcomes alongside financial returns - has a large potential to deliver marine conservation outcomes, but is currently limited by

the availability of "investible" deals to accept the available capital.

Specialist capacity and transition capital are required to advance marine conservation finance. A balance of effort between preventing impacts and funding recovery / management is needed to squeeze the marine conservation finance gap from both sides. This research identifies actionable solutions for addressing both prevention and funding, and articulates how cross-sector partnerships and specialist capacity are needed to advance marine conservation finance.

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Chapter 1. General Introduction

The oceans provide humanity with numerous marine ecosystem services, including food, income, cultural services, recreation, carbon storage, and storm protection (Baskett & Halpern, 2009; Börger et al., 2014; Lau, 2013; Palumbi et al., 2009; Rashid, Scholes, & Ash, 2005; Werner et al., 2014). These essential ecosystem services are under threat from climate change, fishing pressures, coastal development, land-based pollution, and recreation (Doney et al., 2012; Halpern et al., 2012; Halpern et al., 2008; Worm et al., 2006). The economic cost of human damage to nature is large and growing (TEEB, 2013), and much larger than the investment into nature conservation and management (Braat & de Groot, 2012; Buchanan, 1962; Managi, 2012; Thampapillai & Sinden, 2013). The field of conservation finance has been more focused on land than on the water (Rucklehaus 2013), and marine conservation planning has inadequately addressed how to decrease the marine conservation finance gap (Bos, Pressey, & Stoeckl, 2015). This thesis explores the reasons why the marine conservation finance gap is large and growing, investigates three potential mechanisms to reduce the finance gap across a spectrum of business intentions, and identifies both limitations and actionable opportunities to improve the amount and efficacy of marine conservation finance.

Context and personal motivations for the study are presented first (Section 1.1). A brief summary of the background literature is presented in Section 1.2 and research gaps are identified in Section 1.3, noting that a comprehensive treatment of the background and research gaps is presented in Chapter 2. An overview and roadmap of the thesis chapters are presented last (Section 1.4).

1.1 Personal Motivations

The decision to undertake a PhD in the topic of marine conservation finance was based on real-world issues that I encountered during my professional career. At the time I began the dissertation, I had a dozen years' experience in coral reef science, management, policy, and finance. I had worked across multiple sectors - in government, academia, non-profit, and the private sector. While the aim of my career remained relatively steady - to improve the management of marine resources for the benefit of communities that depend on them - my path evolved significantly from the hard sciences to applied sciences, then to management and communities, and then to finance. Several learnings form this journey that directly contributed to the selection of the research topic are described next.

My first postgraduate degree was a Bachelor's of Science in chemistry and marine science, and my second was a Masters of Science in Oceanography with a focus on coral reef biogeochemistry. From the many hours spent in laboratories, I retained a very important and fundamental principle from the field of chemical kinetics. The "rate-determining step" also known as the "rate-limiting step" principle is that for any reaction, the speed of the reaction will be determined by the slowest step (Zumdahl 2005). In a laboratory, a chemist may need to gather multiple compounds and set exact conditions (e.g., temperature, pressure, acidity) for a reaction to happen. Yet many of the components of the reaction are necessary, but not sufficient, for the reaction to proceed. A critical catalyst, together with the other necessary components and conditions, determines if and how fast the reaction proceeds.

As I began to work in coral reef conservation and management, the principle of the rate-determining step resonated with me. I noted that robust science is a necessary component of effective marine conservation, but that science alone was insufficient. I noted that the engagement of communities and stakeholders improved the effectiveness of marine conservation, yet again these alone were insufficient. I experienced first-hand how the enabling conditions of effective governance and political will could significantly improve marine conservation, yet still something was missing. On a bitter-sweet day, after successfully achieving $10 million in funding for a new fisheries program in Hawaii, I realised that even with the best science,

policy, and partnerships, funding is always limiting communities from implementing marine programs. I hypothesised that finance is the rate-determining step for marine conservation, and I decided to focus intensively on the issue.

In a senior position at an international environmental non-profit organisation, I began developing sustainable finance strategies for new and existing marine conservation initiatives. I learned that very few individuals globally were focused in the area of marine conservation finance. I also learned that, in general, the conservation community held the perception that there was simply not enough money to fund conservation. Yet the investors and global business leaders that I worked with communicated their perception that there was more than enough money available, but it was not currently being invested in the most effective ways. I hypothesised that the marine conservation funding dilemma may be analogous to the food scarcity dilemma. While 795 million people are underfed and undernourished globally, the key limitation is not a lack of food, but rather problems with the distribution and waste of food (FAO 2015, UNDP 2012, Gustavsson 2011). I wondered: could this be happening with money that could be used to sustain underfunded and valuable marine conservation initiatives?

1.2 Background

Effective marine conservation requires robust science (Constable 1991), functional governance (Aswani and Ruddle 2013; Marian 2012; Yen-Chiang 2012), and stakeholder engagement (Kuei-Chao et al 2013; Pomeroy & Douvere 2008). Yet there is an overarching limit to marine conservation that has not been adequately addressed in the literature or in practice: finance.

The global conservation finance gap is estimated at $7 trillion USD per year and growing (Bos et al 2015; Chapter 2). Conservation is underfunded in every ecosystem and country (Parker & Cranford, 2010), but the gap is worse in the tropics (Balmford & Whitten, 2003) and marine conservation initiatives globally are "chronically underfunded" (Lennox 2012).

Marine conservation is typically over-reliant on one type of funding - grants - which introduces risks and instabilities into conservation programmes (Lennox 2012; Salamon 2014). The duration of funding (typically 1-5 years) does not match the length of time required to achieve sustained conservation outcomes (Bottrill et al 2011; Gurney et al 2014), which leads to organisations spending a disproportionate amount of time fundraising rather than implementing their conservation programmes (Elkington & Hartigan 2008).

Numerous conservation finance tools and strategies have been developed and tested, yet the vast majority of these have been in terrestrial contexts (Rucklehaus 2013). The marine conservation context does share some similarities with terrestrial conservation, yet there are key differences that may affect how conservation finance is approached, including tenure and property rights (Barner et al 2015) and increased flows and connectivity of pollutants and impacts (e.g., Waterhouse et al 2015). Robust and systematic research and development of conservation finance tools and strategies - specific to the marine context - is essential to manage resilient marine ecosystems.

1.3 Research Gaps and Aim

Gap 1. Systematic analysis of reasons for and potential solutions to resolve the marine conservation finance gap

Early pioneers in financial planning for marine conservation began work in the 1990s. In 1995, the World Bank sponsored a workshop on 'sustainable finance' for coral-reef conservation that produced an inventory of tools for revenue generation and economic incentives (Hooten & Hatziolos, 1995). Later, the World Wildlife Fund developed a 'menu of options' for marine conservation finance (Moye, 2007; Spergel & Moye, 2004). A financial planning tool was piloted for Mesoamerican marine protected areas in 2007 (TNC, 2013). Consultants working for the Packard Foundation produced a white paper on innovative finance mechanisms for sustainable fisheries, citing several successful case studies around the world (Jain & Gardaret, 2007). In 2012, The Nature Conservancy developed a white paper entitled "Monies for Marine Conservation" which focused primarily on federal spending in the United States (Lennox, 2012) and included 'finance and capacity' as the last step in a guidance document on business planning for conservation (TNC, 2013). The United Nations Environment Programme and Global Environment Facility produced "Catalyzing Ocean Finance" in 2012 (UNDP, 2012), although this did not extend beyond a list of management tools and predicted leverage factors.

While these efforts laid a foundation for financial planning in marine conservation, they are mostly limited to 'menus' of options without strategic or rigorous methods for evaluating finance options for different marine conservation goals and contexts. This is partly due to the fact the conservation finance is more often dealt with in the grey literature; there are few peer-reviewed studies (Salamon 2014;(Höchstädter & Scheck, 2015).

Gap 2. Financial planning has not been integrated into conservation planning

Planning of marine conservation initiatives takes many forms. There is a body of peer-reviewed literature that describes best practice. The field of systematic conservation planning investigates methods for identifying priorities, locations, and management strategies for species and ecosystems (Margules & Pressey, 2000). One of the key principles of systematic conservation planning is efficiency, or minimising the costs of achieving objectives for biodiversity (Margules & Pressey, 2000). Methods have evolved to account for data on social and economic variables (Pressey and Bottril 2009, Knight *et al.* 2010), the opportunity costs of conservation actions (Naidoo et al., 2006), and the equity problems around opportunity costs to different stakeholder groups (e.g., Adams *et al.* 2010). Conservation planners have developed methods that maximise the financial return on investment by determining 'efficiency' through a particular type of cost-benefit analysis. While important and necessary, these methods fall short of financial planning. One reason is that efficiency is not the same thing as 'sufficiency,' or knowledge of the total amount of money needed to reach our conservation goals (Possingham, 2012). Secondly, cost estimates of conservation programmes rely on numerous assumptions, so single estimates of total costs are usually less realistic than ranges of costs (V. Adams, Segan, & Pressey, 2011). Thirdly, financial analysis, even if it includes cost-benefit information, is not complete without identifying the investors, finance mechanisms, investees, and investments needed to provide the necessary resources over appropriate time-frames.

The large international non-governmental organisations concerned with nature conservation have adapted scientific best practice and developed various conservation planning methods and guidance documents (Robert L. Pressey & Bottrill, 2009). Community-driven initiatives sometimes use these best-practice methods, although some community-based initiatives are developed with less strategy or rigorous conservation planning principles (Horigue, Aliño, White, & Pressey, 2012; Mills, Adams, Pressey, Ban, & Jupiter, 2012). Regardless of how rigorous the analysis and decision-making processes are, a generality is that financial planning – identifying the investors, finance mechanisms, investees, and investments – is typically considered after conservation strategies have been devised, and then by people other than conservation planners and without the participation of appropriate stakeholders such as resource users,

local community leaders, and government representatives.

Gap 3. Rigorous analysis of how to engage with businesses to close marine conservation finance gap

Accessing capital beyond traditional government and philanthropic investments - including concessionary, venture, and mainstream commercial private capital - is critical for reducing conservation finance gaps and achieving durable conservation outcomes (Clark et al. 2013, Salamon 2014, Huwyler et al 2014, Bos et al 2015). The potential for private investment in conservation is on the order of $200 to $400 billion USD, with higher potential in more mature projects and more "mainstream" or traditional financial institutions (Credit Suisse et al 2016). Yet there are significant barriers to developing conservation-business partnerships and accessing private capital, including cultural and social norms of conservation organisations (CFA 2014), perceived risks of financial capture (the risk of the organisation advancing the objectives of the funder instead of advancing the objectives of the organisation; Grech et al 2013), and gaps in understanding between the business sector and the conservation sector (Bugg-Levine and Emerson 2011).

Engagement with businesses for conservation funding is often limited to donations (Lennox 2012) and corporate social responsibility (e.g., Gulbrandenson 2000). There appears to be a broad spectrum of business objectives beyond philanthropy and corporate social responsibility. Conservation programmes could engage with business along the entire spectrum if they had the necessary tools and information. Analysis of how marine conservation programmes can partner with various types of businesses is not adequately addressed in the literature.

Gap 4. Identification of "investible" marine conservation projects

One of the key difficulties in conservation finance is identifying suitable investment opportunities that can accept private capital (Huwyler et al 2014, Bos et al 2015, Credit Suisse et al 2016, Walsh et al in prep(a)). This is sometimes termed the 'supply side issue' meaning that the supply of 'investible deals' is more constraining than the availability of capital (Bugg-Levine & Emerson 2011, Richter 2014, Walsh et al in prep(a)). Conservation projects are rarely designed to attract return-seeking private capital, but rather they are typically designed by practitioners and scientists with little formal training in finance and investment (Bos et al 2015). Sometimes conservation projects can be retrofitted to accept private return-seeking capital, but only if a sufficient revenue stream can be identified. More often, innovative and novel approaches are necessary to match private commercial capital to conservation outcomes. With more capital than deals available, the identification of investible conservation projects may unlock large amounts of investment. Systematic analysis of if and how marine conservation initiatives can become "investible" is needed.

1.4 Approach

The gaps identified above lead to the **overall aim** of this research: **to investigate strategies and financial mechanisms that can improve the amount and efficacy of investment into marine conservation.**

The approach of this research is to address the overall research aim at several scales. Chapter 2 reviews relevant literature across numerous disciplines on the global scale. Chapters 3 and 4 have a narrower focus on discrete examples of marine conservation finance tools in one study site – the Great Barrier Reef, Queensland, Australia, for reasons that are explained below. Chapter 5 investigates one category of finance mechanisms at the global scale. The combinations of broad and narrow, global and regional, provide a forest-and-the-trees picture of this field of research within the time and capacity limitations of doctoral research.

The methods for each data chapter have been selected to best answer the research questions. Marine conservation finance is an interdisciplinary and cross-sector field which considers many aspects of how to identify, manage, invest, and assess investments into marine outcomes. While the word "finance" in the title of the thesis may conjure the expectation for financial models, the thesis has been purposely approached through a different lens. Money may indeed be the language of finance. However, considering the interdisciplinary nature of "marine conservation finance" as opposed to the singular discipline of "finance," multiple languages - including money - are valid. One of the central tenets of this thesis is that marine conservation finance needs to be progressed through interdisciplinary and cross-sectoral initiatives (see Figure 2-1 on Page 28). Many of the challenges identified that are limiting marine conservation finance have to do with policy, governance, stakeholders, and other issues beyond financial modelling (see Chapter 2). The methods for each data chapter were determined by understanding how to best answer the research questions. Since the research questions were about non-financial modelling issues (e.g., policy, governance, stakeholder perceptions, etc.), qualitative methods were selected as the most appropriate way to address these questions.

1.5 Chapter Roadmap

Chapter 2 reviews the relevant literature and articulates the need for and scope of the new and emerging field of marine conservation finance. This published paper identifies five challenges associated with marine conservation finance, and proposes five potential ways forward. This research illustrates how government, private, academic, and non-profit sectors can better collaborate to reduce the marine conservation finance gap, identifies specific priority research questions that were pursued in Chapters 3-5, and lays the foundation for many years of further research in this field. A figure from Chapter 2 conceptualises the link between each chapter of this thesis and therefore will be presented next.

The spectrum of business objectives, from profit-maximising to social enterprises, and the resultant impact on the conservation finance gap can be conceptualised as in **Figure 1-1**. Businesses with a primary objective of maximising profits cause a large conservation finance gap and large net negative

environmental outcomes (red end of the spectrum, on the left). Businesses with the primary objective of creating social and/or environmental benefits can theoretically create large net positive environmental outcomes and can help alleviate the conservation finance gap (green end of the spectrum, on the right). For the purpose of this thesis research, I selected three example finance mechanisms across this spectrum, as represented by the tool icons, with the white numbers corresponding to thesis chapter numbers.

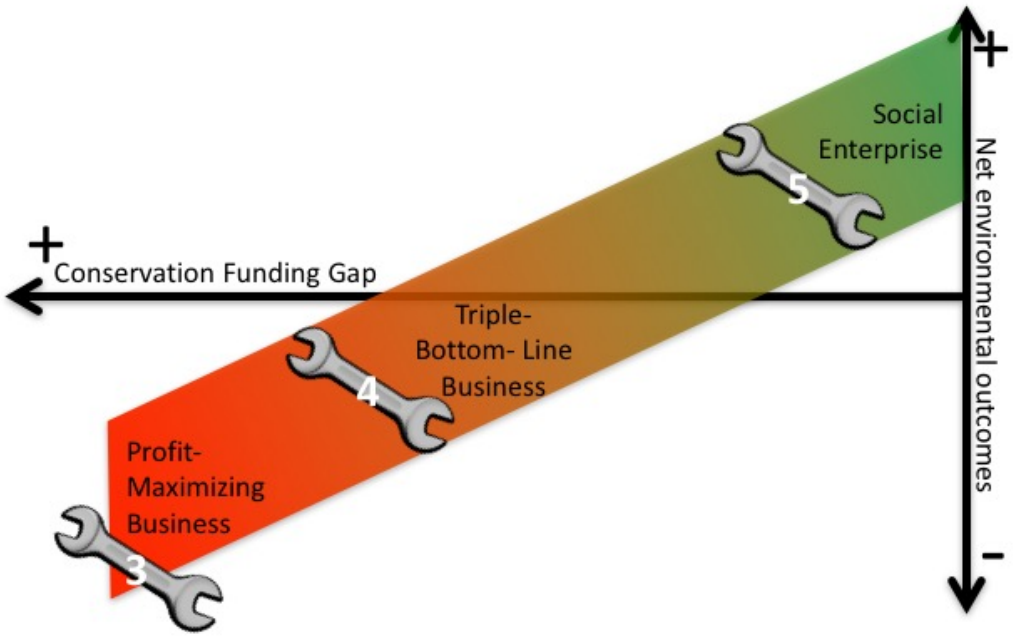


Figure 1-1. Connection between business objectives and the global conservation finance gap. The *x*-axis represents the size of the conservation finance gap, from positive on the left to negative on the right. The *y*-axis represents the net environmental outcomes created by businesses, from negative at the bottom to positive at the top. The numbered tool icons represent the three case studies that were researched in this thesis, and the white numbers refer to the corresponding thesis chapters.

Chapter 3 explores one example tool for engaging with profit-maximising businesses to decrease the conservation finance gap: marine biodiversity offsets (Figure 1-1). Offsets are a regulatory mechanism to

make companies compensate for permitted damage to the environment. The potential for and efficacy of marine biodiversity offsets is investigated in the case study site of the Great Barrier Reef World Heritage Area, Queensland, Australia.

Chapter 4 presents a research study on a finance mechanism - a revolving loan fund - to engage businesses in the middle of the spectrum (Figure 1-1). Revolving loan funds are a mechanism whereby debt is used to create both environmental benefits and profits, which can be reinvested into new loans. This study investigated if and how the creation of a concessionary (low-interest) loan fund could incentivise changes to agricultural practices, resulting in improved water quality for the Great Barrier Reef World Heritage Area.

Chapter 5 focuses on the right end of Figure 1-1, the social enterprises whose primary objective is to create social and environmental benefits through business. This chapter is a global review of the opportunities for and challenges to using impact investments to create marine conservation outcomes.

Chapter 6 synthesises the findings from Chapters 2-5, discusses further research needs, and presents the thesis conclusions.

Chapter 2. Marine Conservation Finance: the need for and scope of an emerging field

Published as Bos, Pressey, and Stoeckl. 2015. Ocean and Coastal Management (116):114-128.

Abstract

The global oceans contribute to human wellbeing by providing marine ecosystem services, but the ability of the oceans to continue providing these services is jeopardised by anthropogenic impacts. There is a limit to marine conservation that has not been adequately addressed: finance. This paper reviews the state of marine conservation funding, identifies associated challenges, and recommends possible ways forward. We identify five challenges: 1) funding for marine conservation is inadequate in terms of the size, duration, and diversity of revenue, 2) finance mechanisms are under-developed and under-utilised, 3) finance is often disconnected from conservation planning, 4) the environmental side-effects of economic activity increase the gap in global conservation funding, and 5) few individuals and programmes specialise in marine conservation finance and integrate its disparate lines of thinking. We then propose five solutions: 1) financial strategies for marine conservation, 2) increased research on and development of finance mechanisms, 3) integration of financial planning into conservation planning, 4) engagement of businesses in reducing the gap in conservation funding for marine ecosystems, and 5) definition, focus, and specialists for the emerging field of marine conservation finance. Multi-sector and interdisciplinary collaboration is essential to reduce the marine conservation-finance gap and sustain marine ecosystem services.

1. INTRODUCTION

The global oceans contribute to human wellbeing by providing marine ecosystem services including food, income, cultural services, recreation, carbon storage, and storm protection (Baskett & Halpern, 2009; Börger et al., 2014; Lau, 2013; Palumbi et al., 2009; Rashid et al., 2005; Werner et al., 2014). The ability of the oceans to continue providing these essential ecosystem services is in jeopardy due to anthropogenic impacts that include climate change, fishing pressures, coastal development, land-based pollution, and recreation (Doney et al., 2012; Halpern et al., 2012; Halpern et al., 2008; Worm et al., 2006). There are numerous approaches and tools being used to address these challenges, including but not limited to marine protected areas (MPAs), marine and climate policy, sustainable or green development, and fisheries management (Halpern, 2014; Norse, Crowder, Soule, & Marine, 2005; Pikitch et al., 2004; Ray & McCormick-Ray, 2014; Roff, Zacharias, & Day, 2011). Herein we use the inclusive term 'marine conservation initiatives' to refer to all initiatives for management, restoration, and sustainable use of marine resources.

Marine conservation initiatives are widespread globally, involving almost every country on earth (e.g., CI, 2014; IUCN & UNEP-WCMC, 2013; TNC, 2014; WCS, 2014; WWF, 2014). There are notable success stories about conservation objectives having been achieved and/or threats averted (Knowlton & Jackson, 2011). More often, however, there are stories of declines in marine resources, and consequential impacts on human wellbeing, despite monumental efforts (e.g., GBRMPA, 2014). The scientific literature abounds with factors that constrain the success of marine conservation initiatives. Examples include disjointed and inadequate ocean governance (Aswani & Ruddle, 2013; Marian, 2012; Yen-Chiang, 2012), conflicts between stakeholders (Kuei-Chao, Ching-Ta, & Hwung-Hweng, 2013; Pomeroy & Douvere, 2008), and limited enforcement capacity (Monteiro, Vázquez, & Long, 2010). Yet there is an overarching limit to marine conservation that has not been adequately addressed in the literature or in practice: finance.

The aims of this paper are to review the state of marine conservation finance, investigate the challenges associated with funding marine conservation, understand the potential consequences of the marine conservation finance gap, and propose recommendations to address those problems. We begin by

reviewing both the grey and scientific literature to identify five key challenges related to marine conservation finance (Table 2-1; Section 2). Next, we discuss strategies that have the potential to mitigate these challenges (Table 2-1; Section 3). We conclude in Section 4 by summarising the extent of the problem, the consequences for marine ecosystems and human wellbeing, and possible ways forward.

Table 2-1. Challenges and recommendations for marine conservation finance

Section	Issue	Section	Recommendation
2.1	Funding for marine conservation is inadequate in terms of the size, duration, and diversity of revenue streams.	3.1	Marine conservation programs need financial plans.
2.2	Finance is not integrated into conservation planning.	3.2	Financial planning should be integrated into conservation planning.
2.3	The selection of finance mechanisms is often opportunistic.	3.3	A systematic and rigorous method for selecting finance mechanisms is needed.
2.4	The need for conservation funding is growing due to environmental externalities.	3.4	All types of businesses need to be engaged with to reduce environmental externalities, and different tools are appropriate for different businesses.
2.5	While there are numerous interdisciplinary fields of practice and research that are related to marine conservation finance, very few individuals and programs specialize in this area.	3.5	The emerging field of marine conservation finance needs definition and specialists.

Among our intended audience are marine conservation scientists and practitioners. We draw from, but do not comprehensively review, diverse bodies of literature, including those in sustainable development, ecological economics, conservation planning, and marine ecology. Because of the interdisciplinary nature of this paper, many terms will hold different meanings to people in different disciplines. Accordingly, we try to use terms with the widest currency, and define them as they arise.

2. CHALLENGES

The global oceans contribute to human wellbeing by providing marine ecosystem services including food, income, cultural services, recreation, carbon storage, and storm protection (Baskett & Halpern, 2009; Börger et al., 2014; Lau, 2013; Palumbi et al., 2009; Rashid et al., 2005; Werner et al., 2014). The ability of the oceans to continue providing these essential ecosystem services is in jeopardy due to anthropogenic impacts that include climate change, fishing pressures, coastal development, land-based pollution, and recreation (Doney et al., 2012; Halpern et al., 2012; Halpern et al., 2008; Worm et al., 2006).

2.1 Inadequacies in marine conservation finance

Funding for marine conservation finance is inadequate in three ways: the size, duration, and diversity of revenue streams.

2.1.1 Size

Fundamentally, at the macro scale, the need for conservation funding is a result of people consuming and damaging biodiversity and ecosystem services and not paying enough to restore, maintain, and manage those services (Braat & de Groot, 2012; Buchanan, 1962; Managi, 2012; Thampapillai & Sinden, 2013). The remaining financial burden is either taken on by others, notably philanthropists and governments (Evans et al., 2012; van Beukering, Papyrakis, Bouma, & Brouwer, 2013), or ignored. The resultant gap between the economic costs of environmental degradation – estimated globally at $7.3 trillion USD per year and increasing (TEEB, 2013) – and the available global funding for biodiversity and ecosystem services - estimated between $36-38 billion USD per year (Parker & Cranford, 2010) and $51 billion USD per year (GCP 2012) – is the approximately $7 trillion annual gap in global conservation funding. This novel estimate is significantly greater than a recent estimate by Credit Suisse, World Wildlife Fund, and McKinsey & Company (2014) of $300 billion USD total global conservation finance gap.

While we could find no comprehensive estimate of the portion of this gap relevant to marine conservation, there is consensus among experts that chronic underfunding of marine conservation is a problem (Lennox,

2012). Conservation is underfunded everywhere (Parker & Cranford, 2010), but the gap is worse in the tropics (Balmford & Whitten, 2003) where many marine conservation activities are undertaken. The only global estimates of gaps in marine conservation funding that we could find are related to objectives for coverage of MPAs and 'rebuilding' marine fisheries, that is, restoring fish populations and achieving maximum sustainable yield from wild fisheries (Pitcher, 2001; Worm et al., 2009). To achieve the United Nations Convention on Biological Diversity target of 20% of the ocean in MPAs, management costs were estimated at between $4 and $8 billion USD per year (converted to 2014 USD`; Balmford & Whitten, 2003), although this is likely to be an underestimate (Ban & Klein, 2009). Subsequently, McCarthy et al. (2012) estimated that achieving and effectively managing a 10% coverage of MPAs would likely cost between $3 and $8 billion USD per year.

The cost to 'rebuild' fisheries includes, but is not limited to, fisheries buyouts (purchasing fishing quotas and/or fishing vessels), research and development for less harmful fishing gear and the purchase of that gear, more efficient infrastructure for seafood distribution, capacity building, and certification or marketing of sustainable seafood (C. W. Clark & Munro, 2005; Cunningham, Neiland, Arbuckle, & Bostock, 2009; EDF, Unit, & 50in10, 2014; Hilborn, Orensanz, & Parma, 2005; Rangeley & Davies, 2012; Watson et al., 2002). In 2012, the cost to 'rebuild' global marine fisheries was estimated at $203 billion USD (Sumaila et al., 2012). (Ye et al., 2013) later estimated that one component of the cost to 'rebuild' fisheries – fisheries buyouts - would cost between $96 and $358 billion USD.

We could find no global estimates of the costs of other types of marine conservation initiatives, but estimates for local and regional initiatives are large. For example, an initiative to manage agricultural pollution for the Great Barrier Reef, Australia, has been allocated $200 million AUD over five years ($171 million USD`; J. E. Brodie et al., 2012). As another example, the United States National Oceanic and Atmospheric Administration grants approximately $11 million USD annually, matched by nearly $5 million USD from other sources, for coral-reef conservation. These programs should ideally be extended globally, at an unknown cost, and complemented with diverse additional marine conservation initiatives that have not been costed.

2.1.2 Duration

The duration of funding for marine conservation initiatives is often influenced by: 1) government political cycles (Claudiu-Gabriel & Claudiu, 2012); and 2) the frequent desire for philanthropists to fund interventions that are perceived as new and innovative, rather than sustaining implementation of time-tested approaches (Salamon, 2014). The duration of most funding streams for marine conservation initiatives (1 to 5 years) does not usually match the length of time required to achieve intended conservation objectives (Bottrill, Hockings, & Possingham, 2011; Gurney et al., 2014; Keppel, Morrison, Watling, Tuiwawa, & Rounds, 2012; Lennox, 2012). Sometimes the objective might be to protect marine resources from impending damage, and in that context, large infusions of capital with short durations are needed. More often, marine conservation initiatives require long-term interventions to both achieve and then maintain objectives (Keppel et al., 2012; Olsen & Christie, 2000). It can take several decades for marine ecosystems to recover from disturbances and sustain ecological processes (Lotze, Coll, Magera, Ward-Paige, & Airoldi, 2011; Russ & Alcala, 2004) and for communities associated with the marine ecosystems to reap benefits in terms of wellbeing (Christie et al., 2009; Torell et al., 2004).

One consequence of short-term funding is a high degree of project fragmentation whereby projects start and stop several times and are modified at each iteration according to new investor requirements. Fragmentation can undermine stakeholder confidence and make it difficult to retain qualified staff (SFI, 2012). A second consequence is that practitioners often find themselves in entrepreneurial mode, spending a disproportionate amount of time on fundraising when they could better use their capacities towards programme development and implementation (Elkington & Hartigan, 2008). The ultimate consequences of short-term funding are withdrawal of financial support before potential ecological and social benefits of interventions are realised, or reversal of positive trends in human wellbeing (Gurney et al., 2014) and recovery of species (Keppel et al., 2012; Olsen & Christie, 2000).

2.1.3 Diversity

Modern Portfolio Theory states that diversification is necessary to achieve the highest return for the lowest risks (Markowitz, 1952). In terms of revenue for marine conservation, this theory indicates that revenue sources should be diversified to ensure that marine outcomes are achieved while minimizing the risk of financial instability. However, the benefits of diversification are tempered by the costs associated with developing and managing multiple revenue streams (Rowland 1999). The optimal level of diversification is thus context-dependent.

We could find no published analysis of revenue diversification for marine conservation, but the grey literature suggests a high dependence on two sources of revenue: philanthropic individuals and governments (Lennox, 2012). The global supply of government and philanthropic funds alone are not enough to solve the world's urgent environmental problems, so additional sources of revenue are needed (C. Clark et al., 2013; Salamon, 2014). Over-reliance on one or two sources of revenue puts marine conservation initiatives at greater risk of not securing the necessary size and duration of funding to achieve intended objectives. During economic recessions, global or local, funding for conservation programmes can be drastically cut (Bakker *et al.* 2010). Ideological shifts with changing governments can also reduce funding through changes to legislation, regulation, and incentives (Carroll and Stater 2008, Chang and Tuckman 1994).

Over-reliance on high-net-worth individuals for philanthropic donations is also risky because individuals' personal or financial circumstances can change and undermine programme stability. For example, from the experience of the first author, a large marine conservation initiative had to be paused for one year due to a medical health crisis of the initiative's major donor and, without diversified revenue sources to sustain implementation, there were negative consequences for the communities and the marine ecosystems involved. This was not an isolated event, but similar events are not often discussed in the literature due to the sensitive and personal nature of soliciting donations from high-net-worth individuals, and because failures are often not reported in conservation literature (Redford & Taber, 2000). Diversification of revenue sources can mitigate the risks associated with each individual funding source.

2.2 Finance mechanisms

A finance mechanism is defined here as an instrument through which funds flow from investors to investees. Investors are defined here as the individuals or entities that provide the funds, and the investees as the individuals or entities that receive the funds. Comprehensively reviewing all finance mechanisms for conservation is outside of the scope of this paper. We provide a brief overview of the types of finance mechanisms that are being used or considered for marine conservation, and the typical investors and investees involved (Figure 2-1).

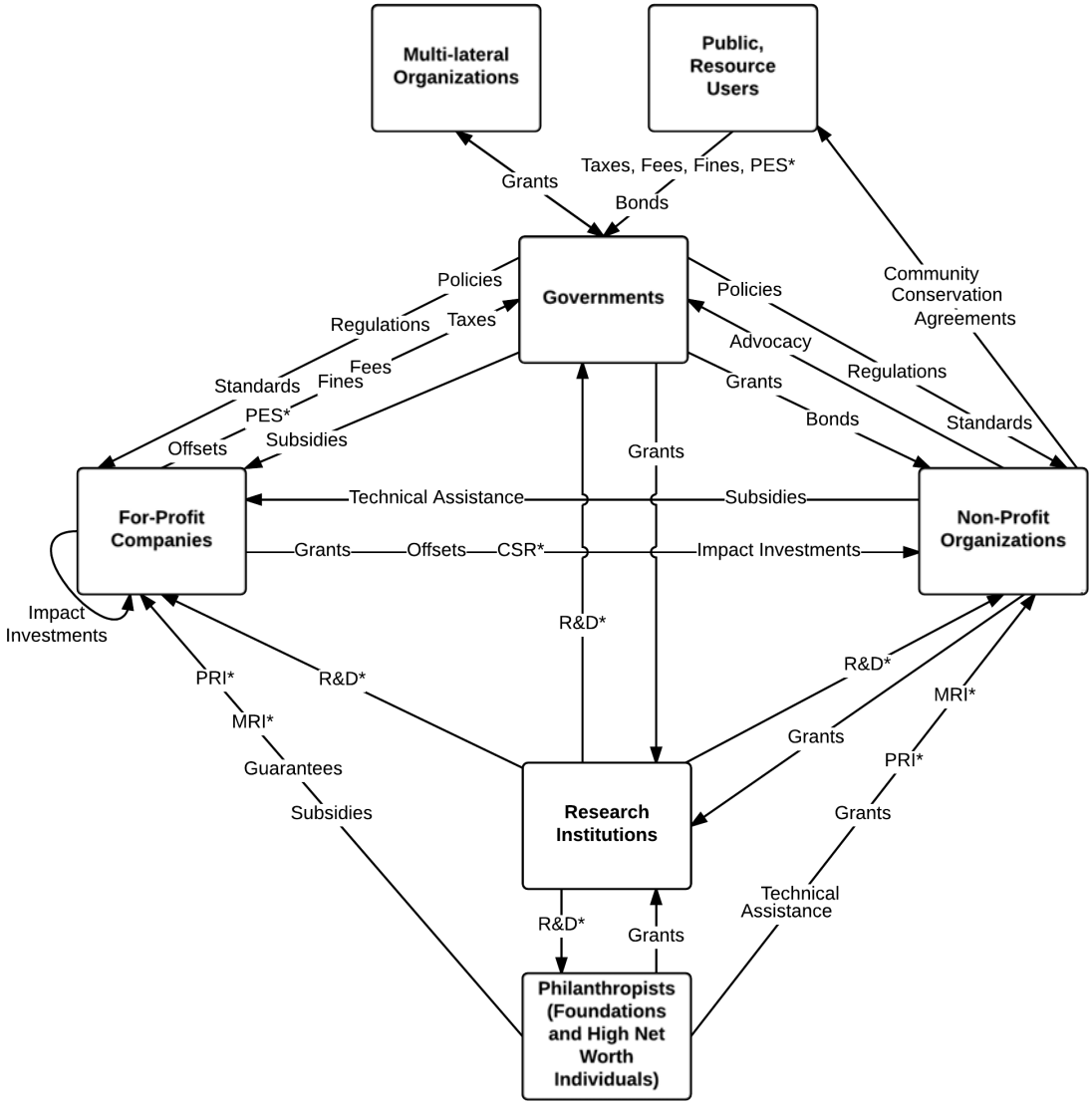


Figure 2-1. Collaboration in marine conservation finance. Interdisciplinary and multi-sector collaboration is required to improve finance for marine conservation. Governments, for-profits, non-profits, and research institutions all have roles to play in securing and managing funds, but the types of finance mechanisms and the specific roles differ. The typical flow of funds from investors to investees for each finance mechanism is depicted with an arrow (Section 2.2). The support roles depicted in the figure are described throughout the paper, and the importance of improving these collaborations is discussed in Section 3.5. *Acronyms: PES = payments for ecosystem services; CSR = corporate social responsibility; R&D = research and development; PRI = programme-related investments; MRI = mission-related investments.

The most common finance mechanism for marine conservation is a grant (Lennox, 2012). Grants are monies that do not have to be repaid. Governments, high-net-worth philanthropists, foundations, multi-lateral institutions (conglomerates of governments), and private companies are all investors that make grants for marine conservation. Investees in the case of grants include non-profit organisations, governments, multilateral institutions, and private companies. Grants are necessary but not sufficient to achieve marine conservation objectives. Many types of marine conservation activities can only be funded by grants. For example, long-term monitoring of publicly-owned coral reefs is very important, and difficult to fund without government grants. There will continue to be strong demands for grant monies for marine conservation.

Beyond grants, there are additional finance mechanisms that can generate revenue for social and environmental purposes (Salamon, 2014). Notably, market-based instruments create economic incentives (rewards or punishments) for marine conservation outcomes (Fujita et al., 2013). Many market-based instruments were developed by environmental economists to reduce the negative environmental impacts associated with the production of goods and services (hereafter 'environmental damages') and the uncompensated costs associated with those environmental damages (the damages and costs together are hereafter 'environmental externalities`;' Thampapillai & Sinden, 2013). One subset of market-based instruments, discussed below, can both provide economic incentives and generate revenue. A second subset, mentioned briefly in Section 3.4, creates economic incentives without generating revenue.

Numerous revenue-raising market-based instruments have been proposed, are in development, or are being applied for marine conservation. Marine payments for ecosystem services, is one of the most 'promising' market-based instruments for generating sustained revenue to achieve marine outcomes (Fujita et al., 2013). Investors for marine payments for ecosystem services are either the beneficiaries of the ecosystem services, and/or the people damaging the ecosystem services (Lau, 2013; Wunder, 2007). The investees are the entities that are protecting and managing the marine ecosystem services. It is possible for the same entity to be an investor and investee. For example, a coastal community could collect money from individuals and then use the funds to manage a marine ecosystem service.

The most notable example of a marine payment for ecosystem service is 'blue carbon,' by which investors - typically entities creating high carbon pollution such as large international corporations - pay money to investees - typically communities or non-profit organisations who are protecting and managing coastal carbon stores such as mangrove ecosystems (including the soil beneath the mangroves`; J. T. Greiner, McGlathery, Gunnell, & McKee, 2013; Schlesinger et al., 2011; Ullman, Bilbao-Bastida, & Grimsditch, 2013). Fees (e.g., for use of MPAs) and taxes (e.g., for tourism accommodation) can generate revenue from the general public and from users of ecosystem services (the investors) that flows towards governments, communities, or non-profit organisations (the investees) to manage the MPAs or marine areas, potentially in an economically efficient and equitable manner (Farr, Stoeckl, & Beg, 2011; Knapman & Stoeckl, 1995). Entrance and user fees for MPAs are common globally, including notable examples in Palau, Hawaii, and Australia (GBRMPA, 2014; Mak, 1995, 1998; Uyarra, Gill, & Côté, 2010) and have been shown to be supported by visitors in some regions (Farr, Stoeckl, Esparon, Larson, & Jarvis, 2014).

Community conservation agreements are another payment for ecosystem services whereby local communities (investees) are given funds and economic incentives in the form of cash, capital investments into infrastructure, or access to services in exchange for stewardship activities (Niesten, Gjertsen, & Fong, 2013). Typically the investors are philanthropists channelling funds through non-profit organisations. There are also examples of private companies offering funds to communities in exchange for marine conservation. For example, communities in Fiji receive financial rewards for shark conservation (Brunnschweiler, 2009).

Negative economic incentives are generated from market-based instruments through, for example, fines (e.g., for breaking fisheries rules) and performance bonds (e.g., bonds held during construction affecting marine ecosystems to insure against deleterious impacts). Biodiversity offsets are a widely-used market-based instrument for assigning financial liability for environmental damage to developers (the investors), and have large potential to generate revenue for investees in marine conservation, including governments, non-profits, and private companies. Offsets can act as a negative incentive if the financial requirement is large enough to deter or alter developer decisions. In most cases, however, offsets have not been managed well enough to prevent net environmental losses, which occur when the financial requirement is too small

to compensate for environmental damage and/or compensation for damage is not scientifically or practically possible (Bos, Pressey, & Stoeckl, 2014).

An old idea that has recently gained significant momentum is re-directing perverse subsidies such as those for fisheries (EDF et al., 2014; Rangeley & Davies, 2012) and agriculture (Evans et al 2012) towards more sustainable enterprises. Investors in subsidies can include governments (who source funds from the public through taxes and other finance mechanisms), philanthropists, or private companies. The investees can include communities, non-profit organisations, and private companies. Government fisheries subsidies are in the order of $25 billion USD per year (Sumaila et al 2010), so even a portion of this money redirected could significantly raise the capital available to 'rebuild' fisheries (EDF et al., 2014). (Cullis-Suzuki & Pauly, 2010) estimated that global MPAs act as a beneficial fisheries subsidy on the order of $870 million USD per year, but this is only a small amount compared to perverse fisheries subsidies.

Individually transferrable quotas are an instrument to control access to or use of a resource. When individuals or businesses are allowed to buy and sell access to that resource, a market is created that helps to ensure environmental outcomes are achieved at least economic cost, providing certain conditions are met. Pollution cap-and-trade markets are an example. Polluters must choose between paying for the right to pollute or spending money to reduce their pollution. Business that can easily reduce pollution do so, thus avoiding the need to pay for a permit; those that cannot afford to reduce their pollution must either purchase a permit or shut down. These types of instruments have been applied most notably in marine conservation as fisheries-catch shares, which are widely used globally for both targeted and bycatch species (Bonzon et al 2010). They have also been used for reducing water pollutants (Wiener 2004). The selection of the investor in the administrative costs of quota schemes – either government or industry – can significantly influence the design and outcomes of the quota scheme (Stranlund & Chávez, 2013).

Private insurance markets could also be used to manage risks to the marine environment from profit-maximising businesses (Costanza et al 2010). Insurance could replace environmental performance bonds and reduce the need for government revenue for environmental restoration by placing the liability on

companies for their actions and developing insurance products to help companies pay for damages.

Despite the numerous market-based instruments at various stages of development, most are relatively untested in marine compared to terrestrial ecosystems (Rucklehaus 2013). More research is needed to develop finance mechanisms that can engage more investors, generate more revenue, and package economic incentives together with revenue. Proposed research questions are discussed in Section 3.2. Because of the complex web of investors and investees involved (Figure 2-1), more coordination and collaboration is needed to realise significant improvements in marine funding (Section 3.5).

2.3 Financial planning

Finance mechanisms (Section 2.2) have not been well matched to funding needs (Section 2.1), in part because of poor financial planning. In 2012, the first author conducted an online survey of marine conservation professionals about problems in marine conservation finance. The survey was answered by 135 individuals working in at least 19 countries and in a variety of marine conservation organisations including research, government, non-profit, and consulting. The survey found that 49% of respondents did not have a finance strategy for their marine conservation program and another 25% were unsure if their organisation had a finance strategy. The reasons behind poor financial planning clearly need to be explored.

Early pioneers in financial planning for marine conservation began work in the 1990s. In 1995, the World Bank sponsored a workshop on 'sustainable finance' for coral-reef conservation that produced an inventory of tools for revenue generation and economic incentives (Hooten & Hatziolos, 1995). Later, the World Wildlife Fund developed a 'menu of options' for marine conservation finance (Moye, 2007; Spergel & Moye, 2004). A financial planning tool was piloted for Mesoamerican marine protected areas in 2007 (TNC, 2013). Consultants working for the Packard Foundation produced a white paper on innovative finance mechanisms for sustainable fisheries, citing several successful case studies around the world (Jain & Gardaret, 2007). In 2012, The Nature Conservancy developed a white paper entitled "Monies for Marine

Conservation" which focused primarily on federal spending in the United States (Lennox, 2012) and included 'finance and capacity' as the last step in a guidance document on business planning for conservation (TNC, 2013). The United Nations Environment Programme and Global Environment Facility produced "Catalyzing Ocean Finance" in 2012 (UNDP, 2012), although this did not extend beyond a list of management tools and predicted leverage factors.

While these efforts laid a foundation for financial planning in marine conservation, they are mostly limited to 'menus' of options without strategic or rigorous methods for evaluating finance options for different marine conservation goals and contexts. In addition, most of the work on sustainable funding for marine conservation has been disconnected from conservation planning.

Planning of marine conservation initiatives takes many forms. There is a body of peer-reviewed literature that describes best practice. The field of systematic conservation planning investigates methods for identifying priorities, locations, and management strategies for species and ecosystems (Margules & Pressey, 2000). One of the key principles of systematic conservation planning is efficiency, or minimizing the costs of achieving objectives for biodiversity (Margules & Pressey, 2000). Methods have evolved to account for data on social and economic variables (Pressey and Bottril 2009, Knight *et al.* 2010), the opportunity costs of conservation actions (Naidoo et al., 2006), and the equity problems around opportunity costs to different stakeholder groups (e.g., Adams *et al.* 2010). Conservation planners have developed methods that maximise the financial return on investment by determining 'efficiency' through a particular type of cost-benefit analysis (Teh et al 2008). While important and necessary, these methods fall short of financial planning. One reason is that efficiency is not the same thing as 'sufficiency,' or knowledge of the total amount of money needed to reach our conservation goals (Possingham, 2012). Secondly, cost estimates of conservation programmes rely on numerous assumptions, so single estimates of total costs are usually less realistic than ranges of costs (V. Adams et al., 2011). Thirdly, financial analysis, even if it includes cost-benefit information, is not complete without identifying the investors, finance mechanisms, investees, and investments.

The large international non-governmental organisations concerned with nature conservation have adapted scientific best practice and developed various conservation planning methods and guidance documents (Robert L. Pressey & Bottrill, 2009). Community-driven initiatives sometimes use these best-practice methods, although some community-based initiatives are developed with less strategy or rigorous conservation planning principles (Horigue et al., 2012; Mills et al., 2012). Regardless of how rigorous the analysis and decision-making processes are, a generality is that financial planning – identifying the investors, finance mechanisms, investees, and investments – is typically considered after conservation strategies have been devised, and then by people other than conservation planners and without the participation of appropriate stakeholders such as resource users, local community leaders, and government representatives (Figure 2-2).

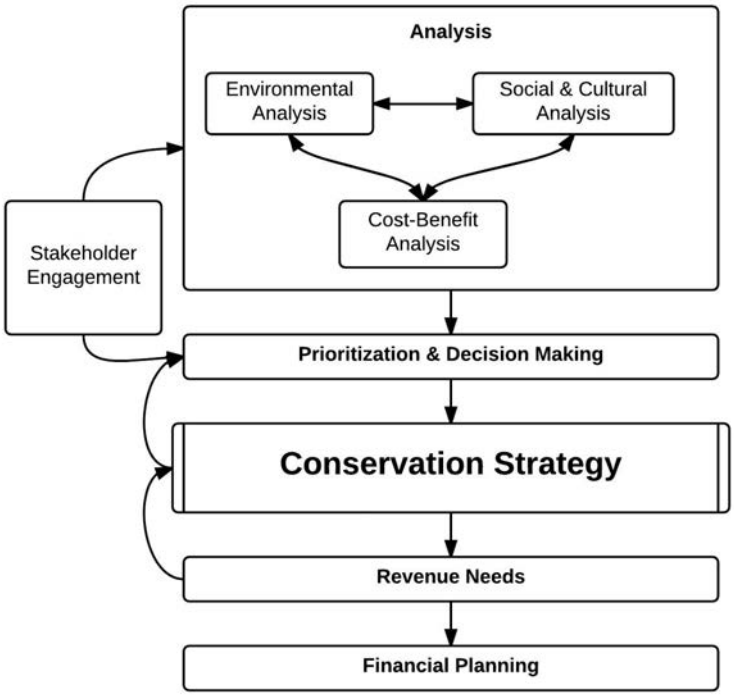


Figure 2-2. Typical sequence of financial planning relative to development of conservation strategies. The development of conservation strategies begins with environmental, socio-cultural, and cost-benefit analyses, ideally by engaging stakeholders. After prioritisation and decision-making, a conservation strategy is created. Even if attempts have been made to minimise the costs of conservation

actions, financial planning is normally considered after the conservation strategy is created, and without the inclusion of stakeholders.

Disconnecting finance from conservation planning creates several problems. First, most market-based instruments have social, cultural, and political implications (Adhikari & Boag, 2013; Jack, Kousky, & Katharine, 2008; Van Hecken & Bastiaensen, 2010; Villagómez-Cortés & del-Ángel-Pérez, 2013), so these finance mechanisms need to be considered during the socio-cultural analyses, with the input of stakeholders. Only then can feasible and appropriate mechanisms be identified for particular contexts. Partitioning of government funds for conservation also has social and economic implications that need to be analysed. Second, waiting until after planning is complete to start addressing finance can cause delays to implementation, and this can damage crucial yet fragile relationships between stakeholders and planners (Pomeroy & Douvere, 2008). Third, consideration of innovative finance mechanisms might introduce new opportunities or strategies to achieve conservation outcomes. Consideration of these mechanisms early in the planning process could change the objectives and recommended actions of a conservation strategy.

2.4 Environmental damages and externalities

Market-based instruments that also act as finance mechanisms for individual marine conservation initiatives can decrease (formally, 'internalise,') environmental externalities, but they do not prevent all environmental damages (Section 2.2). The marine conservation finance gap (Section 2.1) is therefore likely to persist even after improved financial planning for individual initiatives (Section 2.3). To fully understand the conservation finance gap, we need to investigate the role of businesses. Businesses impact the size of the conservation finance gap, to varying degrees depending on business objectives (Figure 2-3).

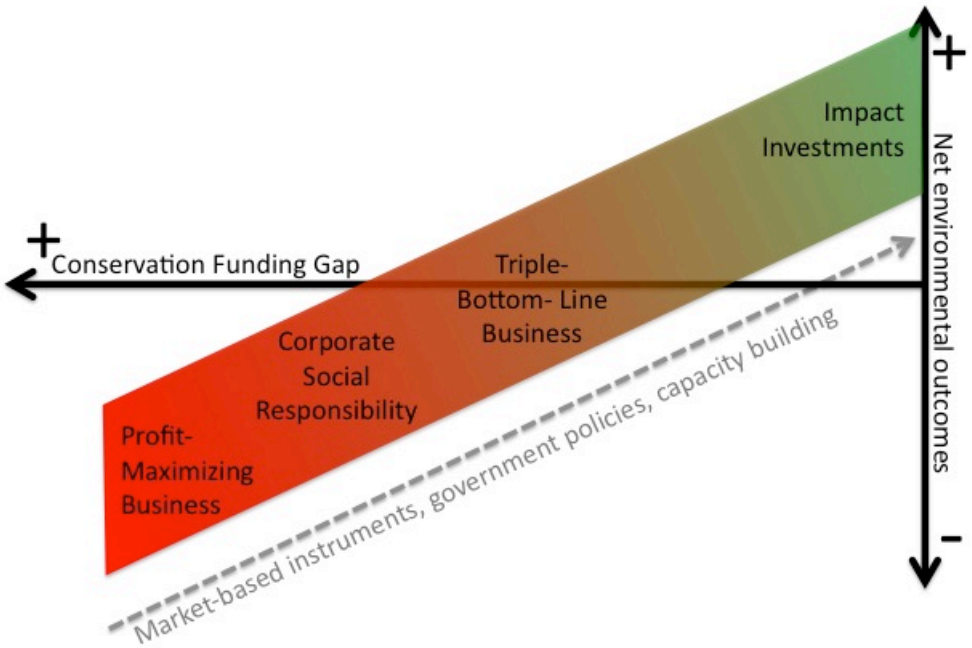


Figure 2-3 Connection between business objectives and the global conservation finance gap.

The *x*-axis represents the conservation finance gap, and the *y*-axis represents the net environmental outcomes created by businesses. There is a spectrum of business objectives, from profit maximising on the left to impact investments on the right. Profit-maximising businesses widen the conservation finance gap most, and impact investments contribute most to closing the gap. To reduce the conservation finance gap, businesses along the entire spectrum need to be engaged using market-based instruments, government policies, and capacity building (blue arrow, described in Section 3.4).

On the left end of the spectrum in Figure 2-3 are businesses that aim to maximise profits rather than social or environmental welfare (Ervin et al 2012). In the absence of government policies and market-based instruments, and depending upon what goods or services are being produced, these profit-maximising businesses can create large negative environmental outcomes (environmental damages), thus contributing to a large conservation finance gap.

Next on the spectrum are businesses that adhere to the idea of 'corporate social responsibility' by voluntarily investing financial and technical capital into social and environmental outcomes (Freemen 1984). An example of corporate social responsibility for marine conservation would be a large retailer buying and selling sustainably-harvested seafood using the Marine Stewardship Council scheme (Gulbrandsen, 2009). Despite evidence of 'green washing' whereby companies market themselves as environmentally responsible without changing practices to minimise negative impacts, there are many examples of corporate social responsibility reducing environmental impacts (Dahl, 2010; Kilian & Hennigs, 2014; Lam, 2014; McWilliams, Siegel, & Wright, 2006; Nalband & Al-Amri, 2013; Pomering, Johnson, & Noble, 2013; Reider-Gordon, Funk, Ewelukwa, Feldman, & Wagner, 2013; Wan & Walker, 2012). Another type of business sits at this place of the spectrum: businesses that pass the 'negative screening' requirements of the growing number of 'socially-responsible investment' funds because they have 'less bad' social and environmental practices (Lydenberg & Grace, 2014). For example, many pension funds that claim to be 'socially-responsible' no longer invest in companies that are involved in the fossil-fuel industry because of concerns over climate change. 'Less bad' practices often result in significantly fewer negative environmental outcomes (Laufer, 2003), so these companies are placed to the left of centre in Figure 2-3.

Towards the middle of the spectrum are businesses termed 'triple-bottom-line' (United Nations 2007) or 'utility-maximising' because they seek to maximise more than just profits and can (but do not always) achieve net neutral environmental outcomes (Ervin et al 2012). These businesses might still create environmental damage, but they attempt to offset this damage. Businesses in this category, increasingly including large multinational corporations, consider biodiversity and ecosystem services to be 'material' (UNEP 2010). They recognise that biodiversity and ecosystem services significantly affect the financial bottom line and therefore include them in 'green accounting.' Green accounting is a component of moving beyond measuring success by profits alone, towards more holistic measures of human progress (Costanza et al., 2014; Kubiszewski et al., 2013).

At the far right end of the spectrum are 'impact investments', defined by The Global Impact Investing

Network as 'investments made into companies, organisations, and funds with the intention to generate social and environmental impact alongside financial return.'- In the case of impact investments, it is implied that the 'environmental impacts' are positive, which follows the well-established definition of impact in the field of programme evaluation (Ferraro, 2009). The majority of impact investments target social and health problems such as poverty, water security, malnutrition, and disease in developing countries (Bugg-Levine & Emerson, 2011; O'Donohue, Leijonhufvud, Saltak, Bugg-Levine, & Brandenburg, 2010). A smaller proportion of impact investments focus on environmental targets, with only a handful focused on the marine environment (CFA, 2014). Impact investments have net positive environmental outcomes and either close or reverse the conservation finance gap. The most notable examples of impact investments for marine conservation are entrepreneurial MPAs, which are primarily funded by profit-bearing business models, typically associated with dive tourism (Colwell 1995, 1997, 1998). There are examples of entrepreneurial MPAs in Tanzania, Malaysia, Indonesia, and Fiji (Brunnschweiler, 2009; Gjertsen & Niesten, 2010; Teh, Teh, & Chung, 2008`; Nordland 2013).

Another version of impact investing is the use of debt and equity to fund 'rebuilding' of marine fisheries (e.g. Hastings *et al.* 2012, Rands *et al* 2012). Rangely and Davies (2012) commented that, while localised success has been achieved by initiatives in innovative fisheries finance, "none have made an impact at the scale required."

There are many opportunities to develop new impact investments for marine conservation. Foundations can make impact investments to achieve marine outcomes through programme-related investments and mission-related investments. These are mechanisms that enable foundations to make debt or equity investments to achieve social or environmental impacts using their charitable funds or corpus, respectively. New business models can be explored for social enterprises that produce positive marine impacts and are not reliant on grants, thereby freeing up grant funds for other purposes.

While we could find no definitive estimates of the number of businesses in each category of Figure 2-3, we do know that only a small portion of global investments are placed into businesses with explicit

environmental objectives (Salamon, 2014), and we postulate that most businesses would be to the left of centre. This situation adds to the current high conservation finance gap, indicating the need to change business objectives and environmental outcomes.

2.5 Capacity to address these challenges

The challenges and efforts described in this paper are synthesized from numerous bodies of literature. Next we outline the key fields of research that contribute to our understanding of marine conservation finance, starting with academic fields, followed by non-academic efforts, and discuss the need to integrate these diverse efforts and lines of investigation.

The fields of marine ecology, oceanography, and environmental science provide our understanding of the state of marine resources, marine ecosystem services, trends and causes of decline, and potential environmental solutions. To these we add knowledge from the fields of natural-resources management, the social sciences, and systematic conservation planning to understand coupled human-ecological systems, options for resource management, and processes for developing conservation and management strategies.

The field of sustainable development, based on the idea of intergenerational equity (Brundtland, 1987), provides mechanisms to reduce the environmental impacts of new developments. Economics (with subspecialties of environmental, ecological, and sustainable) provides knowledge of the linkages between environmental and economic systems, environmental externalities, market-based instruments, and equity issues. The fields of corporate and non-profit finance provide the foundation for understanding how to secure and invest revenue, and the concepts of risk-return profiles and diversification. Socially-responsible investing, impact investing, and environmental finance, which are largely focused on reducing carbon emissions, provide models for investing capital to achieve environmental outcomes.

Outside of academia, the United Nations Development Programme and the World Bank are multi-lateral organisations with programmes on sustainable development and environmental finance. International

non-profit organisations (e.g., International Union for the Conservation of Nature, The Nature Conservancy, World Wildlife Fund, Conservation International, and Forest Trends) contribute to 'sustainable funding' and conservation business planning. A highly relevant professional body is the Conservation Finance Alliance (http://conservationfinance.org/). While this group is heavily focused on terrestrial biodiversity, the discussions and outputs are directly applicable to marine ecosystems.

The impact-investing industry is growing rapidly, with many international and localised entities providing infrastructure and capacity building (Bugg-Levine & Emerson, 2011; Salamon, 2014). Large conferences, including Social Capital, bring together social entrepreneurs and investors to discuss impact investments and, in 2013, there was a conference session on fisheries finance. A handful of private foundations have explicit programme priorities related to impact investing and socially-responsible development in addition to, but not yet combined with, priorities in marine conservation. The International Coral Reef Initiative has a working group focused on the economic valuation of marine resources, and this group also works on topics in marine conservation finance in members' respective government, multi-lateral, or non-profit organisations.

This brief summary highlights decades of academic research across many disciplines, pioneering and rapidly-expanding non-academic programmes for environmental finance and impact investments, and a scattering of non-academic professionals making significant advances in marine conservation finance. There is a lot of information and momentum to build upon, and numerous professionals with whom to collaborate. Still lacking is the capacity to weave these strands together, leverage ongoing work, and focus more strongly on marine conservation finance. In the 2012 survey of global marine conservation finance, mentioned above, 83% of respondents indicated that they lacked the human capacity (including knowledge, people, and time) to adequately address finance problems. The challenges described in this paper are large in scale and complexity, posing significant risks to marine ecosystems and human wellbeing; to address these challenges properly will require improved capacity, collaboration, and focus.

3. Recommendations

3.1 Developing finance strategies

Every marine conservation initiative, rather than half of initiatives as implied by the survey results above, should include a finance strategy. Total funding does not need to be secured before the initiative begins, but a strategy for obtaining adequate funding should be developed beforehand. The strategy should address the three inadequacies described in Section 2.1. The strategy should define how much funding is needed for the initiative and ensure that the size of the revenue streams meets this need. The strategy should include diversification of revenue sources to improve the financial stability of the initiative. The strategy should also seek to ensure that funding is available for the full duration of the initiative. Having a finance strategy does not guarantee adequate funding, but it will improve the likelihood that the initiative can be sustained and outcomes reached. The selection of finance mechanisms (Section 3.2), integrating financial planning into conservation planning (Section 3.3), engaging businesses to narrow the finance gap (Section 3.4), and building capacity in marine conservation finance (Section 3.5) are discussed next.

3.2 Analyzing and profiling finance mechanisms

Increased research on and development of finance mechanisms for marine conservation initiatives is needed to reduce over-reliance on grants, improve diversification of revenue sources, and generate both revenue streams and economic incentives for conservation outcomes. Numerous market-based instruments that can also generate revenue are being developed, but there is a need to build on that work to: 1) identify more mechanisms that could be used for marine conservation, 2) modify other mechanisms for the marine context, and 3) test those mechanisms in marine conservation settings (below).

Building upon the 'sustainable funding' work of several non-profit organisations (Moye, 2007; Spergel & Moye, 2004; ten Kate, Bishop, & Bayon, 2004; TNC, 2013), we recommend asking the questions in Table 2-2 when considering the application of finance mechanisms for marine conservation. The capacity to do this research will be discussed in Section 3.5. The outputs of this research can be used to: 1) identify potential

new finance mechanisms for marine conservation; and 2) analyse the feasibility of finance mechanisms for a particular marine conservation initiative (see Figure 2-4, Section 3.3).

Table 2-2. Research questions for conservation finance mechanisms

Ecological	What is the likelihood that the mechanism will produce measurable and positive ecological impacts? What is the risk of unintended, negative ecological impacts?
Cultural	What is the likelihood that the mechanism will have positive or negative impacts on Traditional / Indigenous communities, cultural use of marine habitats and resources, and/or traditional values of marine habitats and resources?
Social / equity	What are the potential social benefits of the mechanism? What is the likelihood that the mechanism will create inequity between stakeholders or increase tensions between stakeholders?
Legal	What laws, regulations, and policies are required for this mechanism? If they are not already in place, can they be feasibly established to support the mechanism?
Economic	What economic incentives will be created by this mechanism, and whom will they benefit or disadvantage?
Cost-efficiency	Will the development and implementation of the mechanism be cost-effective?

3.3 Integrating financial planning into conservation planning

We propose that financial analysis be integrated into the early stages of the process of conservation planning, in an iterative cycle with environmental and socio-cultural analyses (Figure 2-4). This approach enables feedback between financial analyses and other aspects of conservation planning, reduces delay between planning and implementation, and allows for the engagement of stakeholders in identifying

feasible and appropriate finance mechanisms.

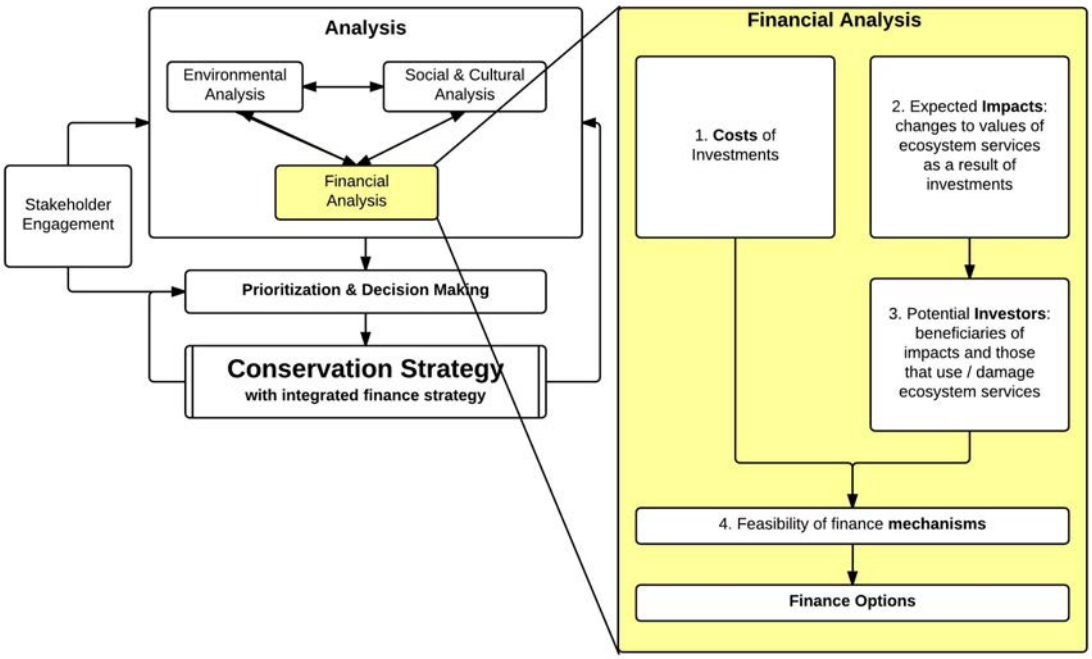


Figure 2-4 Recommended timing and components of financial planning relative to the development of a conservation strategy. Financial analysis, with engagement of key stakeholders, should be an iterative component of the analyses required to set the scene for conservation strategies, instead of being left to the end (see Figure 2-1). Financial analysis includes identification and investigation of potential investments, monetary and non-monetary values of biodiversity and ecosystem services, potential investors, and the feasibility of finance mechanisms. Finance options are then included in the prioritisation and decision-making processes, with further adjustment as needed during application of conservation actions.

We propose a generalised process for financial analysis (yellow box of Figure 2-4). Step 1 is to estimate the costs of the potential conservation interventions (e.g., research, direct action, policy development, hereafter 'investments'), acknowledging that this step will be iterative as the conservation strategy is developed and the extent of interventions is better defined. Costs include acquisition, transaction, management, damage, and opportunity costs, some of which can be difficult to estimate (V. M. Adams, Pressey, & Naidoo, 2010; Carwardine et al., 2010; Moore, Balmford, Allnutt, & Burgess, 2004; Naidoo et al., 2006).

Step 2 is to estimate the positive impacts that are likely to be created by the investments, sometimes referred to as 'return on investment.' Communities derive benefits from the marine environment in many different ways, including for social, cultural, environmental, and economic purposes (Hicks, 2013). Estimating the non-financial importance and estimating economic values that people place on the marine biodiversity and ecosystem services is difficult and controversial, because of both philosophical debates and limitations of methods (Atkinson & Bateman, 2012; Baveye & Baveye, 2013; Carson & Flores, 2001; Costanza, 1998; Daily et al., 2000; Fourcade, 2011; Heynen & Robbins, 2005; Opschoor, 1998; Robert et al., 1997; Sagoff, 2011; Natalie Stoeckl et al., 2014; Turner, Morse-Jones, & Fisher, 2010). Where possible, economic, social, cultural, and environmental values should be estimated, both before and after the proposed investments. The difference in values before and after can then be used to estimate the potential impacts of the investments. Comparing costs with impacts is akin to a cost-benefit analysis.

Step 3 is to identify potential investors using the theory of payments for ecosystem services. This theory calls for the beneficiaries of ecosystem services or the entities causing damage to biodiversity and ecosystem services to pay for conservation and management (see Section 2.2 and Pagiola 2004). For example, if it is determined that one impact from an investment is storm protection from coral reefs, then coastal landowners could be identified as potential investors. As another example, if it is determined that a community places high importance on clear water quality, and a coastal development is reducing water quality, then the developer could be identified as a potential investor. A third group of potential investors are individuals or entities that both benefit from and negatively affect marine biodiversity and ecosystem services, such as fishermen. If both local beneficiaries and impacting entities are too impoverished to fund conservation, then regional or global beneficiaries (e.g., multilateral organisations representing developing countries that are benefiting from fisheries) or impacting entities (e.g., multinational corporations purchasing offsets for environmental damage) can be investors.

Step 4 is to identify potential finance mechanisms. The outputs of steps 1-3 can be used in a process of elimination. The cost information (from Step 1) can rule out potential finance mechanisms by matching the scale of the problem to the potential revenue generated by different mechanisms. Information on financial

impacts (from Step 2) is also useful for eliminating mechanisms based on monetary scale. For example, social impact bonds are only feasible for projects that generate over $50 million in financial impact (Salamon, 2014), and would be ruled out for investments that could not generate this level of financial return. Information on non-financial impacts (from Step 2) can help eliminate mechanisms that do not match the ecosystem services involved. For example, if the non-financial impact is decreased agricultural pollutants, then the shipping insurance bonds would be eliminated as a potential mechanism. Information on potential investors (from Step 3) eliminates mechanisms based on who is involved. For example, if fishermen are not identified as potential investors because they do not benefit from or adversely affect the values of a particular conservation strategy, then any finance mechanisms involving fishermen would be excluded.

After elimination of inappropriate mechanisms, the remaining ones would be further assessed based on questions in Table 2-2 and the context (environmental, social, cultural, and economic) of the area(s) in which the investments are being considered. This assessment would provide more detailed information, primarily qualitative, about which finance mechanisms could be most suited to a particular conservation strategy in a particular area.

The output of Step 4 is a set of options for finance mechanisms, along with the expected costs and impacts of those investments. Decisions on finance mechanisms would then be made with the engagement of stakeholders (see "prioritisation and decision-making" box on left side of Figure 2-4), ultimately leading, with some further iterations, to a conservation strategy with an integrated finance strategy, including a diverse portfolio of mechanisms, and the buy-in of key stakeholders.

3.4 Engaging businesses to minimise the finance gap

The market-based instruments employed as finance mechanisms in conservation strategies will not negate the entire global conservation finance gap. Given the relationship between business objectives and the finance gap (Figure 2-3), it is clear that businesses need to be better engaged. Different tools and

approaches are appropriate depending on where a business lies on the spectrum in Figure 2-3 and described next.

3.4.1 Government policies and market-based instruments

On the left end of the spectrum in Figure 2-3 are businesses that put profit first. Engagement with these types of businesses to reduce their contribution to the marine conservation finance gap involves restrictive government policies and market-based instruments that require financial compensation for environmental damage. Biodiversity offsets, pollution cap-and-trade markets, and private insurance markets, as described in Section 2.4, are examples of mandated market-based instruments that can be used here.

Towards the middle of the spectrum in Figure 2-3, governments have important roles to play in enabling businesses to reduce their environmental damages and produce positive marine impacts. Governments can set advertising standards to reduce 'green washing' and other unsubstantiated claims of environmental credentials (Dahl, 2010; K. Walker & Wan, 2012). Governments can create policies that support 'green accounting' and transparency for environmental damages (Cairns, 2000; Rout, 2010; Serafy, 1997). Policies that create new legal structures that allow businesses to pursue social and environmental missions at 'concessionary' (below average market) rates of financial returns are essential to the development of impact investments (Bugg-Levine & Emerson, 2011; Salamon, 2014). Government policies can also allocate funding to support research on and development of market-based instruments, reduce perverse subsidies, and create positive subsidies that fund the transition to more sustainable industries, including the impact-investing industry.

At the far right of Figure 2-3 are impact investments that produce net positive environmental outcomes. The role of the private sector in marine conservation is arguably the least understood or explored. Because the field of impact investing is so new, there are market failures. Subsidies, market infrastructure, and clear government policies are therefore needed (Bugg-Levine & Emerson, 2011; Salamon, 2014). The authors of this paper are engaged in forthcoming research about the opportunities and challenges of developing

marine impact investments.

3.4.2 Capacity building

Engagement with businesses along the entire spectrum requires capacity building. Partnerships are required between conservationists and businesses, regardless of business objectives, to decrease environmental damages. For example, for companies that are interested in corporate social responsibility, marine conservation researchers and practitioners can provide essential advice on the damages to the marine environment and recommended changes to business practices. Two-way capacity building is required for socially-responsible investments and impact investments because investors typically lack the technical ecological and conservation knowledge, and marine conservation practitioners typically lack expertise in investments (Lydenberg & Grace, 2014; Salamon, 2014). Non-profit organisations can engage in advocacy to increase understanding within government agencies and request changes to policies and funding arrangements. Technical assistance from non-profit organisations to social enterprises can increase the capacity of the for-profit sector to make impact investments. Technical assistance from philanthropists to non-profit organisations can build their capacity to make programme-related and mission-related investments.

Government policies, market-based instruments, and capacity building across sectors could help shift business activity from the left towards the right of Figure 2-3, as pictured by the blue arrow.

3.5. Shaping the emerging field of marine conservation finance

The recommendations proposed in Sections 3.1 – 3.4 could proceed with the current capacity and organisation of that capacity (Section 2.5). However, to improve our ability to address the challenges discussed here, we present a possible way forward that includes expanding the scope of marine conservation finance, increasing the number of specialists focused on marine conservation finance, increasing cross-sector and cross-discipline collaborations, and clarifying the terminology used to describe

this emerging field, as discussed next.

3.5.1 Scope

Significant efforts are underway to find money for marine conservation, improve conservation planning, reduce the environmental externalities of businesses, and create impact investments, but these bodies of work have not yet been united to solve the challenges of the marine conservation finance gap. Outcomes for marine conservation could be improved by weaving these strands together. The scope of marine conservation finance should therefore include: 1) financial planning to generate revenue and economic incentives at the scale of individual conservation initiatives; 2) research on and development of finance mechanisms for the marine conservation context; 3) engagement with businesses to reduce their contributions to the conservation finance gap; and 4) the development of impact investments for marine conservation. Without each of these components, the marine conservation finance gap is likely to widen.

3.5.2 Collaboration and specialists

Most of the fields of research and practice described in Section 2.5 are already interdisciplinary and collaborative, but collaboration for the specific purpose of addressing the scope of marine conservation finance is limited. Increased collaboration is needed between sectors (multi-lateral organisations, public and resource users, governments, for-profit companies, non-profit organisations, research institutions, and philanthropists) and disciplines (conservation planning, marine ecology, social sciences, environmental sciences, environmental economics, business, sustainable development, and impact investing). The separate but complementary roles that are required for these collaborations are described throughout the paper and illustrated in Figure 2-1. Without these collaborations, reducing the marine conservation finance gap will be very challenging.

We recommend that more specialists in marine conservation finance are needed to catalyse these collaborations, synthesize outputs from many fields of work, leverage funding opportunities, and improve

the capacity to address the problems of marine conservation funding. There appears to be growing interest in marine conservation finance, and there are scattered specialists conducting exciting and important work, but more specialists are needed. It is difficult within current education systems to obtain training across the many components of marine conservation finance, so more research is needed to understand how to attract and train specialists in this emerging field.

3.5.3 Terminology

Last, we emphasize the importance of the terminology in this paper to describe this field. While the widely-used term 'sustainable funding' is often used to describe programmes and projects addressing the marine conservation finance gap, this term is misleading and detrimental. There is no clear threshold of 'sustainable' funding beyond which the need for ongoing financial planning, implementation, and evaluation is negated. Conservation planning and development of conservation strategies are iterative processes (Robert L. Pressey, Mills, Weeks, & Day, 2013) and financial planning for marine conservation similarly must be ongoing and iterative. Donors that have invested in 'sustainable funding' projects might have the false expectation that, once the project is complete, funding for marine conservation is also complete. This can make ongoing support unlikely. We recommend that a more appropriate term for the field is 'marine conservation finance.' A focus on financial planning, rather than 'sustainable funding,' will change the expectations of investors (including philanthropic donors) and stakeholders from one-off funding efforts to ongoing and strategic financial planning.

4. Conclusions

Human-well being depends on marine biodiversity and ecosystem services, which are in jeopardy due to human activities. There is not enough funding to protect and manage marine biodiversity and ecosystem services, and the funding is too short in duration and at risk due to the lack of diversity in funding portfolios. Marine conservation initiatives are over-reliant on government and philanthropic grants, and market-based instruments need to be further developed for marine conservation. Although costs and benefits of

conservation interventions are increasingly being considered in conservation planning, the other aspects of financial analysis – investors, mechanisms, and investees – are not being considered until after conservation strategies are developed, with adverse consequences for the success of those strategies, the marine environment, and the communities that depend on marine ecosystems.

Every conservation strategy needs a financial strategy, which includes market-based instruments that are appropriate for the socio-cultural and ecological context of the initiative, and which are developed with the engagement of stakeholders. Improving initiative-level funding is necessary but not sufficient. The environmental damages from businesses also need to be addressed to reduce the conservation finance gap, and there are numerous tools available for engaging businesses, depending on the objectives of those businesses.

While there is tremendous knowledge and momentum to build upon to address these challenges, coming from numerous academic and non-academic fields of work, there is a lack of capacity focused directly on marine conservation finance. Expanding the scope of marine conservation finance and increasing the collaboration and number of specialists focused on this emerging field could improve the likelihood of reducing the marine conservation finance gap. Clear terminology of this emerging field, steering away from 'sustainable funding' towards 'marine conservation finance,' is important in defining the scope and expectations of this work.

Finance is certainly not the only limit to marine conservation but, if finance remains poorly considered, all other marine conservation work is at risk of unravelling. Caution is needed to avoid 'idea inflation' or disproportionate attention to the 'new and different' over the 'tried and true' (Bugg-Levine & Emerson, 2011), and defining of the marine conservation finance field will not be a panacea. On the other hand, business as usual has resulted in the very large marine conservation finance gap. The ideas in this paper go some way to explaining why that gap exists, and have the potential to significantly reduce that gap. Collaborative and focused attention on marine conservation finance is urgently needed to preserve marine ecosystem services and support human wellbeing.

Chapter 3. Effective Marine Offsets for the Great Barrier Reef World Heritage Area

Published as Bos, Pressey, and Stoeckl. 2014. Environmental Science & Policy 42:1-15.

Abstract

Biodiversity offsets are a prevalent mechanism to compensate for development impacts to natural resources, but the appropriateness and efficacy of offsets remain the subjects of research and debate. Effective offsets for impacts to marine resources present even more challenges than those for terrestrial impacts. The Great Barrier Reef World Heritage Area is globally valuable for both biodiversity and heritage, but coastal development is undermining these values, and more effective offsets are needed to compensate for the damage. To improve the effectiveness of marine offsets for the Great Barrier Reef, we recommend that: 1) Proponents be required to follow and document their adherence to the mitigation hierarchy, which considers offsets only as a last resort after avoidance and mitigation, 2) Proponents and regulators consider the risk of offsetability prior to offset design, 3) The Australian government require offsets to achieve additional, measurable net benefits, relative to the counterfactual baseline, for all affected values, 4) Specialist third parties (not government or proponents) design and implement marine offsets, 5) Offsets are direct and specific to the affected values, with very minimal investment into research, 6) Offsets are consolidated into strategic implementation sites, with long-term legal protection, that are consistent with the zoning of the Great Barrier Reef Marine Park and adjacent coastal land uses, 7) The time between impact and net benefit should be minimized, and net benefits should be maintained in perpetuity, 8) Proponents pay the full cost of offset implementation, monitoring and evaluation, and cost is agreed upon before the development is approved, and 9) Monitoring of the efficacy of offsets is separate to but coordinated with regional monitoring programs for ecosystem health, and monitoring data are made publically available. Within this context, and with careful and rigorous methods as described herein, offsets can contribute to maintaining the Outstanding Universal Value of the multiple-use World Heritage Area.

1. Introduction

It has been estimated that, globally, business activities cause about US $7.3 trillion worth of damage annually to the environment that is not paid for (formally`, "externalities`," TEEB, 2013). Communities and governments are increasingly requiring businesses to compensate for this loss (Houdet, Trommetter, & Weber, 2012). One way of doing so is for governments to require proponents of developments (hereafter, "proponents") to compensate for their negative impacts by implementing activities aimed at restoring and maintaining biodiversity and ecosystem services (hereafter "offsets").

Despite their prevalence, the appropriateness and efficacy of biodiversity offsets remain the subjects of debate (Blundell, 2006; Bull, Suttle, Gordon, Singh, & Milner-Gulland, 2013; Susie, Nicholas, & Jo, 2013). Offsets have been criticized for not meeting ecological targets due to a variety of factors including inadequate planning, compliance, and monitoring (Bentivoglio, 2003; Bull, Suttle, Gordon, et al., 2013; Levrel, Pioch, & Spieler, 2012; M. Maron et al., 2012; NRC, 2001; Race & Fonseca, 1996). Contrary to their intended purpose, offsets can contribute to biodiversity decline (Gibbons, 2010; S. Walker, Brower, Stephens, & Lee, 2009). Poor offset planning is partly due to offset policies that are vague (Bronner et al., 2013) and inadequate (Pickett et al., 2013).

Studies of the efficacy of marine offsets are "scarce and patchy" compared to those for freshwater and terrestrial ecosystems (Levrel et al., 2012). In Canada, a comprehensive review of fish-habitat mitigation revealed that 86% of projects could not even be evaluated for effectiveness due to poor monitoring and records (Harper & Quigley, 2005). Among the few available marine assessments, Bentivoglio (2003) found that marine mitigation projects in the U.S. Pacific Islands required under wetland regulations have been only 65% effective.

While there is longstanding international support for the principle that polluters pay for their impacts (OECD, 1972), concerns remain that businesses should not be allowed to purchase the right to harm the environment (McKenney & Kiesecker, 2010). Even for those who believe that businesses should pay for

compensatory actions, there is the complicating issue of equity: impacts to and benefits from the environment are shared by many, so requiring some but not all stakeholders to pay can be controversial. In this paper, we do not engage in the debate about whether offsets should be allowed. Rather, we assume that the current trend towards using offsets will continue, and investigate how to maximise the beneficial outcomes of these offsets while minimizing risks.

Two main types of environmental offsets are carbon offsets and biodiversity offsets, and each of these types can be mandatory or voluntary. This paper focuses exclusively on one type of environmental offset: mandatory biodiversity offsets that are required of proponents as part of legal approvals for development projects. In particular, the paper investigates offsets that are required for impacts to marine biodiversity and ecosystem services in the Great Barrier Reef World Heritage Area (GBRWHA).

The region is an important test case because of its global significance combined with increasing pressures on its biodiversity from major coastal developments (Jon Brodie & Waterhouse, 2012; GBRMPA, 2013). The GBRWHA is also the focus of debate and policy formulation around marine offsets. The region was designated as a World Heritage Area in 1981 to recognize and protect the "Outstanding Universal Value," which includes 62 biodiversity and heritage values (in this paper`, the term "value" refers to these biodiversity and heritage values except when specific mention is made to "economic value`," GBRMPA, 2013). This designation is in danger because of concerns by the United Nations Educational, Scientific, and Cultural Organization over the Australian and Queensland Governments' management of mining and associated port developments in and adjacent to the GBRWHA (Douvere & Badman, 2012). In July 2013, the health was downgraded from "moderate" to "poor" (Government of Queensland, 2013a).

The Australian and Queensland governments manage the GBRWHA through an intergovernmental agreement (1978) and a complex system of laws, regulations, and policies. The Great Barrier Reef Marine Park Authority (GBRMPA) is an independent statutory agency with primary responsibility for managing the Great Barrier Reef (GBRMP Act 1975) and assisting with the management of World Heritage values of the Great Barrier Reef, but several Commonwealth and Queensland agencies have jurisdiction over matters

related to Great Barrier Reef health. The legislation that is most relevant to offsets is the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which requires that all impacts to the Great Barrier Reef from development must be avoided, mitigated, or offset. To guide the design and assessment of offsets, the Australian Department of the Environment implemented a biodiversity offsets policy (hereafter "Policy") in October 2012.

To date, over $185 million dollars of marine offsets have been required under the Policy for the GBRWHA. These monies have not yet been spent due to scientific and political uncertainties. With large offset investments about to be made, and continuing development pressure along the GBRWHA coast that will involve further offsets, a critical analysis of the Policy and intended application to marine offsets is urgently needed to guide the development of effective marine offsets for the GBRWHA. This paper intends to inform the design of recently approved but not yet implemented offsets, and the future design, assessment, and approvals of marine offsets in the region.

The background section of this paper provides the context for this study by reviewing key concepts related to offsets, identifying challenges that are unique to marine offsets as opposed to terrestrial offsets, and drawing from the literature to identify nine core principles for effective design and implementation of offsets. Section 3 outlines current practice for designing and approving marine offsets in the GBRWHA area and provides examples of recently approved offsets. Section 4 describes the limitations associated with current practice, and Section 5 presents recommended changes to the approvals process and offset design. We conclude by articulating how changes in the status quo could lead to improved outcomes for the GBRWHA.

2. Background

2.1. Mitigation hierarchy

The purpose of offsets is to compensate for intentional damage to biodiversity and ecosystem services. At

least 29 countries have policies requiring mandatory offsets for development approvals (Fujita et al., 2013; Gibbons, 2010; McKenney & Kiesecker, 2010; Morandeau & Vilaysack, 2012), although they are more commonly termed "compensatory mitigation" in the United States (Levrel et al., 2012). While policies differ, most are built around the central idea of the "mitigation hierarchy" which states that intentional impacts to biodiversity and ecosystem services should first be avoided, then mitigated (also termed "minimized"), and then any unavoidable and unmitigated residual impacts should be offset as a last resort (ten Kate et al., 2004). Principle 1 of offset design therefore concerns the mitigation hierarchy (Table 3-1).

Table 3-1. Offset Principles

Number	Abbreviated name	Principle
1	Mitigation hierarchy	Offsets should be considered only after impacts are avoided and mitigated.
2	Offsetability	The offsetability risk profile should be considered before offset design.
3	Net benefits	Offsets should aim to achieve net benefits to all affected values measured against the counterfactual baseline.
4	Third-party implementation	Offsets should be designed and implemented by specialist third-party entities.
5	Direct and specific action	Offsets should be direct and specific to the impacted values.
6	Strategic sites	Offsets should be consolidated into regionally strategic implementation sites with long-term legal protection.
7	Temporal strategy	Offset strategies should minimize the time to achieve net benefits and maintain net benefits in perpetuity.
8	Financial liability	Financial liability for offsets should be determined by the costs to achieve and maintain net benefits in perpetuity.
9	Monitoring and adaptation	Offsets should be subject to monitoring and adaptive implementation over appropriate durations.

2.2. Offsetability

Not all impacts can be offset. The term "offsetability" refers to how likely it is that an offset can compensate for an impact (Pilgrim et al., 2013). Even with good design, offsets cannot always compensate for impacts to values. Offsets with low offsetability include those that are highly vulnerable, endemic to a small area, exhibit low resilience, and provide essential community benefits (BBOP, 2012; Pilgrim et al., 2013). A risk-assessment approach has been developed to characterize the offsetability of impacts before offsets are designed (BBOP, 2012). Our proposed principle 2 concerns offsetability (Table 3-1).

2.3 Net benefits

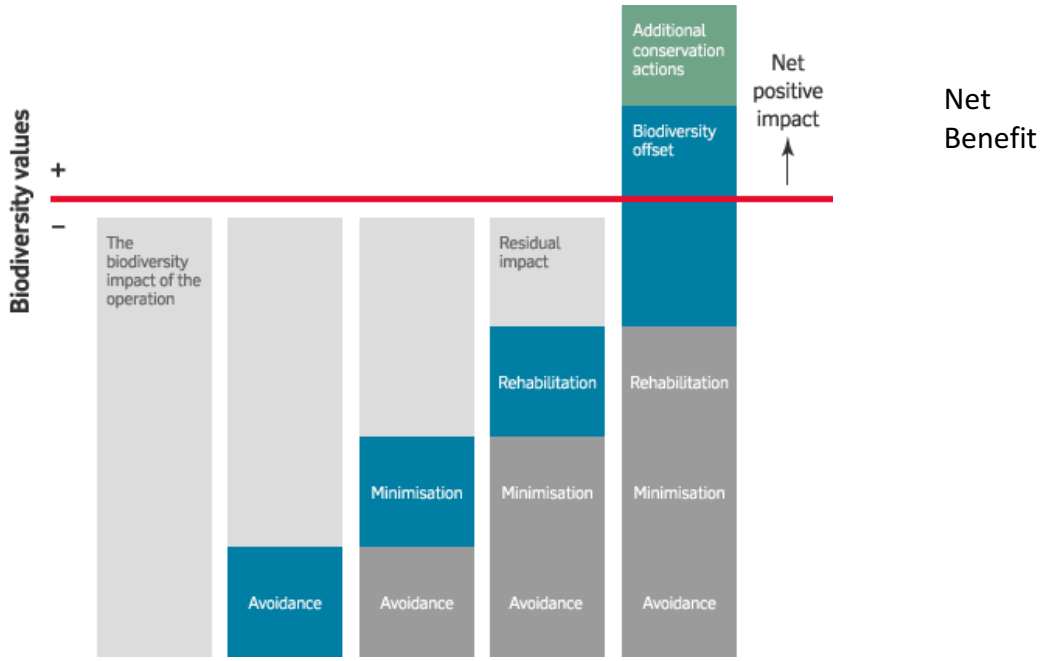
The design of effective offsets begins with a clear definition of the goal, and ambiguous goals are impairing effective implementation of offsets worldwide (Bronner et al., 2013). Historically and globally, the goal of offsets has been to achieve "no net loss" of biodiversity, but this is evolving towards the ideal of a net improvement (BBOP, 2013; McKenney & Kiesecker, 2010) often termed "net benefit" or "net conservation gain."

The goal of net benefits is commonly conceptualised as per Figure 3-1A. However, this figure has two critical flaws, both covered in our third principle (Table 3-1). First, the condition of the value is assumed to be static through time (straight red line in Figure 3-1A). In reality, the condition of values fluctuates through time due to both natural cycles and anthropogenic impacts beyond the development in question. For example, the abundance of marine megafauna may fluctuate due to the availability of food in regions distant from the project site in question. Other values have seasonal and annual fluctuations, such as seagrass cover, even in the absence of developments. Instead, offset efficacy should be measured against the counterfactual baseline – the predicted condition of the value through time without the project or any associated offsets (Ferraro, 2009; Gordon et al., 2011; Martine Maron, Rhodes, & Gibbons, 2013) – as

illustrated by the undulating black line in Figure 3-1B.

A second limitation of the conceptualization in Figure 3-1A is that, to deliver net benefits, offsets must provide "additionality" (Horowitz & Just, 2013; Drew & Drew, 2010). In this context, additionality means benefits to biodiversity and ecosystem services that would not have occurred without implementation of specific offsets, measured against the counterfactual baseline. When offsets do not compensate for impacts, they result in a net loss (Figure 3-1B, Line D). No net loss is equivalent to the counterfactual baseline, or Line C. If an offset is implemented that improves the condition of a value, but not to the point that the condition of the value is improving through time, this can be represented as line B. If an offset improves the condition of a value to the point that the condition is improving through time, this can be represented as line A. Both lines A and B represent net benefits, but have very different long-term outcomes. Line A is aspirational while line B is acceptable.

A.



B.

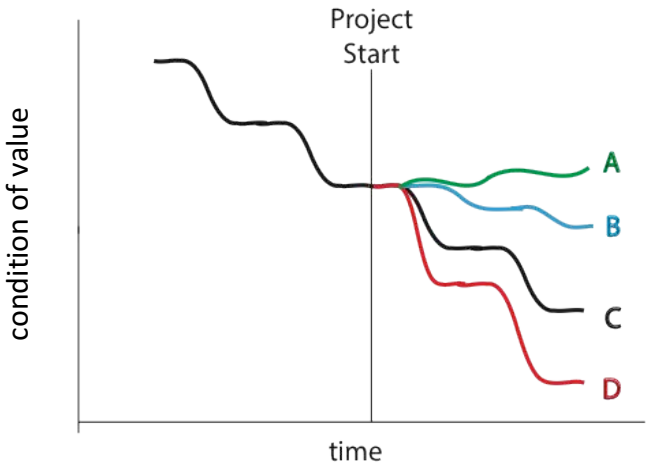


Figure 3-1. Conceptualizations of net benefits from offsets. **A.** Conceptualization of net benefits that is commonly used globally (http://www.riotinto.com/sustainabledevelopment2012/environment/biodiversity.html). The red line in panel A refers to the condition of the value. The term "minimization" this figure is equivalent to "mitigation' in this paper, and the term "rehabilitation" in the figure is incorporated into the term "offsets" in this paper. "Additional conservation action" refers to non-offset activities that are done to improve the condition of

values. **B.** Improved conceptualization of net benefits that accounts for a potentially dynamic counterfactual baseline and variation in efficacy of offsets. Line D represents net loss. Line C represents no net loss. Lines A and B both represent net benefits, but B indicates a continuing, if slower, decline in condition.

2.4 Third-party implementation

While the legal obligation to provide offsets resides with proponents, offsets can be designed and implemented by the proponents directly, by governments, or by third parties. Fourteen countries, including Australia, allow proponents to pay a government or third party to implement offsets (Morandeau & Vilaysack, 2012). If proponents design and implement offsets, there are risks and challenges. Proponents do not typically have in-house expertise in offsets and they do not always contract the best experts (Gane, 2010). In addition, proponents tend to implement offset activities on or near development sites, leading to fragmented offset implementation sites that are close to areas of high impacts and are unlikely to deliver ecological outcomes (ELI, 1994). Offsets that are designed and implemented by governments also have both benefits and risks. Government agencies are often in a good position to identify effective offset activities. Implementation of offsets by a government agency, however, introduces the risk of regulatory capture, with decisions and/or actions of regulatory agencies being influenced by monetary or other benefits flowing to the agency from the industry it regulates (Grech et al., 2013).

The United States, acknowledged as having the most advanced policy for offsets, shifted towards third-party implementation in the 1970s (ELI, 1994; Gane, 2010; McKenney & Kiesecker, 2010). Third-party providers of offsets are promoted by the United States government because they are more cost-effective than proponent-implemented offsets, reduce permitting time, and are designed by restoration experts rather than development experts (USACE, 2008). Third-party offsets can be managed either through a "mitigation bank," which is an entity that does environmental restoration in advance and then sells the benefits to proponents, or through payment for service, called "in-lieu-fee" in the United States, which is similar to a mitigation bank except the offset happens after payment is received from proponents. The success of mitigation banks depends on large capital investments, strong regulatory backing, and demand from third

parties (Burgin, 2008; Gane, 2010). Mitigation banking is preferred because it ensures successful ecological outcomes before impacts occur, but payment for service is the second-best option (USACE, 2008). Our fourth principle (Table 3-1) refers to third-party implementation.

2.5 Direct and specific action

Globally, a wide range of activities have been claimed as offsets, including ecosystem restoration, research, education, and declaration of protected areas. Actions can be classified as "direct" or "in-kind" if they provide a measurable conservation gain, or "indirect" or "out-of-kind" if they provide ancillary outputs. For example, a direct offset to compensate for damage to a mangrove habitat is to plant and manage new mangrove habitat. An indirect offset for this impact would be to fund research on the importance of mangrove habitats.

Globally, using offset monies to fund research and education is increasingly viewed as unacceptable (McKenney & Kiesecker, 2010). The risk involved with investing in research rather than direct action is that research is not likely to result in measurable net benefits to the affected value. In addition, offsets should provide measurable gains that are "specific" to the affected value (BBOP, 2013; Bull, Suttle, Gordon, et al., 2013). Drawing on the example above, to compensate for damage to a mangrove habitat, a specific offset restores mangrove habitat. A non-specific (but still direct) offset would restore seagrass habitat to compensate for damage to mangroves. Offsets must be specific to meet the goal of net benefits. Principle 5 (Table 3-1) relates to direct and specific action.

2.6 Strategic sites

The selection of sites to implement offset activities is considered to be a very important consideration in designing effective offsets (Kiesecker et al., 2009). Our sixth principle (Table 3-1) refers to selection of sites. Marine offsets present even more challenges than terrestrial offsets, related to the different relationship in the sea between ownership of areas and flows of impacts and values. As noted above, one of the central

requirements of offsets is that the site is protected for the long term (McKenney & Kiesecker, 2010). In terrestrial settings, this is most often accomplished by purchasing land but sometimes by securing legal protection. In the marine environment, however, ownership and legal protections of the environment are limited. Marine parks and customary tenure can be designated, but they can also lose designation or be re-zoned to allow more destructive uses. This means that marine offsets are implemented in sites that do not necessarily have long-term protection. Consequently, the benefits of offsets can be lost over time. Even in situations where legal protections can be secured, marine offsets are complicated by the dynamic nature of the marine environment. Impacts, such as water-borne pollutants, and many species, such as migratory marine mammals, move widely (Game et al., 2009). While offsets might theoretically compensate for loss to migratory species and/or migratory habitats (Bull, Suttle, Singh, & Milner-Gulland, 2013), in practice, this would require a greater consideration of both land-based inputs and upstream/downstream flows than current practice.

There is also tension between proximity and distance in designing offsets. On one hand, it is not always possible or preferable to replace a value, such as a range-restricted species or recreational fishing access, hundreds of kilometres away from the impact site. On the other hand, impact sites are often in industrial zones with chronic pressures, and the probability of success of an offset close to these sites is likely to be much lower and the cost much higher than in more distant areas. Policies that promote on- or near-site offsets can lead to fragmented restoration sites with high failure rates (NRC, 2001). Restoration on development sites can be hundreds of times more expensive than off-site restoration (Rolfe 2001).

McKenney and Kesiecker (2010) argue that offset policies should require regional, landscape planning to select implementation sites. Keisecker *et al* (2009) applied systematic conservation planning (Margules & Pressey, 2000) to identify strategic offset sites, finding it advantageous to consolidate multiple offset activities. Implementation of offsets in a few, larger areas rather than small fragmented sites throughout a region is more cost-effective because it consolidates capital expenses, management, and monitoring and is more likely to achieve ecological outcomes because multiple offset activities can be combined into an ecosystem-based approach (Gane, 2010). For example, in one area, three offsets could be implemented

simultaneously to address seagrass, turtles, and sedimentation, respectively. Exceptions might be necessary for values that have very limited ranges or others, such as fishing access, with high spatial variability.

2.7 Temporal strategy

A temporal strategy for the design of offsets produces substantially better ecological outcomes than spatially strategic design alone (Gordon et al., 2011), leading to our seventh principle (Table 3-1). The temporal strategy must consider when the offset starts, how long it takes to achieve net benefits, and how long the net benefits will be maintained. Development impacts can last longer than the activities that caused the impacts. The leading US model requires offsets to start before construction and remain in place "in perpetuity" (McKenney & Kiesecker, 2010). This issue is termed "permanence" in the carbon-offset literature (Bennett, 2010; Horowitz & Just, 2013; Drew & Drew, 2010).

2.8 Financial liability

Achieving and maintaining net benefits requires adequate financial resources, yet budgets are often limiting (BBOP, 2013). It is critical that a transparent and consistent approach is taken to assess liability for offsets, and this approach is summarised in our eighth principle (Table 3-1). There are several options for assessing proponents' offset liabilities (Table 3-2).

Biodiversity and ecosystem services exhibit nonfungibilities, meaning that individual units cannot be mutually substituted. This means that trading impacted units for improved units is theoretically questionable (Salzman & Ruhl, 2000). Nevertheless, numerous systems have been developed to quantify the size of a required offset based on the spatial extent of the impact (Table 3-2, option 1). Multipliers are often used (e.g., 3 acres restoration required for 1 acre impacted) but the magnitude of the multiplier is based on ambiguous and theoretically flawed ecosystem models (Overton, Stephens, & Ferrier, 2013). The Habitat Equivalency Analysis (Dunford, Ginn, & Desvousges, 2004) and Net Present Biodiversity Value (Overton et al., 2013) methods both provide formulae for estimating offset size that consider temporal

equity and time discounting, but both assume that the spatial extent of both the impact and offset can be easily quantified. This is often not true for marine ecosystems. For example, migratory megafauna have large and complex geographical ranges with different parts of ranges important for different life-history stages, so spatial measures of equivalence are not always suitable to determine financial liability.

While some authors have calculated the economic value of biodiversity and ecosystem services (e.g., (Costanza et al., 1997), the methods and consequences of valuing nature remain controversial (Sagoff, 2009; Salles, 2011). At least 36 studies of economic activity or valuation have been conducted or are in progress for the Great Barrier Reef (Stoeckl et al., 2011). The most commonly cited value of the Great Barrier Reef is based on the Deloitte Access Economics series of studies on the economic contributions of reef-dependent industries including tourism, fishing, recreation, and scientific research. The estimate is approximately $6 billion per year in 2012 dollars (DAE, 2013) – but it only measures a subset of the total economic value of the area; many other values (e.g. existence values, bequest values, options values) are omitted. The total economic value of the GBR is thus likely to be much greater than $6 billion per year. In theory, one could divide the DAE (2013) estimate by the area of the reef to generate an economic value per hectare estimate (Table 3-2, option 2). This estimate would not account for spatial variation, possibly over-estimate liability to one subset of values (tourism, fishing, recreation and scientific research), and omit liability to the subset of values that is not included in DAE (2013). A third option would be to undertake a context-specific valuation for each and every offset (Table 3-2, option 3). This would likely be an extremely costly and very contentious exercise, primarily because of the controversy surrounding the different valuation techniques.

A fourth option for estimating appropriate payments for offsets would be to calculate liability as a percentage of development costs or a scaled flat fee (Table 3-2, option 4). A precedent for this method is the Environmental Management Charge that tourists pay to visit the Great Barrier Reef Marine Park. While this calculation would likely be the most simple and straightforward, development costs are not necessarily correlated with the scale of impact and/or the required funds to achieve net benefits.

Likely the best way to ensure that net benefits can be achieved is to assess financial liability based on the costs to implement offset activities, including administration, monitoring, and evaluation (Table 2, option 5). It might be possible to use the Wentworth Group of Concerned Scientists' national environmental accounts for Australia (Cosier et al., 2008) as a basis for estimating these costs. While there are unknowns when estimating costs, the process is arguably more straightforward and transparent than that of estimating economic values. This option also requires, appropriately, that required and low-risk offset activities have been identified before the development is approved.

Table 3-2. Options for calculating financial liability

Option	Name	Financial Liability Calculation	Strengths	Weaknesses
1	Spatial equivalence	Size of impact area x multiplier x cost to restore area	Established methods from terrestrial offset policies	Spatial extent of impact and offset are often difficult to quantify in the marine environment
2	Partial economic value per ha lost	Based on the Deloitte Access Economics economic valuation of the Great Barrier Reef, calculate the average value per ha	Easy, cheap, and fast to calculate; no additional valuations necessary beyond biannual update of Deloitte calculation for whole of region	Only accounts for market values of certain industries and does not account for values associated with many ecosystem services (ecological, social, and cultural)
				Average value for large region does not capture spatially variable values and ignores unique habitats and species
				Does not account for costs to manage impacts and/or restore values; these costs are not necessarily correlated with

				the economic value of lost or damaged areas
				Impacts to the marine environment extend beyond site boundaries due to flows of water and movements of species; site-based calculations can therefore underestimate impacts
3	Valuation study done for each and every offset	Context specific	Theoretically possible to estimate the correct value	Final estimates contentious because they are highly sensitive to valuation method and other research choices
4	Scaled flat fee or percentage based on development footprint	Fee based on size of development / investment	Easy and transparent to calculate	Neither cost nor size of development is necessarily correlated with cost to offset impacts

5	Cost of offset activities	Costs to implement offset activities	More likely that budget will be sufficient to cover costs of offset implementation since this option also requires, appropriately, that required and low-risk offset activities have been identified before the development is approved	Does not account for social equity and issues related to distribution of costs and benefits between stakeholders
				Time-consuming and difficult to cost out each offset activity

2.9 Monitoring and adaptation

To evaluate if an offset is successful, rigorous monitoring that is appropriate to the project goal must be implemented at the same time, with monitoring timeframes appropriately long (Levrel et al., 2012) and mechanisms in place to ensure adaptive management of the offset according to findings of the monitoring program. Effective monitoring of offsets can help move the field towards evidence-based conservation (Sutherland, Pullin, Dolman, & Knight, 2004), providing the motivation for our ninth principle (Table 1).

3. Recent marine offsets in the GBRWHA

In the GBRWHA, the Department of the Environment is the decision-maker about offsets under the EPBC Act. Based on a Memorandum of Understanding between the Department of the Environment and GBRMPA, decisions for projects outside the boundaries of the Great Barrier Reef Marine Park but affecting the Park involve consultation with GBRMPA. If a project is inside the marine park boundary, GBRMPA and the Department of the Environment both have authority to jointly approve the development.

Under the EPBC Act, proponents are supposed to begin by identifying all potential impacts and all potentially affected values. Values include Matters of National Environmental Significance and, since the Great Barrier Reef is a World Heritage Area, cultural and heritage values. Next, proponents are supposed to modify the design of the development to avoid as many impacts as possible. Third, proponents are supposed to design strategies to mitigate impacts. After avoidance and mitigation, proponents are supposed to identify and quantify all residual impacts. Proponents should then design offset strategies to compensate for the residual impacts.

Five major projects were approved between October 2010 and March 2013 that involved marine offsets for the GBRWHA. The approval conditions for these developments are summarised in Table 3-3 to illustrate current practice, and analysed in Section 4.

Table 3-3. Examples of recent EPBC Act approval conditions related to marine offsets in the GBRWHA

Approval Date	EPBC Referral Number	Proponent	Project	Excerpts from approval conditions related to marine offsets
22-Oct-10	2008 / 4402	Queensland Gas Company Ltd and BG International Ltd	Development of a Liquefied Natural Gas (LNG) Plant on Curtis Island	[A] strategy for contributions to field management and visitor awareness of the GBRWHA. The strategy must: (i) provide for activities to support field management to address the increased pressures on the GBRWHA, including but not limited to, pressures on populations of vulnerable species, increased risks from shipping and increased use of the Area; (ii) be developed in consultation with the GBRMPA, to give priority to objectives for the protection of the GBRMP and GBRWHA identified (from time to time), which may include (without limitation) patrols, support for incident response planning and preparedness, data collection, and assistance in visitor management; (iii) provide for the submission of periodic reports to the GBMRPA on the activities conducted, (iv) provide for a budget of at least $200,000 per annum for the life of the project (indexed at CPI) and in addition $100,000 per annum (indexed at CPI) for each operating LNG Train (commencing on commissioning of the relevant Train) to support implementation of the strategy.

22-Oct-10	2008 / 4057	Santos Ltd and PETRONAS Australia Pty Ltd	Development of a Liquefied Natural Gas (LNG) Plant on Curtis Island	[A] contribution of $200,000 per annum for the life of the project (indexed at CPI) for each operating LNG Train (commencing upon commissioning of the relevant Train) to be provided to the Australian and Queensland Government's joint program of field management for the GBRWHA, for expenditure in the Mackay / Capricorn Section
21-Feb-11	2009 / 4977	Australia Pacific LNG Party Ltd	Development of a Liquefied Natural Gas (LNG) Plant on Curtis Island	[A] strategy for contributions to field management and visitor awareness of the GBRWHA. The strategy must: (i) provide for activities to support field management to address the increased pressures on the GBRWHA, including but not limited to, pressures on populations of vulnerable species, increased risks from shipping and increased use of the Area; (ii) be developed in consultation with the GBRMPA, to give priority to objectives for the protection of the GBRMP and GBRWHA identified (from time to time), which may include (without limitation) patrols, support for incident response planning and preparedness, data collection, and assistance in visitor management; (iii) provide for the submission of periodic reports to the GBMRPA on the activities conducted, (iv) provide for a budget of at least $200,000 per annum for the life of the project (indexed at CPI) and in addition $100,000 per annum (indexed at CPI) for each operating LNG Train (commencing on commissioning of the relevant Train) to support implementation of the strategy.

4-Oct-12	2008 / 4468	Hancock Coal Infrastructure Pty Ltd	Abbot Point Terminal 3	The Seagrass Offsets Plan: a) must ensure disturbance limits do not exceed that identified … and confirmed during pre-clearance surveys undertaken as required in Condition 3 within the project area for the life of this approval; b) identify mechanisms/opportunities for the ongoing protection and conservation of seagrass habitat that supports listed and threatened species and migratory species, including inshore dolphins, marine turtles and dugongs within the Coral Sea Region, GBRWHA including the Port of Abbot Point; and c) identify mechanisms in order to achieve the outcomes of this condition with the Queensland Government....The person taking the action is required to a) contribute funding of $350,000 per annum (indexed at CPI), from construction until the expiry of this approval or cessation of operations, whichever comes sooner, to the Great Barrier Reef Field Management Program to fund the employment of Indigenous Rangers who will ensure that the threats to EPBC Act listed threatened and migratory species, coastline and tidal creeks as a result of construction and operation of the project are minimised, b) provide an annual financial contribution of $50,000 per annum (indexed at CPI), from construction until the expiry of this approval or cessation of operations, whichever comes sooner, to be provided to the GBRMPA as a contribution to the Australian and Queensland Government's joint program of field management for the GBRWHA, c) provide an annual financial contribution of $200,000 per annum (indexed at CPI), from construction until the expiry of this

				approval or cessation of operations, whichever comes sooner, to be provided to the GBRMPA to fund Net Conservation Benefits.

5-Mar-13	2010 / 5521	GKI Resort Pty Ltd	Great Keppel Island Resort	To compensate for significant residual impacts on the outstanding universal value of the GBRWHA and the marine environment of the GBRMP, the person taking the action must provide funding of $300,000 per annum (indexed at CPI and exclusive of GST) to implement a Marine Environment Offset Strategy to achieve net conservation benefits. The Marine Environment Offset Strategy must: a) identify research and management mechanisms / opportunities such as for the ongoing protection and conservation of marine habitat including seagrass, reefs, and corals, listed marine species and listed migratory bird species in the Great Keppel Island region; b) include provision for employment of Indigenous rangers; and c) provide timeframes for the implementation. The MEOS must be developed in consultation with the GBRMPA. The funding must be provided annually to the GBRMPA for the implementation of the MEOS from commencement of the action until expiry of this approval or cessation of operations, whichever comes sooner. This funding cannot be used by the person taking the action to comply with any monitoring, management or mitigation measures required by the Minister in other programs, plans, strategies or requirements specified in these conditions.

4. Limitations of current practice in the GBRWHA

It is widely acknowledged that the environmental assessment process in Australia under the EPBC Act has critical flaws that need to be amended (Macintosh, 2010). There are no clear guidelines on how to design, assess, implement, or evaluate marine offsets. In this section, we review current practice in marine offsets for the GBRWHA in relation to the nine principles proposed previously (Table 3-1).

Principle 1. Mitigation hierarchy

Too often, offsets for the GBRWHA are taken out of context and considered before the environmental impact assessment is complete. Offsets should not be used to compensate for impacts that should have been avoided, but this situation is common, especially given the lack of clear guidelines from government on what constitutes sufficient avoidance and mitigation. In other situations, vague offset strategies are submitted to government before the residual impacts are properly described and quantified. It is impossible to design effective offsets if neither regulators nor proponents have identified which impacts must be compensated.

It normally requires a long time for the proponent and government to agree on the impacts, and since offsets should be considered after impact analysis and development of avoidance and mitigation strategies, proponents often do not prepare offset strategies before submitting final Environmental Impact Statements. Often the development is approved and begins before the offset strategy is complete, with two consequent problems: 1) increased risk that a project with an inadequate offset strategy will be approved, and 2) increased time between impact and net benefits (see Principle 7).

Principle 2. Offsetability

Offsetability is not currently considered at all in the design or assessment of marine offsets in the GBRWHA. It appears that when compensation for an impact is assessed to be difficult, indirect offsets are used, and

this does not provide protection for Matters of National Environmental Significance under the EPBC Act.

Principle 3. Net benefits

Recent approvals have incorporated the language "net conservation benefits" (see Table 3-3) but it is not clear that these outcomes are required to be additional to the status quo, or against which baseline they are assessed. Approvals are being given before proponents determine how they will measure net benefits, which makes it impossible for decision makers to know whether offsets will be measurable.

Principle 4: Third-party implementation

Third-party implementation of marine offsets has not yet happened in the GBRWHA. Instead, most recent EPBC approval conditions have required proponents to either provide a financial contribution to GBRMPA to design and implement marine offsets or to consult with GBRMPA on the design of a marine offsets strategy. This introduces the risk of regulatory capture, and importantly, the public perception of this risk.

Principle 5: Direct and specific action

While the Policy is intended to cover "terrestrial and aquatic (including marine)" offsets, it is heavily focused on terrestrial. For marine offsets, the Policy provides exceptions to the rule that 90% of offsets should be "direct", due to the perceived "poorly understood ecosystems in the Commonwealth marine environment." The perception in the Policy that the ecosystems of the GBRWHA are poorly understood is notable, given that this is one of the world's most intensively studied marine regions. Furthermore, interpretation of the definition of "direct" in the Policy is quite arbitrary. This percentage could be interpreted relative to the total budget per development, total budget per region, number of offset projects, or in other ways. If the assumption is made that the 90% rule refers to the total marine offsets budget per development approval, then current approvals do not meet the 90% rule and are utilising the marine exception. Large research offsets have been proposed for the Great Barrier Reef under this exception.

Principle 6: Strategic sites

Recent approval conditions do not specify geographic sites for offset implementation, although one condition refers to a sub-region of the GBRWHA, the "Mackay Capricorn Section" (see EPBC 2008 / 4057 in Table 3-3). Historically offsets have generally been implemented in close proximity to the impact site, leading to numerous small and fragmented sites across the GBRWHA. These sites are not coordinated with regional planning and zoning, nor do they have legal protection against future development impacts.

Principle 7: Temporal strategy

Currently the timing of marine offsets in the GBRWHA has been tied to either the approval date or date of construction, but implementation of all marine offsets has been delayed due to governments and proponents trying to interpret the new Policy and develop offset strategies. For the recent approvals with marine offset requirements, this is between 6 and 60 years. The recent approval conditions do not require offset implementation to start until construction commences, which can be years after permit approvals, losing valuable time for ecosystem restoration. Moroever, the duration of offset implementation under EPBC Act is normally tied to the life of the approval. The conditions also do not ensure that the net benefits will be maintained in perpetuity, which puts the offset areas at risk of degradation over time (BBOP, 2013).

Principle 8: Financial liability

The amount of money that each proponent is required to pay for marine offsets has recently been determined by the Department of the Environment during the EPBC approval process. There is no transparent method or justification. It appears that the budget requirements are loosely based on the size of the development and precedent of past approval decisions. The details of the offset activities that can be undertaken with the prescribed budgets are being determined after approvals. This introduces the large risk that the arbitrary budgets set by the Department of the Environment will not be sufficient to deliver net

benefits to all affected values, or even "no net loss." The sequence of decisions is the critical issue here; costing of activities is currently being done after the budget for offsets is determined. Approval conditions also do not specific budgets for managing, monitoring, and evaluating the offsets.

Principle 9. Monitoring and adaptation

The approval conditions (Table 3) do not specify who should monitor offsets, how they should be monitored, how to adapt implementation of the offset if it is found to be ineffective, and how monitoring information should be disclosed to regulators and the public. It is not possible to determine if the goal of net benefits has been achieved if offset implementation is not monitored adequately. Given the low level of offset effectiveness measured globally and the high level of scientific uncertainty around offset methods (see Section 1), adaptation is likely to be necessary. Approval conditions are limited if they do not explicitly require adequate monitoring and adaptive implementation.

5. Recommendations

Designing and assessing marine offsets in the GBRWHA can be greatly improved by applying the principles described in Section 2 with a few adaptations for the GBRWHA context, as described below.

Principle 1. Mitigation hierarchy

To improve the assessment and approval process, several steps need to be completed in correct order (Figure 3-2). First and foremost, the mitigation hierarchy must be followed during the environmental impact assessment. Proponents should clearly articulate how they followed the mitigation hierarchy, and identify distinctly the overall impacts, impacts after avoidance strategies, impacts after mitigation strategies, and finally the residual impacts to be considered for offsets. Proponents should be required to disaggregate the steps of the mitigation hierarchy to make it easier to assess if they are using the mitigation hierarchy and consistent with the intent of the EPBC Act.

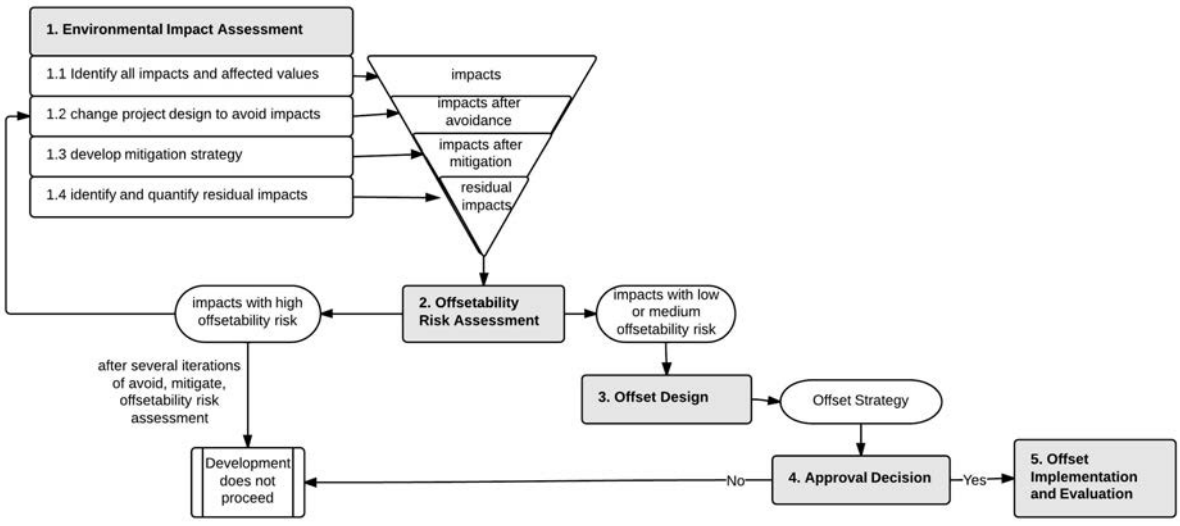


Figure 3-2. Effective offsets require several processes to be completed correctly and in sequence: 1. environmental impact assessment, 2. offsetability risk assessment, 3. offset design, 4. approval decision, and 5. implementation and evaluation.

Principle 2. Offsetability

Instead of proceeding directly from environmental impact assessment to offset design, as is current practice (see Section 4), we recommend inserting another process step herein called the offsetability risk assessment. The risk assessment would provide an additional screen to prevent offsets from being used when they are not appropriate. The risk assessment for offsetability incorporates seven components (Table 4): condition of the affected value, global abundance, regional abundance, scale of the impact compared to natural variability, vulnerability of the value to impacts other than those of the proposed development, resilience of the affected value, and community dependence on the affected value (BBOP, 2012`, adapted here for the Great Barrier Reef).

The risk of each component cannot be summed; rather Table 4 produces a risk profile to inform decision-making. If a residual impact is rated as high risk, the proponent should revisit avoidance and mitigation strategies (Figure 3-2). There may be additional ways to alter the residual impact in a way that would reduce offsetability risk to medium or low. If the offsetability risk is still high after one or more further iterations of avoidance and mitigation, then the development should not proceed. Allowing developments with residual impacts that are not being avoided and mitigated, and have a high risk of not being offset, is counter to the principles of the EPBC Act and the intent of offsets. Only impacts with low or medium-level offsetability risk should be considered for offset design (Figure 3-2).

Note that Table 4 presents one option for assessing risk that combines likelihood and consequence into a simplified matrix that is easier to implement. The output is a risk profile to be interpreted by managers. The risk assessment could be expanded to disassociate likelihood and consequence.

Table 3-4. Offsetability risk assessment adapted to the GBRWHA

	Low Risk	Medium Risk	High Risk
Condition of value at project site	Value is already reduced or degraded	Value is in moderate condition	Value is in good to very good condition
Affected proportion of abundance or geographic extent in the GBRWHA	<1% within GBRWHA	1-10% within GBRWHA	>10% within GBRWHA
Global abundance or geographic extent	Value is globally abundant and/or present across a very large geographic extent	Value is abundant in multiple geographic regions	Value is endemic to or only remains in the impact site
Scale of impact on value compared to normal variation	Predicted residual impact to value is negligible compared to range of normal inter-annual variability in abundance or extent	Predicted residual impact to value is on the same scale as normal inter-annual variability in abundance or extent	Predicted residual impact to value is greater than normal inter-annual variability in abundance or extent

Vulnerability of value to impacts other than the proposed development, across the wider Asia-Pacific region	Value is not threatened or known to be declining in the Asia-Pacific region	It is uncertain if the value is threatened or declining in the Asia-Pacific region and/or evidence exists that the value may soon be threatened, endangered, or declining in the Asia-Pacific region	Value is threatened or known to be declining in the Asia-Pacific region
Resilience of value (both resistance to impact and ability to recover after impact)	Value exhibits high resilience	Resilience is unknown or variable	Value exhibits low resilience
Community and cultural dependence on value	Affected people have low levels of dependence on the ecosystem goods and services underpinned by the value. Access to ecosystem services is not a critical factor in determining livelihoods of affected communities	People are affected variably (e.g., some individuals in the community are highly dependent on the value, while many others are not)	The level of affected people's dependence on the associated ecosystem goods and services is very high (e.g., a local community relies on these services to meet their basic and fundamental needs); the value is of very high social or cultural significance

Principle 3. Net benefits

We recommend that the goal of offsets in the GBRWHA should be to achieve additional net benefits, measured against the counterfactual baseline, as defined in Figure 3-1B. In addition, for the GBRWHA, offsets should be required for all affected values, not just biodiversity. Due to the World Heritage designation of the Great Barrier Reef, Australia has an international mandate to protect and manage all values comprising the Outstanding Universal Value. These include social, cultural, and heritage values, so offsets for these are also required. If and how net benefits might be achieved for non-biodiversity values is a critical gap for research and implementation.

Principle 4: Third-party implementation

The benefit of GBRMPA-implemented offsets is that GBRMPA employs arguably the best experts on management of and impacts on the values of the marine park, and GBRMPA could be able to most effectively identify effective offset activities. But, as noted previously, implementation of offsets by a government agency introduces the risk of regulatory capture. Therefore, we recommend that offsets in the GBRWHA are designed and implemented by specialist third-party entities.

The establishment of third-party offset providers minimises the risk of regulatory capture by disconnecting the permitting process from offset revenues. Moreover, multiple third-party implementers can be advantageous by motivating healthy competition to produce cost-effective ecological outcomes. Government agencies are able to maintain the role of oversight, reducing the risk of regulatory capture but still allowing the expertise and strategic priorities of agencies to be incorporated into offset planning.

In Australia, precedent exists for establishing a conservation bank in New South Wales (Curnow & Fitz-Gerald, 2006). While the political and administrative context for mitigation banking is being developed in Queensland, a payment-for-service scheme for Great Barrier Reef marine offsets could test the effectiveness of third-party implementation. In this scenario, interested third parties could develop offset strategies and

accept, with approval by the Department of the Environment and GBRMPA, payments to implement those strategies.

Principle 5: Direct and specific action

The focus on direct offsets, as opposed to research, is consistent with international best practice (BBOP, 2013). It can be argued that the Great Barrier Reef is one of the best-understood marine systems on earth, which does not support the exception to the 90% rule in the Policy regarding "poorly understood ecosystems." However, issues surrounding the ambiguous definition of "direct" still exist. To overcome this, we recommend that the activities involved in marine offsets could be selected based on a risk assessment approach that examines eight key elements of a successful offset (Table 3-5, adapted from BBOP 2012 for the Great Barrier Reef context). As with Table 3-4, risk cannot be summed across components, but experts and proponents can use the information from this analysis to prioritise potential offsets based on their profile of risk ratings.

Table 3-5. Risk assessment to identify offset activities likely to be successful

	Low Risk	Medium Risk	High Risk
Specificity	Proposed offset specifically addresses the affected value[1]	Proposed offset addresses other parts of the ecosystem that will indirectly benefit the affected value[2]	Proposed offset does not address the affected value[3]
Legality	Proposed offset is legally allowable and does not require any changes to law, policy, or government procedures	Implementation of proposed offset requires a legal change that is unquestionably supported by government	Implementation of proposed offset requires a legal change but support for this change is unknown or not unanimous
Methods	Methods are peer-reviewed and/or proven to be feasible and effective	Methods are peer-reviewed and likely to be feasible and effective	Methods are untested and effectiveness unknown or known to be ineffective in other contexts
Quantifiable benefits	Net conservation benefits can be quantified	Net conservation benefits can be quantified through a proxy or index[4]	Net conservation benefits cannot be quantified

Measurement, evaluation, and adaptive management	Plans to measure and evaluate net conservation benefits, and adaptively manage the proposed offset are detailed and funded	Plans to measure and evaluate net conservation benefits are detailed but not yet funded	No plausible plans to measure and evaluate net conservation benefits or adaptively manage the proposed offset
Interval between impact and net benefit	Very short or no interval between impact and net benefit	Short interval between impact and net benefit	Moderate to long interval between impact and net benefit
Stakeholder support	Affected stakeholders support the project and proposed offset	Affected stakeholders are indifferent or divided, but support can be gained through demonstrating meaningful benefits	Affected stakeholders are opposed to the proposed offset

Notes: 1. For example, the impact is disturbance of seagrass meadows and the proposed offset is seagrass restoration. 2. For example, the impact is disturbance of seagrass meadows and the proposed offset is decreasing sediment loads in the catchment. 3. For example, the impact is disturbance of seagrass meadows and the proposed offset is restoration of hard corals. 4. For example, measuring suspended sediments might be used as a proxy for seagrass recovery.

Principle 6: Strategic sites

We recommend that offsets from multiple development approvals are consolidated onto strategic implementation sites, rather than implemented on or near the impact sites, with few exceptions. These sites could be integrated into existing regional planning and zoning considerations, both marine and terrestrial, to maximise the potential for holistic ecosystem restoration and management. These sites should be in areas that have experienced or are likely to experience some impacts, and therefore could benefit from offset activities, but are not impacted past the point of realistic recovery. These sites should not be adjacent to development sites or other sources of chronic impacts. Sites should be legally protected to secure net benefits in perpetuity.

Principle 7: Temporal strategy

We recommend that the commencement of offsets is connected to the permit approval date, not construction start, and that provisions are made for net benefits to be maintained in perpetuity.

Principle 8: Financial liability

We recommend that a fully-costed offset strategy is required of proponents prior to development approval, and that the costs to achieve and maintain net benefits into perpetuity, including the costs to monitor and adapt, are the basis of the financial liability required by the approval conditions.

Principle 9. Monitoring and adaptation

Isolating the efficacy of offsets from the myriad of other influences on each value, both negative from other anthropogenic impacts and positive from other conservation actions, is difficult and requires well-designed, peer-reviewed monitoring metrics. While regional monitoring is ongoing, offset monitoring should be complementary (so that results can be compared or combined) but separate. Public reporting of offset

monitoring could lead to greater transparency and credibility.

6. Conclusion

Globally, effective offsets are elusive due to poor policies, planning, and evaluation. Marine offsets present additional challenges due to hydrological connectivity and limited legal protections of marine offset sites. The Great Barrier Reef represents a good case study to examine how effective marine offsets could and should be applied. The Great Barrier Reef is globally significant for both biodiversity and heritage values, but these values are under threat due to increasing coastal development. Offsets could be an important mechanism to reduce the social and environmental externalities of coastal development in the Great Barrier Reef and fund improvement in the condition of marine biodiversity and ecosystem services, but as currently applied, offsets fall well short of these potentials.

Current approaches to Great Barrier Reef offsets are not likely to produce net benefits, but are likely to increase the risk of regulatory capture by government agencies, allow trivial payments from proponents to be made in exchange for extensive environmental damage, and draw the focus away from maintaining the Outstanding Universal Value of the Great Barrier Reef by allowing proponents to claim erroneously that they are producing net benefits. These problems arise because current offset approaches are not specific, direct, additional, or accurately costed, and because approval of developments pre-empts the formulation of effective offsets, thereby making them not only unattainable but, in fact, unnecessary.

To improve the effectiveness of marine offsets for the Great Barrier Reef, we recommend:

1. Proponents be required to follow and document their adherence to the mitigation hierarchy, which considers offsets only as a last resort after avoidance and mitigation,
2. Proponents and regulators consider the risk of offsetability prior to offset design,
3. The Australian governments require offsets to achieve additional, measurable net benefits, relative to the counterfactual baseline, for all affected values (biodiversity and other World Heritage values)
4. Specialist third parties design and implement marine offsets,

5. Offsets are direct and specific to the affected values, with very minimal investment into research,
6. Offsets are consolidated into strategic implementation sites, with long-term legal protection, that are consistent with the zoning of the Great Barrier Reef Marine Park and adjacent coastal land uses,
7. The time between impact and net benefit should be minimised, and net benefits should be maintained in perpetuity,
8. Proponents pay the full cost of offset implementation, monitoring and evaluation, and cost is agreed upon before the development is approved, and
9. Monitoring of the efficacy of offsets is separate to but coordinated with regional monitoring programs for ecosystem health, and monitoring data are made publicly available.

Lastly, and underlying all recommendations above, improved planning of regional development could help avoid impacts to Matters of National Environmental Significance and the need for offsets. Within this context, and with careful and rigorous methods as described herein, offsets can contribute to maintaining the Outstanding Universal Value of the multiple-use GBRWHA.

Chapter 4. Great Barrier Reef Loan Fund: can concessionary debt financing of agribusinesses help to achieve water quality targets?

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Highlights

* Agriculture remains the largest source of pollutants in the Great Barrier Reef

* Some changes to on-farm practices can produce both profits and improved water quality

* We use interviews to investigate the feasibility and design of a loan fund

* Results indicate cross-sector support for the piloting of a private loan fund

* Loans may be one of many tools to incentivise water quality improvements

Abstract

Agriculture remains the largest source of water pollutants in the Great Barrier Reef World Heritage Area. Even though Queensland agribusinesses have been actively engaged in environmental stewardship for decades, and political support and funding for improving water quality are at a historic high, funding is inadequate to achieve and maintain ecologically-significant water quality targets. A portion of government grant funding is currently being used for activities that are likely to have a private monetary benefit, and an

opportunity exists to create a revolving environmental loan mechanism. We used semi-structured in-person interviews with investors, government, industry, and scientists to explore the feasibility and potential design of a proposed Reef Rescue Loan Fund. Results indicate that concessionary loans could be offered to incentivise agribusinesses to transition from "code of practice" to "best practice," resulting in improved farm profitability, investor profits, and land management changes that are modelled to produce improvements in water quality. There appears to be cross-sector support for this loan concept, and a loan fund model is proposed herein. Further work, however, is required to understand how to mitigate for climate change impacts on farm income, to develop ways of measuring the environmental benefits of the loans, and how to target a pilot loan program. Loans could be one new tool in the larger toolbox necessary to improve water quality for the Great Barrier Reef World Heritage Area.

Keywords

Economic incentives, sustainable agriculture, Great Barrier Reef, marine conservation finance, water quality, pollution, payments for ecosystem services, debt

1. Introduction

Agriculture is the economic "backbone and social fabric" of regional North and Central Queensland (State of Queensland 2014). Agribusinesses have been actively engaged in environmental stewardship for decades (ABS, 2013; J. Brodie et al., 2013; J. E. Brodie et al., 2012; Kirkegaard, 2012), yet agriculture remains the largest source of water pollutants in the Great Barrier Reef World Heritage Area (J. E. Brodie et al., 2012; Devlin & Schaffelke, 2012; P. Thorburn, 2013; P. J. Thorburn, Wilkinson, & Silburn, 2013). The condition and resilience of the Great Barrier Reef are still declining and agricultural pollution is one of several major causes (GBRMPA, 2014). Nutrients, sediments, and pesticides (including herbicides) that run off agricultural properties into Great Barrier Reef catchments are the main pollutants of concern, and the main contributors of these pollutants are farming for beef, sugar, and horticulture (Waterhouse, Brodie, Lewis, & Mitchell, 2012).

Management of the Great Barrier Reef was historically focused on the Reef itself, particularly through fisheries and tourism. Significant management of agricultural pollution did not begin until the 'Reef Rescue Programme' in 2008 (Brodie & Waterhouse, 2012). In 2009, the Queensland Government introduced load reduction targets for sediment, nutrients, and herbicides, aiming to reduce by 2018 the discharge of sediment by 20% by 2020, nutrients by 50%, and herbicides by 50%. Between 2009 and 2013, $375 million AUD was spent on research, grants, and partnerships to promote progress towards these targets. The Australian government committed similar amounts for 2013-2018 to achieve revised water quality targets under a new program the 'Reef Programme.' In May 2015, the Queensland Government created the 'Great Barrier Reef Water Science Taskforce' and the Australian Government announced plans to invest Reef Trust funds into water quality improvements.

These government initiatives focused on providing information and grant funding to landowners to incentivise changes in agricultural land practices. The "ABCD Framework" is used to report the relationship between agricultural land practices and water quality impacts for the Great Barrier Reef (Queensland, 2013b). On-farm practices have been rated as A, B, C, or D class according to the framework in Table 4-1 for

sugar (Evans 2010), horticulture (Wallace 2010), beef (DEEDI 2011), and grains (DEEDI 2011).

Table 4-1. ABCD framework for on-farm water quality practices in Queensland, Australia

Class	Description	Industry standard	Effect on natural resource condition	Effect on private profitability
A	Aspirational practices	Acceptable practice for the long term	Likely to achieve long-term resource condition goals if widely adopted	Improves profitability in medium to long terms, but currently untested.
B	Best management practices	Acceptable practice for the medium term	Likely to achieve medium-term resource condition goals if widely adopted	Improves profitability in the short to medium terms
C	Code of practice	Acceptable practice today	Unlikely to achieve acceptable resource condition goals	Decline of or stable profitability in the medium to long terms
D	Degrading practices	Unacceptable practice today	Likely to degrade resource condition	Decline of profitability in the short to medium terms

Government initiatives and other actions have reduced agricultural pollutants entering the Great Barrier Reef (Queensland, 2013a, 2014), but these reductions have not met the required targets and are currently insufficient for GBR waters to meet current GBR Marine Park Authority water quality guidelines and load reduction targets for each catchment(Brodie, Lewis, Wooldridge, Bainbridge, & Waterhouse, 2014; GBRMPA, 2010). Reasons for not meeting the targets include: low adoption rates of land practice change (partly because more financial incentives are needed) and insufficient government funding. Each of these limitations is discussed below.

First, adoption rates for land practice changes are below 50% (Queensland, 2013a, 2014; Rolfe & Gregg, 2015). In most instances, these water quality improvement programs assume that land managers are motivated by profit, leading to schemes that offer financial (dis)incentives or seek to prove that practice changes will raise profits; but profits are not the sole driver of on-farm conservation activities. Rural landowner adoption of environmental management practices depends on both the characteristics of the person (values, attitudes, beliefs, goals, motivation for farming) and the characteristics of the practice (costs, benefits, risks, difficulty; R. Greiner & Gregg, 2011; Romy Greiner & Stanley, 2013; Leviston, Price, & Bates, 2011; Moon, Marshall, & Cocklin, 2012; Pannell et al., 2006). Socio-cultural and environmental values are crucially important to northern land managers (Stoeckl et al., 2015) and residents of the GBR catchment (Larson, Stoeckl, Farr, & Esparon, 2015). While farmers are motivated by enlightened self-interest (Campin, Barraket, & Luke, 2013), stewardship and conservation values (Maybery, Crase, & Gullifer, 2005) and lifestyle aspirations (Greiner & Gregg, 2011; Lankester, 2012), they are almost always affected by financial restrictions (Greiner & Stanley, 2013). Farmers are more likely to adopt changes when they can see a financial advantage (Cary & Roberts, 2011; Pannell et al., 2006). Financial incentives have been used in Australia to encourage better nutrient and pesticide management (Greiner & Stanley, 2013; Moon & Cocklin, 2011; Whitten, Reeson, Windle, & Rolfe, 2013), but the lack of diverse and comprehensive financial incentives is cited as a major barrier to adoption (Whitten et al 2013, Herr et al 2004, Lockie and Rockloff 2005, and Janchowski-Hartley et al 2012, Rolfe and Gregg 2015).

Land managers who are primarily driven by financial (dis)incentives may not have a primary goal of maximising profit. Instead, they may wish to minimise cost and/or risk (Asseng, McIntosh, Wang, & Khimashia, 2012; Monjardino, McBeath, Brennan, & Llewellyn, 2013), or maintain flexibility (Romy Greiner, 2015). This may help explain why payments for on-farm conservation initiatives do not always 93 generate addionality (Wunder, 2007) since they may simply provide payment for those who were predisposed to undertake the activity anyway, and this suggests that the profit incentive used in current programs is unlikely to appeal to all land managers. Hence it is important to consider instruments that work to reduce costs and/or uncertainty to supplement programs that increase revenues. A loan fund is such an

instrument.

Second, despite recent political announcements and funding commitments, government funding for reducing agricultural pollution falls significantly short of the estimated $800 million AUD needed every five years to achieve ecologically relevant water quality targets. Government funding would need to be increased and sustained for the extended period required to achieve ecologically significant water quality targets (Waterhouse, Brodie, Audas, & Lewis, 2015). This finance gap – in terms of the size of funding, the duration of funding, and the reliance on a single source of funding - creates the significant risk that conservation and human well-being targets will not be met or sustained, despite the strong science and partnerships (Bos et al., 2015).

Government grants can currently be accessed for some land practice changes that, through economic modeling, are predicted to return private financial benefits (Star et al., 2013b; van Grieken, Lynam, Coggan, Whitten, & Kroon, 2013). This situation presents the opportunity to use loans, instead of grants, to incentivise adoption of some land practice changes. Limited grant funding could then be more efficiently focused on land changes with little to no private financial benefit in the short term.

Environmental loan funds (one type of revolving loan fund) are market-based instruments with "significant potential" to contribute to marine conservation finance (Bos et al., 2015; Lennox, 2012). Typically, these funds provide loans at below-market ('concessionary' or 'subsidised') interest rates for the purpose of incentivising behavior changes that are likely to result in improved environmental outcomes. The repayment of loans allows for new loans to be offered, theoretically "recycling" the capital indefinitely. Environmental loan funds have been used to achieve various environmental goals including restoring degraded lands, improving drinking water quality, increasing energy efficiency, and fisheries finance (Maiorano & Savan, 2015; Pontius, 1994).

One example of an environmental loan fund developed to improve environmental outcomes from agriculture is Conservation International's Verde Ventures Fund. This fund provided concessionary loans to

farmers in Central and Southern America to achieve environmental improvements. As of 2013, this fund has invested $23 million USD, generating $7 million in profits for investors alongside environmental and social improvements (e.g. reduced pollution and improvements in community well-being).

In Australia, environmental loan funds have been used to incentivise clean energy improvements (Australian Government, 2012; Hyland, 2013; Kortt & Dollery, 2012). Government-backed revolving loan funds for agribusinesses, although with goals other than environmental improvement, demonstrate the potential for adaptation to Reef water quality. In response to industry demand, the Australian Government launched a federal farm finance program in July 2013 that provides concessional loans to farmers for drought relief at a subsidised interest rate of 4.34%. The $420 million AUD federal program is administered at the state level, with $30 million AUD allocated for Queensland in 2014-2015. The Queensland government also provides concessional loans to farmers to improve "sustainability" and "productivity." However, in this program, 'sustainability' refers to the economic sustainability of agricultural properties, not environmental sustainability, and the loans are primarily used to purchase livestock, infrastructure, and equipment.

This paper investigates the potential to develop a concessional environmental loan fund that incentivises agribusinesses to adopt on-farm water quality practices, herein referred to as the Reef Rescue Loan Fund (RRLF). We explore stakeholder demand for a RRLF, feasible criteria and structures for a RRLF, and challenges to its design and implementation. A literature review (Section 2) was used to develop four key research questions, which were then investigated through in-person semi-structured interviews with key stakeholder representatives (Section 3). Results are presented and discussed in Section 4, followed by a proposed RRLF model (Section 5), and conclusions (Section 6).

2. Background

This research began with a review of several literatures including catchment water quality, agricultural economics, and environmental management in the Great Barrier Reef World Heritage Area. The literature

review was used to shape four main research questions, given in the following section, which were answered using a combination of literature research and in-person, semi-structured interviews with stakeholder representatives.

Stakeholder engagement is critical to effective natural resource management interventions (Gray, Shwom, & Jordan, 2012; Larson et al., 2015; Reed, Hubacek, & Prell, 2009; M. S. Reed et al., 2009; Star et al., 2013a; Waterhouse et al., 2012), and in particular, the design of marine conservation finance mechanisms (Bos et al., 2015). The literature review helped to identify five key types of people with influence on the feasibility and design of a RRLF: 1) the Queensland agricultural industry, 2) investors, 3) natural resource management groups and non-governmental organisations (NRMs & NGOs), 4) governments (federal and state), and 5) scientists with research expertise in water quality and agriculture (Butler et al., 2013; Larson, 2009; Larson et al., 2015; Star et al., 2013a; Stoeckl et al., 2014; Stoeckl et al., 2011; Waterhouse et al., 2012).

3. Interviews

Table 4-2 summarises the number and affiliation of interviewees. Participants were initially recruited via professional networks by identifying representatives of the five key stakeholder groups who had at least ten years of relevant experience. Experience was identified by job title, publications, contract experience, and/or professional referee. Investors are a closed group with difficult access, due to their general desire to limit unsolicited requests for investments. The other four stakeholder groups are not closed but are small due to the specific, necessary expertise. For these reasons, snowball sampling - which is appropriate for identifying individuals of small, closed networks (Goodman 1961) – was used to recruit additional participants. At the end of an interview, the participant was asked to nominate other appropriate participants. These participants were then contacted and asked to participate. The process stopped when no new potential participants were identified.

Table 4-2. Number and affiliation of interviewees

	# Individuals
Investors	17
Government	18
NRM & conservation NGO	11
Queensland agricultural industry	22
Water quality and agricultural scientists	10
Total	78

Each interview began with an informal conversational introduction to build rapport and trust, followed by a structured set of questions, and ending with time to pursue subjects of interest that surfaced during the structured questioning (Patton 2002). Four research questions were asked to each participant (research questions listed below). For each question, background and context were provided, followed by the specific question, and then five to fifteen minutes of directed conversation on the topic. The semi-structured interviews were used to generate data interactively between the first author and the interviewee (Kvale 1996).

Interviews were conducted between October 2013 and April 2015. Most interviews were conducted in person in Queensland, Australia. A few interviews with investors were conducted in person in New South Wales, Australia. Interview notes were electronically typed during the interviews. Notes were later analyzed for emergent themes and patterns (Patton 2002) to answer each of the four research questions, presented next.

Research question 1: What are the incentives and challenges for participation in a RRLF? This question

concerned the demand by stakeholders for a RRLF. The literature revealed historical and theoretical reasons why these stakeholder groups may or may not support a RRLF, and the motivations and concerns were further explored during the interviews.

Research question 2: Who is the most trusted entity to manage a RRLF? Loan funds can be managed by governments, private financial institutions, non-profit organisations, or boards with mixed stakeholder representation. It is important to investigate which entity is most trusted to manage a RRLF for several reasons: trust is critical to the success of financial incentives (Gray et al., 2012; Jack, Kousky, & Sims, 2008); the Great Barrier Reef literature discusses ongoing concerns about trust between agribusiness and governments (Cary & Roberts, 2011; Rolfe & Gregg, 2015); and mistrust of government is a key barrier to adoption of land practice changes (Herr et al 2004, Greiner et al 2009, Greiner and Gregg 2011).

Research question 3: What are feasible methods for determining eligibility for agribusinesses to access a RRLF? The third research question identified what cases are most appropriate for loans, and how to pragmatically design a fund to efficiently select for those cases. Because **"**substantial variations in drivers of adoption exist across landholders, enterprises, and practices [,] … a suite of financial incentives and policy mechanisms are needed, not just one broad policy" (Rolfe and Gregg 2015). There is spatial heterogeneity in the economic costs and benefits of ABCD practices (Thorburn et al., 2013), so loans are not suitable for every landowner or every practice change.

Research question 4: What environmental metrics should be monitored, and by whom? The fourth research question investigated how to measure the environmental success of a RRLF. Monitoring for changes in water quality in a way that can attribute changes to on-farm practices is complicated, expensive, and sometimes involves a significant time-lag (Carroll et al., 2012b; Schaffelke, Carleton, Skuza, Zagorskis, & Furnas, 2012; Shaw et al., 2010). To understand if a RRLF is producing positive impacts (Ferraro 2009) that are 'additional' to the counterfactual situation of no intervention (Bennett, 2010; Horowitz & Just, 2013; Drew & Drew, 2010), careful selection of metrics is required.

4. Results and Discussion

4.1 Incentives and challenges for participation

Research question 1. What are the incentives and challenges for participation in a RRLF?

The reasons and incentives (in black) and the challenges and concerns (in red) expressed by interviewees from four sectors are illustrated in Figure 4-1 and discussed by theme thereafter.

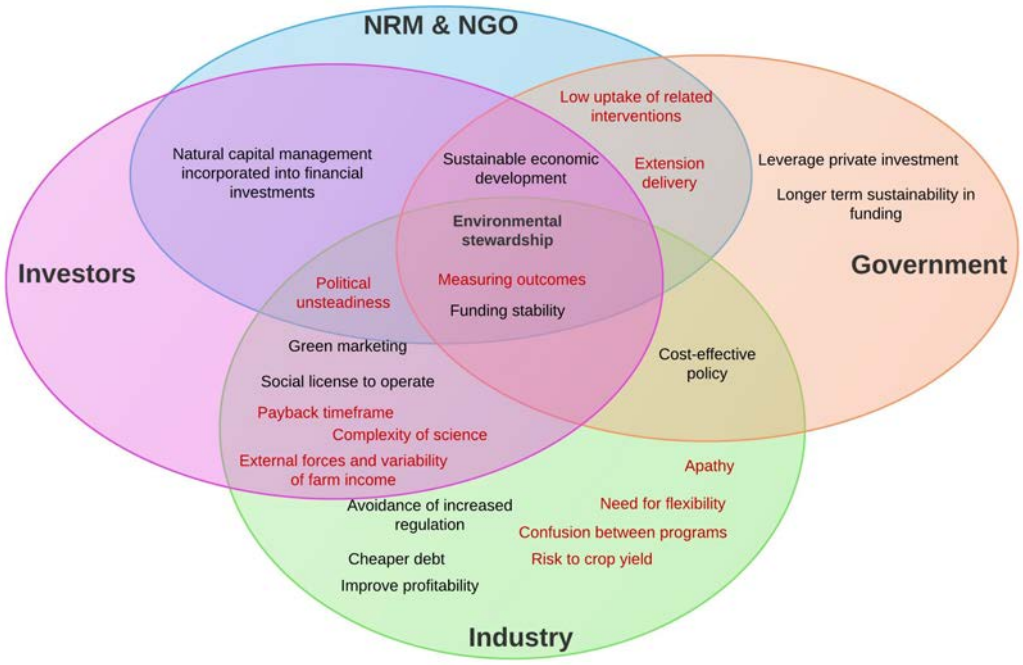

Figure 4-1. Reasons and incentives (black) and challenges and concerns (red) for participation in a RRLF, from interviewees by sector.

4.1.1 Reasons and Incentives for Participation in a RRLF

Environmental Stewardship and Sustainable Development

Four sectors agreed that environmental stewardship and funding stability were two important factors that

would motivate involvement. This is consistent with the literature, which indicates that stewardship values and financial considerations are important factors for adoption of mechanisms (Maybery et al 2005, Greiner & Gregg 2011, Rolfe and Gregg 2015). For industry, corporate social responsibility – which can simply be defined as doing good and avoiding bad (Lin-Hi & Müller, 2013) – can be at the core or on the periphery of company mission and strategies, varying widely between companies (Aguinis & Glavas, 2013). Motivations for social responsibility include enlightened self-interest, cultural norms, and strategic positioning of businesses (Ricks & Peters, 2013).

Investors, NRMs & NGOs, and government expressed views that a loan program could help progress society towards idealised sustainable economic development where "the needs of industry and the needs of the environment find balance." Notably, this sentiment was not articulated by industry interviewees, and is not mentioned in the literature as a significant incentive for adoption by industry.

Investors and industry both shared the desire to engage in a loan program to improve "green marketing" and "social license to operate." The need to gain a social license to operate – or community acceptance and support for a private business – is particularly relevant now for the banking industry in Queensland due to the active "divestment" campaigns of several non-profit organisations who are encouraging the public to boycott banks based on the environmental damage of their investments. Interviewees who represented banks in Australia indicated that their institutions are increasingly considering environmental criteria in investment decisions. One interviewee spoke about increasing "community appreciation" of their business activities, and others described it as "adding value" to their products. This is consistent with the environmental stewardship drivers of adoption described in the literature (Maybery et al 2005, Greiner & Gregg 2011, Rolfe and Gregg 2015).

Investors and NRMs & NGOs agreed that they would be motivated by the incorporation of natural capital into investment decisions, which could reduce long-term financial exposure and risks. When a business damages natural capital, it exposes the business and investors to the potential liability to pay for that damage, but accounting for natural capital in investment decisions helps to avoid damage and thereby

reduce financial risks (UNEP, 2011). While some interviewees discussed this matter in a very theoretical way indicating that loans "should" lower risks, other interviewees indicated that risk reduction was "real and measurable" in time frames that affect market decisions.

Avoiding big government

Avoidance of increased government regulation was expressed as a motivating factor by some, but not all, industry interviewees. This is the same motivation behind industry engagement in many other sustainable agriculture interventions, and it is based on the perception that successful voluntary programs will negate the need for "command-and-control" government involvement in the agricultural industry.

Government interviewees considered that a loan program was desirable because it has the potential to leverage new non-governmental capital into the Great Barrier Reef. A loan program could help both diversify revenue and increase the total amount of capital available to achieve environmental outcomes for the Reef.

Reducing debt burden

Most industry interviewees agreed that access to cheaper debt would be attractive to agribusinesses, provided that the interest rate was significantly below current market rates of approximately 4-5% for a payback period of 3-5 years (one interviewee mentioned that the rate should be no higher than 2-3% with a payback period of 7-10 years in order for the loans to be attractive to businesses.) From the literature, we know that agribusinesses have large debts, high and increasing interest costs, and are asking for interest rate subsidies.

Rural debt in Australia is at $60 billion AUD (ABARES, 2013) and has sharply increased over the last 15 years while net value of farm production has remained stagnant (Matthews, 2013; Rees, 2012). The food market in Australia is highly competitive, and agribusinesses face pressures including ongoing market

consolidation and the increasing costs of inputs (Spencer & Kneebone, 2012). The northern Australia beef industry is particularly under pressure and unprofitable (Romy Greiner & Stanley, 2013). More than one-third of agribusinesses are seeking debt or equity, which is significantly higher than the all-industry average of 11% (ABS, 2012). The average debt for large farms (excluding dairy farms, for which debt is higher) is $476,000 AUD (ABARES, 2013). The interest component of farm costs rose 72% from 2005 to 2011 (Rees, 2012). Industry interviewees mentioned that engagement in a loan program might improve profitability, and this would motivate their involvement.

Increasing return on investment

Investors expressed the view that the potential for profits from environmental investments was a positive motivator for them. While acknowledging that the profits may be less than "traditional" investments because of the subsidy, many investors spoke about a loan program being more profitable than charity or donations. These responses are consistent with the literature that documents changes to philanthropy, with investors looking for new ways to improve the world around them while maintaining capital (Arrillaga-Andreessen, 2011; Bos, Pascal, Pressey, Stoeckl, & Lowe, in prep). The financial return on investment for grants is negative; a neutral or slightly positive financial return on investment from a loan mechanism is a financial improvement for conservation grant-makers. The terms "philanthrocapitalism" and "venture philanthropy" describe the desire of philanthropists to act more like investors and get the biggest return (social, environmental) per dollar invested (Bishop, 2013; Bishop & Green, 2009; Schumpeter, 2013). While philanthropy in Australia is much smaller than in the United States, Australia is still one of most philanthropic countries in the world (Commonwealth of Australia, 2014): 87% of adult Australians give charitable donations (Commonwealth of Australia, 2005), and experts predict the role of philanthropy in Australia to grow and produce new combinations of private and public dollars to achieve social goods.

4.1.2 Challenges to and Concerns about Participation in a RRLF

Metrics and Monitoring

At the centre of Figure 4-1, the common concern shared by all sectors was measuring environmental outcomes of the loan program, most commonly expressed as concerns that the temporal and geographic scales of environmental monitoring might not align with the scales of short-term, on-farm practice changes. Section 4.4 gives more discussion on metrics and monitoring.

Trust in Government

Three sectors (investors, NRMs & NGOs, and industry) shared a common concern about government involvement in a loan program, pointing to "political unsteadiness" or erratic and premature changes to government programs once established. These sectors recognised the need for a loan program to be stable and continuing over timeframes that are meaningful to agribusinesses, over periods of approximately 8-15 years. Government interviewees expressed awareness that other sectors had this concern. A component of the "political unsteadiness" was expressed as governments "swinging back and forth" between a tough regulatory environment and a more voluntary system of changes to practice. Industry interviewees expressed concern about the government being involved in a voluntary program and then later using industry information against the industry during a stronger regulatory period, and this concern was echoed by investors and NRMs & NGOs. These sentiments were consistent with the literature that reports ongoing problems with trust between agribusiness and governments in the Great Barrier Reef region (Cary & Roberts, 2011; Rolfe & Gregg, 2015).

Adoption Rates and Extension

NRMs & NGOs and government interviewees agreed on two concerns: a history of low adoption rates of other sustainable agriculture interventions, and the difficulty of providing adequate extension to accompany a loan program. These two concerns are inter-related. Most interviewees agreed that more extension is needed to increase adoption rates of sustainable agriculture programs, but that extension alone is not enough. Interviewees mentioned their perceptions that low uptake is a result of inadequate

consultation during the design of interventions, overly complex or onerous application processes, the lack of access to internet and electronic application processes by some agribusinesses, and the lack of time and/or interest by some agribusinesses in understanding how interventions could benefit them.

Investors and industry also had common concerns including the timeframe for investment returns ("would the loan period be long enough to realise both environmental and financial returns?"), complexity of the science, and external forces affecting the variability of farm income (most notably drought and other climate-related factors – discussed later in Section 6).

Concerns expressed by industry interviewees included: 1) apathy in some, but not all, agribusinesses; 2) the need for a high level of flexibility because each agribusiness experiences different needs and challenges; 3) some, but not all, agribusinesses would be confused by the introduction of a "new" intervention when so many other interventions exist, and 4) some water quality practices may increase the risk of failing to achieve a desirable crop yield. These concerns were generally expressed to influence the detailed design of the loan program, rather than opposing the piloting of a loan program.

Overall, interviewees expressed keen interest and desire to engage in the design of a loan program, along with some caution about getting the details of the design right. Several interviewees ended conversations by saying "the devil is in the detail" and similar phrases.

4.2 Loan Management Entity

Research Question 2: Who is the most trusted entity to manage a RRLF?

Interviewees were asked to discuss options for which entity should manage the loan program. Four options were proposed during the interview process (columns of Table 4-3: 1) government, 2) NRMs, 3) a new third party, and 4) an existing commercial financial institution. Entries in the rows of Table 4-3 concerning eligibility options will be discussed in Section 4.3.

Table 4-3. Eligibility and Entity Options for a RRLF. Note: "BMP" = Best Management Practice and "WQIP" = Water Quality Improvement Plan.

		Entity Options	Government	NRM	New Third Party	Financial Institution
		Advantages	political will to support innovation in water quality finance	network and capacity to support industry and coordinate between sectors	trust, coordination of diverse capacities	risk retained by private entity, high capacity for due diligence and fiscal management, client base
		Disadvantages	lack of trust by agribusiness industry, difficult for governments to receive repayments, risky if default and have to collect security	NRMs do not have financial management structure or capacity, financial risks too high, risky if default and have to collect security	new infrastructure needed	lack of capacity in water quality science, potential equity issues for agribusiness access, potentially harder to attract subsidy
Eligibility options	**Advantages**	**Disadvantages**				
Land condition change (C to B)	Strong science and engagement around ABCD framework	Many properties have mixed ratings, some revisions to ABCD necessary, property is held as security which is risky if default	**not feasible** (lack of trust and financial risk)	**not feasible** (financial risk)	**not feasible** (property used as security, too risky for government-affiliated third party to repossess farms)	**feasible**

Adopt voluntary BMPs	Strong science and engagement around best management practices	voluntary uptake has been low to date and reasons not completely understood yet, property is held as security which is risky if default	**not feasible** (lack of trust and financial risk)	**not feasible** (financial risk)	**not feasible** (property used as security, too risky for government-affiliated third party to repossess farms)	**feasible**
Purchase equipment	In cases of default only equipment is confiscated not entire property, easier to model risk and return	Not very successful under grant incentive program, many necessary practice changes not related to new equipment	**not feasible** (lack of trust and financial risk)	**not feasible** (financial risk)	**feasible**	**feasible**
Practices in WQIP that are modeled to show profit and environmental benefits	Higher certainty that practice will lead to improved profitability and environmental outcomes	Restricts agribusiness to use capital only for very specific purpose, when capital may be needed for other pressing needs	**not feasible** (lack of trust and financial risk)	**not feasible** (financial risk)	**feasible**	**feasible**
Agribusinesses proposes property-specific plan	Flexibility for agribusinesses to innovate and manage relative to context of the site	Very expensive due diligence as each application needs to be individually assessed	**not feasible** (lack of trust and financial risk)	**not feasible** (financial risk)	**not feasible** (expensive due diligence)	**feasible**

4.2.1 Government

The Australian and Queensland governments currently have a relatively high level of political will to support innovations in funding for water quality outcomes. A loan program could fit within the scope of the Commonwealth's Reef Trust, Reef Plan, and/or the Queensland Government's 2015 announcement of $100 million dollars committed to improved water quality outcomes. Governments could also have the advantage that a loan program is more likely to provide equitable access for agribusinesses.

The disadvantages of a government body managing this loan program, however, outweigh the potential opportunities. Almost all agribusiness industry interviewees said that they would not trust government to manage a loan program. As mentioned above in Section 4.1, industry is concerned that governments will misuse sensitive commercial information for regulatory or compliance purposes. In addition, the relevant government agencies are currently not structured to receive loan re-payments and it would be very difficult to create a suitable structure for doing so. If loans were secured with farms, it would be even more difficult. It would be politically infeasible for a government to repossess an agricultural property if the borrower defaulted, especially if it was a small family-run property. Lastly, a few interviewees mentioned that the mandate for governments to be equitable might be a disadvantage because the resources could be spread too thin to effect meaningful change and/or the agribusinesses that need the most support might not get enough support. Because of the first three disadvantages listed above, it does not appear feasible for a government agency to manage the loan fund.

4.2.2 NRM

The second entity option is NRMs. In Queensland, regional NRM bodies receive state funding and play a vital role in connecting communities and governments for on-the-ground conservation. NRMs have the advantage of an existing infrastructure and network that could easily coordinate between industry, scientists, government, and investors (Dale et al., 2013). While it appears from interviewee responses that NRMs do have significantly greater trust from industry than governments, NRMs share many of the

disadvantages that governments have. NRMs are not currently structured to give loans or receive repayments, and it would be politically infeasible for NRMs to repossess agricultural properties during defaults. Several NRM interviewees said that the financial risks involved in managing a loan program were too high for NRMs. For these reasons, it does not appear feasible for NRMs to manage the loan fund.

4.2.3 Third Party

Another entity option is a third party, similar to the Verde Ventures model described in Section 2 which uses an NGO to manage the loan fund. This entity would have a decision-making board that includes agribusiness industry, NRM, governments, scientists, and investors. The advantages of utilising a third party entity are the potential for a high level of trust from all sectors, and the ability to coordinate diverse interests and capacities through an un-biased platform. A third-party could more easily establish financial management infrastructure than governments or NRMs. The disadvantage of a third-party entity is that time and money would be needed to create and sustain a new entity, unless an existing suitable entity was found. This option appears to be feasible and should be investigated further, including analysis of building on the Queensland Rural Adjustment Authority loan program.

4.2.4 Commercial Financial Institution

The fourth entity option is an existing commercial financial institution. Interviewees mentioned three key advantages of this option: 1) all financial risk is retained by a private entity with the capacity and liability insurance to manage that risk; 2) financial institutions have a very high capacity for due diligence and financial management, and 3) financial institutions have long-term relationships with agribusiness clients and therefore have some ability to educate clients on the loan program and to utilise data and knowledge about their clients to make low-risk investment decisions. Three key disadvantages were raised: 1) financial institutions have low capacity to understand technical water quality issues and practices, 2) there are potential equity issues if private firms do not allow equal access to all agribusinesses, 3) it may be more difficult for a commercial financial institution (than a third party entity) to attract government subsidy capital

because governments often assume that commercial financial institutions should not have access to public funds.

These disadvantages could be mitigated through partnerships and planning. For example, a bank could contract water quality expertise. One interviewee suggested that if several commercial financial institutions offered loan products, then perhaps an unaffiliated broker (similar to a mortgage broker) could help connect agribusinesses to loan providers. Another interviewee mentioned that governments could partner with commercial financial institutions through a model similar to the Queensland's Drought Recovery Concessional Loans. This option appears to be feasible and requires further investigation.

4.2.5 Feasible loan management entities

From the analysis above, it appears that it is not feasible for governments to manage the loan fund due to both the lack of trust of agribusiness industry and the risk involved if loan defaults involve agricultural property repossession. NRMs do not have the financial management structure or capacity to manage the loan fund, and it appears that the financial risks are too high for NRMs to be willing to manage the loan fund. Commercial financial institutions may be able to manage the loan fund because they can overcome the trust and financial risk barriers. A new or existing third-party entity could also manage the loan fund, including but not limited to an NGO entity, depending on the loan eligibility criteria, which are discussed next.

4.3 Loan Eligibility

Research Question 3: What are feasible methods for determining eligibility for agribusinesses to access a RRLF?

Interviewees were asked to discuss options for determining eligibility of agribusinesses to access a loan program. Five options were proposed by interviewees (rows of Table 4-3): 1) improving land condition from

C to B within the ABCD framework, 2) the adoption of voluntary Best Management Practices, 3) purchasing equipment that will lead to improved water efficiencies and/or pesticide application, 4) implementing on-farm water quality practices from Water Quality Improvement Plans that have undergone economic modeling to show commercial value and environmental benefits, and 5) agribusinesses proposing property-specific investment plans.

4.3.1 ABCD Framework Transition C to B

Within the ABCD framework, the transition from D to C practices requires compliance management to bring most agribusinesses to the community and industry standards (see Figure 4-2). The transition from B to A practices is costly because aspirational practices are not yet validated and require testing (Queensland, 2013b). In the middle of the framework, transitioning from C to B practices, should theoretically lead to improved private profits.

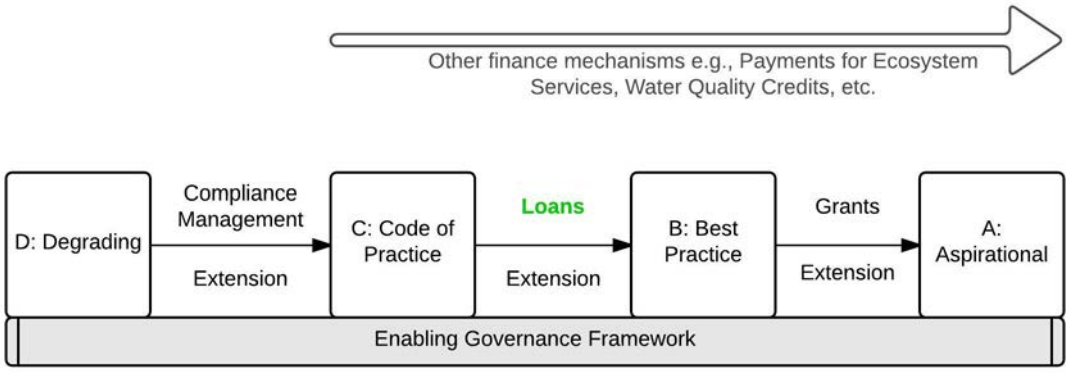

Figure 4-2. Potential for loans to be used within the ABCD framework. The transition from C to B practices is likely to produce private profits, and thus might be amenable to loan financing.

Interviewees generally concurred that the ABCD framework has strong scientific and stakeholder support and acceptance across sectors. Two disadvantages were discussed by interviewees. First, many agricultural properties have a mix of land condition ratings; some parts of a property could be in A, for example, and others in D. This would make it complex to assess eligibility. Second, if land condition change is the eligibility criterion, then the security for the loan is most likely to be the property itself. If a business

defaulted on the loan, the creditor would have to repossess the property, and this is politically infeasible for the government or a third-party who is closely associated with the government. Therefore this eligibility option appears to be only feasible for a commercial financial institution to manage, with adequate risk management strategies for repossession.

4.3.2 Voluntary Best Management Practices

The second eligibility option is using loans to further incentivise the adoption of voluntary Best Management Practices. There are two voluntary, industry-led programs for Best Management Practices in the region – 'Smartcane BMP' and 'Grazing BMP.' These programs allow agribusinesses to self-assess their current practices and learn about practices that are at or above industry standards. The advantage of this option is a strong scientific foundation to the Best Management Practices system. The disadvantage is that it is unknown to what extent financial incentives would improve adoption rates of voluntary Best Management Practices programs, which is consistent with the literature reviewed above. One of the interviewees mentioned that the industry body Canegrowers commissioned interviews to investigate low uptake rates of voluntary programs, but that the results are not publicly available. A second disadvantage, like that of option 1, is that agricultural properties would need to be held as securities for the loans. This option appears to be feasible only for commercial financial institutions to manage, with adequate risk management strategies for repossession.

4.3.3 Equipment Purchase

The third eligibility option is that loans could be used to purchase equipment that is likely to improve water efficiencies on the property, decrease rates of application of fertilisers and herbicides, and/or decrease the run-off of fertilisers and herbicides. For example, hooded sprayers or auto-steer tractors can be used to avoid double application of chemicals. The advantages of this option are that the potential environmental benefits are easier to model and predict. Further, because the piece of equipment can be used as the security for the loan, there is no risk of a farm being repossessed. However the disadvantages of this option are that: 1)

many important water quality practice changes do not involve the purchase of new equipment, and would therefore miss out on incentives under a loan program, and 2) equipment purchased under the Reef Rescue water quality incentive grants did not result in the predicted environmental benefits, possibly due to inadequate training on how to use the equipment (according to government and NRM interviewees). If this eligibility option is used, adequate extension and capacity building would be essential to success. This option appears to be feasible for a new third party or a commercial financial institution, with adequate extension.

4.3.4 Water Quality Improvement Plans

The fourth eligibility option is that loans could be made available for specific water quality improvement practices that are listed within Water Quality Improvement Plans as likely to produce both commercial and environmental benefits. For example, one industry representative discussed his experience with sub-surface application of fertiliser to be both environmentally and financially beneficial. This option has the advantage of higher certainty that the loans will be repaid and environmental benefits achieved, relative to options 1, 2, or 5, based on expert economic modeling. The disadvantage is that agribusinesses would be restricted to use the capital for a very prescribed purpose that may not allow enough flexibility to the business operator to adapt to business needs and external influences (e.g., drought, see Section 5.2). This option appears to be feasible for a new third party or a commercial financial institution, with adequate provision for flexibility as needed.

4.3.5 Property Plans

The fifth option is for agribusinesses to propose property-specific investment strategies and conduct their own modeling to predict the financial and environmental returns. This option provides the greatest degree of flexibility for agribusinesses to innovate and manage their properties relative to the specific contexts of the sites. This option is most aligned with the Australian Government's policy on agriculture: "to achieve a better return at the farm gate…it is farmers who need to make business decisions that will make them

profitable and competitive. The Government's role is to set the right policy environment to support this outcome for farmers and across industries, not to make business decisions for farmers who are far better placed to do so" (Commonwealth of Australia 2014).

However, this option would be very expensive for both agribusinesses and investors. Small agribusinesses are not likely to have the capacity or capital to develop property-specific investment strategies, supported by water quality monitoring. However, some of the larger conglomerates may have this capacity. The due diligence on the part of the loan management entity would be very expensive for this option, because every application would have to be individually assessed. This expense is likely to be too much for a third party loan fund, but may be considered by a commercial financial institution working with their larger clients.

4.3.6. Eligibility option feasibility

Based on the above analysis, it appears that Options 3 and 4 – equipment purchase and practices designed for Water Quality Improvement Plans – could be feasible for either a third-party entity or a commercial financial institution. Options 1, 2, and 5 – land condition change, voluntary Best Management Practice programs, or property plans – could be feasible for commercial financial institutions.

4.4 Metrics and Monitoring

Research Question 4: what environmental metrics should be monitored, and by whom?

For a RRLF to contribute towards water quality targets in the region, it must incentivise land practice changes that result in measurable improvements for nutrients, sediments, and/or pesticides, above and beyond counterfactual improvements (what would have happened without the RRLF). The effectiveness of a RRLF as an incentive could be measured using surveys to agribusinesses. Measuring water quality improvements at the appropriate geographic and temporal scales, however, is more difficult (Carroll et al., 2012b; Schaffelke et al., 2012; Shaw et al., 2010).

Interviewees generally agreed that measuring changes to water quality parameters at the farm scale is not feasible in the "next several years" due to the expense, technical capacity, and need for consistent and long-term sampling. The expense could negate financial incentives and advantages of a RRLF. Some interviewees (cross-sector) considered that this limitation could halt the development of a RRLF. In addition, the highly variable weather and rainfall patterns across the GBR catchment make detecting trends in reduced pollutant loads at any scale very difficult over a short (a few years) period.

On the other hand, many interviewees offered the idea of monitoring practice changes (e.g., change in rates of fertiliser application) and using modeling to estimate the resultant changes to environmental metrics. This approach is consistent with the methods used currently to assess water quality performance of changed management practices from grants under Reef Rescue and the Reef Programme and the same as is planned for prediction of management performance under Water Quality Improvement Plans. Industry interviewees discussed the opportunity to monitor practice changes in conjunction with existing annual audits of agricultural properties. Institutions that finance agribusinesses normally conduct annual audits of agricultural practices as conditions of loans. A large auditing firm is contracted by most commercial financial institutions to conduct these audits, and fees are paid to the auditing firm. It might be possible for additional criteria to be added to existing audits for a fee. The criteria could assess whether the agribusiness is adhering to the practice change conditions of the loans.

Several scientists mentioned that modeling of predicted environmental improvements could be conducted in conjunction with the *eReefs* Program, a collaboration between the Great Barrier Reef Foundation and five branches of government, which is synthesising environmental water quality data for the Great Barrier Reef and modeling predicted changes in environmental parameters given management change scenarios. However eReefs is primarily a marine modelling tool currently and is not being used at the paddock scale. The paddock scale models currently being used to assess management performance with regard to water quality such as APSIM, HowLeaky and GRASP (Carroll et al., 2012a; Keating et al., 2003) may be appropriate for assessing environmental outcomes of an RRLF investment.

4.5 Additional Considerations for Design of a RRLF

During the unstructured phase of the interviews, respondents raised three key considerations for the design of an RRLF: 1. agribusiness heterogeneity, 2. climate change and drought, and 3. the agricultural supply chain.

4.5.1 Agribusiness Heterogeneity

A common theme that emerged during the interviews is the heterogeneity of Queensland agribusiness - in terms of commodity, size, and intention – and how this heterogeneity might affect the design, implementation, and uptake of a RRLF. The three most prevalent agricultural commodities in Queensland are sugar, beef, and horticulture. Interviewees concurred that sugar - compared to the other commodities - has a shorter production cycle, requires more equipment (which offers opportunities for equipment improvements and finance), and offers more opportunities for directly connecting practice changes to downstream water quality impacts, particularly in relation to nutrient pollution. In beef production, fine sediment is the biggest pollutant of concern, and practice changes to reduce erosion and hence fine sediment loss may require long time horizons (i.e., 25 years; Brodie et al. 2012a). An interviewee said that horticulture is increasingly becoming technology intensive, so there may be opportunities to finance new technologies with improved environmental outcomes. However, the consensus appeared to be that a RRLF focused on sugar would be more successful in achieving improved water quality targets on the scale of the Great Barrier Reef, than if focused on grazing or horticulture.

Two other components of heterogeneity are the size and intention of the agribusiness. Three categories of agribusiness emerged from the interviews. First are large corporate farms, second are small to medium enterprises, and third are hobby farms. The large corporate farms are solely driven by profit, may have higher environmental capacity amongst their staff, but may be less needy of financial assistance and therefore less incentivised by concessional loans. The small to medium enterprises are solely dependent on

farm income and may be the most in need of financial assistance, and therefore most motivated by the incentive of a low interest rate, but may not have much time or knowledge for water quality issues. Hobby farms tend to be less dependent on farm income because they have non-farm income. Because the motivation for hobby farms is about lifestyle, not profits, they may be the least motivated by financial assistance. Some interviewees mentioned that hobby farms are less engaged in current water quality meetings and incentive programs than other types of agribusiness.

Interviewees often discussed the changing demographics of farming in Queensland, specifically the transition away from small farms towards larger corporate farms (Lawrence & Gray, 2000; Pritchard, Burch, & Lawrence, 2007) and the ageing of family farm managers (Smailes, Griffin, & Argent, 2014). Many interviewees saw opportunities for water quality improvements from this transition because larger farms will mean: 1) fewer points of contact for extension work, 2) increased capacity for environmental outcomes, and 3) a generally younger and more educated workforce. Banks expressed preference for the "more sophisticated" producers because it lowers the risk of default, and the "appetite" for financing loans under the $1 million benchmark is "falling."

Based on these considerations, the RRLF could be piloted in the small to medium enterprises in the sugar industry. This target population may be most likely to have economic data on water quality practice changes, greatest need to access farm finance, and greatest need for improved capacity for environmental outcomes. This research project did not solicit enough information on a geographic prioritisation of a pilot program, and this is a question for further research.

4.5.2 Climate change, drought, and farm income variability

Climate change and drought are significantly impacting farm productivity cycles (Anwar, Liu, Macadam, & Kelly, 2013; Calzadilla et al., 2013; Sanderson & Ahmadi-Esfahani, 2011; Smailes et al., 2014; Suryaprakash, 2011) and, according to interviewees, making it increasingly difficult for agribusinesses to repay traditional loans. To receive a loan from a commercial financial institution, an agribusiness must have

a drought strategy (per interviewees from investment sector), but according to at least one investor who was interviewed, drought strategies are being "overwhelmed" because of the worsening of droughts associated with climate change. The Queensland Government's "Drought Recovery Concessional Loans Scheme" was developed to aid agribusinesses whose drought strategies have not succeeded.

While climate variables are outside of the control of agribusiness, they need to be considered in the design of RRLF products. At least one researcher advocates for the use of income-contingent loans instead of concessionary loans. The repayment of income-contingent loans is tied to farm income, so if a farm does not make a profit one year because of a drought, then it does not have to repay the loan that year (L. Botterill, 2000; L. C. Botterill, 2013). Income-contingent loans for a RRLF may be a potential solution for designing a RRLF in the context of climate change, and this requires further investigation.

4.5.3 Agricultural supply chain

Interviewees across sectors discussed possibilities for expanding the RRLF to consider investment opportunities across the agricultural supply chain – including wholesalers, retailers, exporters, and marketers. The government's past and current agricultural water quality interventions have been "behind the farm gate" and there may be untapped potentials for economically efficient environmental changes in other parts of the supply chain. For example, sugar cane mills are a key component of the supply chain and could be a target market for environmental finance contingent on purchasing contracts that stipulate environmental conditions on suppliers. As another example, several interviewees said that contractors should be allowed access to a financial incentive program like a RRLF. Agribusinesses often use contractors to do farming activities such as applying fertiliser. Providing incentives to contractors could reach several agricultural properties at the same time, and help contractors overcome hurdles in achieving economies of scale for purchasing more efficient equipment.

A third example is providing economic incentives to support practice changes for marketers of agricultural products. There is momentum towards "green and clean" agricultural market segmentation in North

Queensland (Commonwealth of Australia, 2015), but according to interviewees, market differentiation has not happened in sugar because it is a bulk-sold commodity. One interviewee expressed the opinion that Australian consumers assume that produce is safe and environmentally-friendly by default, and are therefore less willing to pay premium prices than consumers in Europe or Asia, but that perhaps there is an opportunity to improve the marketing of premium agricultural exports.

5. RRLF Model

There appears to be broad cross-sector support for the creation of a RRLF and several feasible options for RRLF design. Figure 4-3 conceptualises a potential model for RRLF based on the results and considerations above, and articulates proposed key roles for each participating sector.

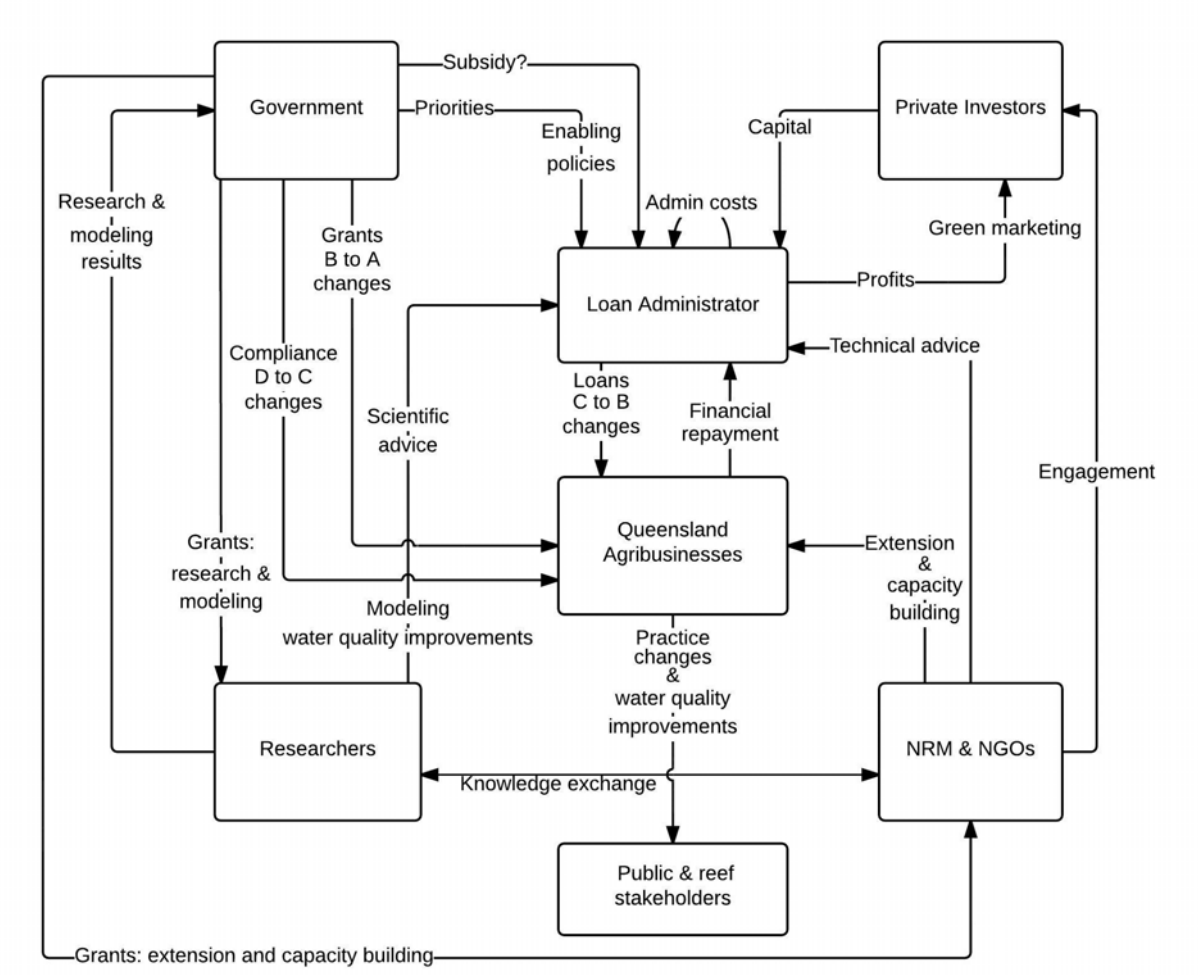

Figure 4-3. Conceptual model of a RRLF showing partners (boxes), roles, and flows of

funds (arrows with text).

The loan management entity ('loan administrator'), whether it is a new third-party loan fund or a commercial financial institution (Section 4.2), could use private capital to offer concessional loans to Queensland agribusinesses. By way of example, this model illustrates eligibility option 1 – land use change from C to B – but could be modified for other feasible eligibility options (Section 4.3).

Even though governments are not feasible as loan fund managers, government still has important roles to play in an RRLF. Government could provide subsidy capital to incentivise the creation of an RRLF. Enabling policies by governments are important to the infrastructure of an environmental loan fund; for example, if government policy provides grants for economically viable practice changes, incentives to take up a concessionary loan program will be negligible. If, instead, government policy focuses government grants for B to A transitions, and compliance management of D to C transitions, private capital could be effectively engaged in C to B transitions (see Figure 4-2). Government could continue to offer grants to researchers for water quality research and modeling of environmental outcomes, and grants to NRMs and NGOs for extension and capacity building to agribusinesses.

NRMs & NGOs are also not appropriate for managing the loan fund but could maintain important roles including capacity building and training for agribusinesses, technical advice to the loan administrator, and engagement of the private sector to identify and access foundational capital.

Researchers could provide modeling results and scientific advice to the loan administrator. Queensland agribusinesses would receive loans, provide repayments to the loan administrator, and then through practice changes, provide water quality improvements for the public and reef stakeholders.

6. Conclusions

Improving the quality of water leaving agricultural properties and entering the Great Barrier Reef is vitally

important to ensure the long-term protection of this national and global icon. Engagement of the agricultural industry to date has resulted in a solid foundation of partnerships, data, and motivation, but current funding models and economic incentives are not sufficient to meet the geographic and temporal scale of the challenges. Economic incentives must target farmers with high conservation ethics (R. Greiner & Gregg, 2011), be combined with programs to raise awareness about the incentives (Meadows, Emtage, & Herbohn, 2014), have low administrative burden (Blackmore & Doole, 2013), and present low risks for farmers (Jellinek, Parris, Driscoll, & Dwyer, 2013).

Because policy mechanisms that include financial incentives "remain important" for capital and transformation costs, but not recurrent costs (Rolfe & Gregg, 2015), a RRLF could be one of several tools to incentivise a transition towards a more sustainable agricultural industry, in conjunction with grants, extension and capacity building, and potential future payments for ecosystem services.

An opportunity exists to create an environmental loan product that provides concessionary loans to agribusinesses that adhere to practice changes and that, through scientific modeling, are predicted to result in measurable improvements in the water quality entering the Great Barrier Reef. There appears to be keen interest across sectors to refine a model loan fund that provides an additional economic incentive to achieve water quality targets. There are several shared concerns across sectors about the details of this hypothetical loan fund that require further investigation, including monitoring of environmental benefits, the optimal geography and target audience to pilot these ideas, and the need to position any new products within the suite of existing water quality incentives without confusing farmers. Due to perceived risks of land practice changes, agribusinesses are more likely to adopt changes if they can trial the changes first with mitigated risks (Pannell et al., 2006), and therefore the RRLF concept should be piloted before region-wide implementation.

In the words of one anonymous interviewee, "No doubt some farmers would make changes with these loans, but it's probably a small percentage of all farmers." Clear articulation of who is most likely to benefit from these loans, and how to provide them with adequate extension, will be very important for success.

This analysis revealed that several variants of loan fund structure are feasible, but all require strong partnerships between government, private investors, industry, and researchers. As one interviewee put it, "money is enabling…but it is all about relationships and people." The proposed model loan fund presented herein could be one tool in the toolbox to achieve long-term regional improvements in water quality for the Great Barrier Reef.

6. Acknowledgements

We would like to acknowledge funding support from the NESP Great Barrier Reef Water Quality Hub and advice and "Science for Management Award" funding from the Great Barrier Reef Marine Park Authority.

Chapter 5. Marine Impact Investments: Opportunities and Challenges

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1. **Introduction**

Globally, the economic costs of human degradation of nature vastly outweigh investments into biodiversity and environmental management, resulting in a conservation finance gap of approximately $7 trillion USD every year and growing (Bos et al., 2015; Parker & Cranford, 2010). Businesses play a large role in environmental degradation by impacting natural capital without accounting for the economic values of the natural capital (TEEB, 2013).

The earth is a "blue planet" because over two-thirds of its surface is covered by oceans. Marine resources are vitally important to human populations. The global oceans contribute to human wellbeing by providing marine ecosystem services including food, income, cultural services, recreation, carbon storage, and storm protection (Baskett & Halpern, 2009; Börger et al., 2014; Lau, 2013; Palumbi et al., 2009; Rashid et al., 2005; Werner et al., 2014). The ability of the oceans to continue providing these essential ecosystem services is in jeopardy due to anthropogenic impacts that include climate change, fishing pressures, coastal development, land-based pollution, and recreation (Doney et al., 2012; Halpern et al., 2012; Halpern et al., 2008; Worm et al., 2006).

There are numerous approaches and tools being used to address these challenges, including but not limited to marine protected areas (MPAs), marine and climate policy, sustainable or green development, and fisheries management (Halpern, 2014; Norse et al., 2005; Pikitch et al., 2004; Ray & McCormick-Ray, 2014; Roff et al., 2011). Herein we use the inclusive term 'marine conservation initiatives' to refer to all initiatives for management, restoration, and sustainable use of marine resources. Marine conservation initiatives are widespread globally, involving almost every country on earth (e.g., CI, 2014; IUCN & UNEP-WCMC, 2013; TNC, 2014; WCS, 2014; WWF, 2014).

While we do not yet know what proportion of the global conservation finance gap is relevant to the marine environment, we do know that marine conservation is: 1) chronically and globally underfunded, and 2) over-reliant on government and philanthropic donations, putting marine ecosystem services and

communities at risk (Bos et al., 2015; Gurney et al., 2014; Lennox, 2012). Government and philanthropic investments in the oceans will always be necessary, but will never be sufficient to close the marine conservation finance gap.

For decades, societies have been working to decrease the impacts of business on the environment, in other words to make businesses "less bad" (Bugg-Levine & Emerson, 2011). For example, the fields of sustainable development, corporate social responsibility, and environmental policy have developed in order to regulate and incentivise businesses to reduce their environmental "footprints" (Freemen 1984). However the paradigm of making businesses "less bad" results in a continual race between environmental degradation and mitigation, and despite monumental conservation and environmental management efforts, it appears that the environment is losing the race.

There is an alternate paradigm to consider: business models could theoretically be used to generate profitable, net positive environmental outcomes. The concept that economy and ecology can be mutually beneficial has roots in the 1970s (Braat & de Groot, 2012) and evolved to include discussions about sustainable development in the 1980s (WCED 1987). In the 1990s, the term "triple-bottom-line" (economic, ecological, and social; Elkington 1997) became a popular way to describe businesses that aimed for more than just financial profits. Economists term this "utility maximisation" where utility can include economic, environmental, and social targets (Ervin et al 2012). This blurring of the lines between natural, financial, and social capital is termed "blended value" (Emerson 2000) or "value plurality" (Barman, 2015).

The latest iteration of this concept is "impact investments," which have been defined by the Global Impact Investing Network as "investments made into companies, organisations, and funds with the intention to generate social and environmental impact alongside financial return." In this definition and in this paper, the term "impact" refers to positive impacts or benefits, for example, cleaner water, more jobs, and protected species. Unlike corporate social responsibility and socially responsible investing that try to be "less bad," impact investing is differentiated by the "intention" to produce net positive environmental or social outcomes (Brest & Born, 2013; Bugg-Levine & Emerson, 2011; O'Donohue et al., 2010).

The impact investing industry is still in its infancy, but growing rapidly (Brest & Born, 2013; Green, 2016; Mair & Milligan, 2012; Nee, 2013; O'Donohue et al., 2010; Salamon, 2014). The industry is expected to reach $500 billion dollars by 2019 (Monitor Institute 2009). Some experts are claiming that "impact investing is emerging as its own discipline," distinct from other types of philanthropy and business (Bugg-Levine & Emerson, 2011; p. 235). The majority of impact investments target social and health problems such as poverty, water security, malnutrition, and disease in developing countries (Bugg-Levine & Emerson, 2011; O'Donohue et al., 2010). A smaller proportion of impact investments focus on environmental impacts, for example clean energy, and only a handful of impact investments are focused on the marine environment (Bos et al., 2015; CFA, 2014). This paper investigates the question: can impact investing produce marine outcomes through profit-generating business models?

2. Methods

Marine conservation practitioners have been engaging with businesses through a variety of partnerships and mechanisms to both reduce impacts to the marine environment and increase funding (Larsen, 2016). Bos et al (2015) included a brief search for marine impact investments and concluded that there are relatively few investments that have been designed with the intention of producing benefits for the marine environment as well as financial returns, whether or not these are termed 'marine impact investments'; the 2015 study further recommended that a more comprehensive search for marine impact investment examples was needed.

The first step in this research was to comprehensively review these reports and literatures to holistically but succinctly describe all of the essential components of the impact investing industry. Impact investing is a new industry and most of the publications on this field are in the grey literature (Salamon 2014). Publications include books that describe stories of impact investments (e.g., Rodin and Brandenburg 2014)), reports by financial or non-governmental organisations of surveys of impact investors or investments (e.g., GIIN 2014), editorials and case study reports in business magazines (e.g., Stanford Social

Innovation Review), and a handful of peer-reviewed publications scattered across business and sustainable development literatures that make reference to impact investing. These publications were analysed to first identify the major components of the impact investing industry. This step enabled comparison between the necessary components of the impact investing industry and those operating in the marine conservation context (Section 3.3).

The second step was to identify examples of impact investments that had been made with the intention to produce marine conservation outcomes. For this step, the grey and peer-reviewed literatures were reviewed. To separate marine impact investments from other types of marine conservation finance, we used the GIIN definition of impact investments (included above).

The third step was that the first author conducted semi-structured interviews in 2014-2015 with 21 impact investors (12 individuals and 9 foundations) operating in social or environmental philanthropy. The investors were identified through professional networks, peer recommendations, the literature reviews, and attendance at impact investing industry conferences, workshops, and seminars. To be interviewed, the investor had to self-identify as an impact investor who had made at least one impact investment in the last ten years. Investors are a closed group with difficult access, due to their general desire to limit unsolicited requests for investments. For these reason, snowball sampling - which is appropriate for identifying individuals of small, closed networks (Goodman 1961) – was used to recruit additional participants.

Interviews were conducted in person or by telephone, depending on geographical opportunity. Investors were asked ten questions over a period of twenty minutes to one hour. For each question, background and context were provided, followed by the specific question, and then five to fifteen minutes of directed conversation on the topic. The semi-structured interviews were used to generate data interactively between the first author and the interviewee (Kvale 1996). Responses were recorded by the first author and later analysed for examples of marine impact investments and a critical analysis of impact investing industry components relative to the marine conservation context. Due to the sensitive nature of investing, responses have been kept anonymous and will be shared only in aggregate.

3. Results and Discussion

3.1 Impact Investing Industry Critical Components

Figure 5-1 illustrates the critical components of the impact investing industry that were identified through the literature reviews and the investor interviews. Each component will be discussed thereafter.

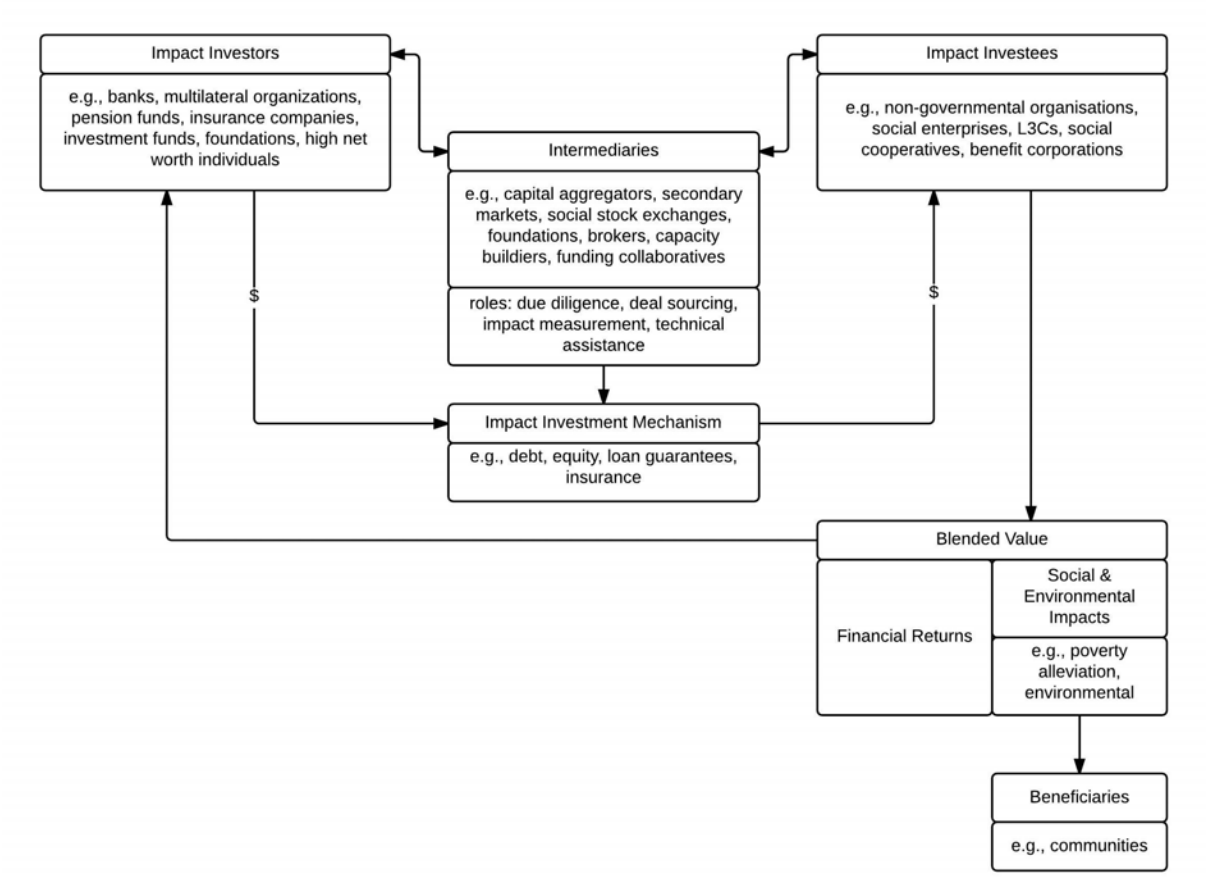

Figure 5-1. Impact Investing Participants, Mechanisms, and Outcomes. The global impact investing industry involves a heterogeneous group of investors making investments to investees to produce blended value, including social and environmental impacts and financial returns, ultimately helping beneficiaries such as communities. Note: "L3C" = A low-profit limited liability company (L3C) is a legal form of business entity in the United States that was created to bridge the gap between non-profit and for-profit investing.

3.1.1 Impact Investors

The first critical component of an impact investment is an "impact investor," the source of the capital. Impact investors are a heterogeneous group and can include philanthropic foundations, multilateral organisations (e.g., World Bank), mainstream financial institutions (i.e., large international banks), high-net-worth individuals, pension funds, insurance companies, and investment funds (Bugg-Levine & Emerson, 2011; Mair & Milligan, 2012; O'Donohue et al., 2010; Salamon, 2014). The shared commonality of impact investors, according to the GIIN definition of impact investing, is that they make the investment with the 'intent' to produce financial returns and social / environmental impacts.

Motivations for investors to make impact investments appear to vary. The literatures document a growing desire amongst philanthropic investors to seek the highest levels of return on investment, sometimes termed 'philanthrocapitalism' and 'venture philanthropy' (Bishop, 2006, 2013; Bishop & Green, 2009; Buckland, Hehenberger, & Hay, 2013; Lorenzi & Hilton, 2011; Schumpeter, 2013). At the same time, there is evidence that investors who have traditionally sought profit-first opportunities are looking for new ways to improve the world around them whilst maintaining capital (Arrillaga-Andreessen, 2011; Salamon, 2014). Corporations that make impact investments may be motivated to make impact investments by similar factors that motivate them to make philanthropic donations: enlightened self-interest, cultural norms, and strategic positioning (Ricks & Peters, 2013). Hence there is a "meeting in the middle" that is occurring from historically different perspectives on investments, a growing desire to maximise profits and purpose at the same time, or as economists would refer to it, an increase in "utility-maximising" behaviours (Ervin et al 2012).

3.1.2 Investees

Those who receive impact investments and produce impacts are known as "impact investees." Most commonly, impact investees are social enterprises, operating as for-profit companies, created for social and/or environmental purposes. One particular type of social enterprise that is gaining popularity in the

United States is a benefit corporation (also called "B-Corp"). Benefit corporations have legal structures that allow them to pursue their missions even if those missions reduce the financial returns to shareholders. Other legal structures for social enterprises include social cooperatives, community interest corporations (United Kingdom), low-profit limited liability companies (L3Cs; United States), and flexible-purpose corporations (United States; Bugg-Levine & Emerson, 2011). Non-profit organisations, although traditionally reliant on grants, can accept some forms of impact investments in some jurisdictions (Rodin and Bruckenburg 2014).

3.1.3 Mechanisms

Impact investments have been made across several "asset classes" (asset class is defined as a category of investments that behave the same way in the marketplace`; Bugg-Levine & Emerson, 2011; O'Donohue et al., 2010; Salamon, 2014), including:

Debt: capital that must be repaid plus interest,

Social Impact Bonds: loans from investors to non-profit organisations that are repaid through government savings

Loan Guarantees: promise to assume debt if borrower defaults,

Equity: purchasing shares in the ownership of a business that are repaid with profits and dividends,

Insurance: contract that obligates one party to compensate for financial losses of another.

As of 2011, 75% of impact investment deals were financed by debt (Saltuk, Bouri, & Leung, 2011) and, in particular, one type of debt - loans - remains "by far the most common" impact investing mechanism because loans are typically fast to mature and least risky (Salamon, 2014, p. 39). Numerous loan funds have been developed around the world to provide concessional (below market-rate) loans to impact investees (Salamon 2014).

One particular type of loan is called a "social impact bond", or "social benefit bond" in Australia. These bonds are long-life loans that are only repaid if social impacts are achieved (SFI, 2012). For example, the

State government of New South Wales in Australia developed an AUD $7 million social benefit bond that provided loans to non-profit organisations working to help "families at risk" from domestic violence, unstable housing, and related social issues. Impact investors provide capital to the non-profit organisations, and investors receive financial returns (at 7.5%) from government, financed by savings in government's social services budget.

Sometimes impact investment loans are made possible through the provision of "loan guarantees" which alter the risk-return ratio by lowering risks (Salamon, 2014). For example, a government could provide a loan guarantee to a bank that wanted to provide loans to impact investees. If the investee defaults, government bears the risk, not the bank. This can incentivise investments into new or untested markets (Rodin and Bruckenburg 2014).

Equity can be used to fund social enterprises that are not ready to re-pay loans. Investors receive dividends instead. A handful of collaborative funding bodies bring impact investors together to hear pitches for social enterprises seeking equity investments. Insurance can be used as an impact investing mechanism in a similar way that loan guarantees operate; companies that want to modify practices to improve social or environmental incomes mitigate the risk of decreased revenue by purchasing specialist insurance (Salamon 2014).

3.1.4 Intermediaries

There are many problems in executing successful impact investment "deals". Consequently, "intermediaries" - organisations that work between investors and investees – are vitally important and almost always used (Bugg-Levine & Emerson, 2011; Richter, 2014; Salamon, 2014). The main four roles of intermediaries appear to be: 1) deal sourcing (identifying potential investments), 2) due diligence (assessing the risks and returns of the potential investments), 3) impact measurement (monitoring and evaluating the social and environmental benefits of an investment), and 4) technical assistance (building capacity of investees and investors) (Bugg-Levine & Emerson, 2011; O'Donohue et al., 2010). Each of these

roles will be discussed in turn.

Deal sourcing for impact investments can be more difficult than for traditional investments for three reasons. First, investment levels tend to be small (less than $1 million) which is below the normal threshold for many investors (O'Donohue et al., 2010). Second, impact investment deals tend to be more complex and require expert knowledge in technical subject areas that most investors do not have the capacity to assess (Bugg-Levine & Emerson, 2011). Third, there are more impact investors than there are 'investible deals', and this inequality is often termed the 'supply side issue' (Bugg-Levine & Emerson, 2011; Richter, 2014). From the perspective of investees, it is very difficult to find the impact investors willing to take risks and invest in high social impact with concessionary financial returns (Nee, 2013). Intermediaries play a crucial 'matchmaking' role to source deals and bring investors and investees together (Brest & Born, 2013).

The complications associated with deal sourcing also significantly raise the costs of due diligence (O'Donohue et al., 2010). Due diligence is necessary to understand the risk-return profiles of potential impact investments, but there is currently no standard way to assess the risks of environmental impact investments (CFA, 2014) and the risk-return parameters of impact investments are often very different than traditional investments (Richter, 2014). Due diligence can be very complex and involve judgments about capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to interest rate (Richter, 2014). Investors often do not have the capacity to conduct due diligence for impact investments, instead calling on contract intermediaries (Salamon, 2014). One type of intermediary – a 'capital aggregator' – reduces due diligence costs and transaction costs through economies of scale, by pooling impact investment monies, sourcing deals, and making impact investments (Richter, 2014).

After deals are sourced and investments made, there is still a need for intermediaries to provide unbiased monitoring, reporting, and benchmarking of results (Brest & Born, 2013; Tuan, 2014). In 2009, the Global Impact Investing Network was launched as an intermediary organisation to address some of these issues. As of October 2013, there are 270 active impact products and 1,300 investors registered with network, making this Network the largest and most geographically diverse intermediary organisation that focuses on impact

investments. There are numerous intermediaries with more limited geographic ranges including community development finance institutions, consultants, and non-profit organisations, e.g., Impact Assets in the United States (Bugg-Levine & Emerson, 2011).

Intermediaries provide technical assistance and capacity building to help bridge market gaps (Richter, 2014). Sometimes the technical assistance is provided by investors along with funding, and sometimes technical assistance is provided by intermediaries through training sessions, workshops, and singular consulting engagements (Tuan, 2014). Technical assistance is often necessary for entities that are expanding from more traditional non-profit programs to innovative for-profit models (Bugg-Levine & Emerson, 2011). Providing technical assistance alongside investment reduces the risk of providing capital to 'inexperienced investees' (Richter, 2014).

3.1.5 Blended Value

Impact investments are designed to produce 'blended value' (Emerson 2000) - the sum of at least two components of value: financial returns and social or environmental impacts.

By definition, impact investments must be designed to create financial returns, but returns range from highly concessionary (below average market rate of return) to above market rate (Brest & Born, 2013; Mair & Milligan, 2012; Nee, 2013). In a survey targeted at impact investors in North America, some investors expected 0-5% return, while others expected upwards of 25%; the study found that investors sacrificed financial returns in developed markets, but were competitive with market rates in emerging markets (O'Donohue et al., 2010). This may be because "developing and low-income countries abound with opportunities to profitably serve social and environmental needs that are unmet by governments and civil-society" (Huppe & Silva, 2013), whereas more developed governments and civil societies fill more of this market gap.

The Global Impact Investing Network developed the Impact Reporting and Investing Standards (IRIS) to

assist investees in monitoring their social and environmental impacts with standard metrics. The adoption of IRIS metrics is voluntary, and although 120 organisations are registered on IRIS and claiming that they use IRIS in some form, there is very little consistency in how the metrics are applied. In a survey of impact investors, only 2% said that they use a third-party to measure impact and many have proprietary methods for measuring impact (O'Donohue et al., 2010) that may or may not use IRIS. Root Capital has social and environmental impact due diligence score cards, but only applicable to agribusiness. The quality and quantity of data on social and environmental impacts of impact investments is insufficient, particularly from developing countries, and this is a barrier to engaging more investors (Huppe & Silva, 2013).

A recent survey of environmental impact investing funds identified that half of the 23 funds use IRIS, but most use IRIS in combination with other metrics because IRIS metrics are not precise or accurate enough to capture environmental benefits (CFA, 2014). If metrics are not consistently applied or adequately correlated to environmental change, then it is very difficult to compare the effectiveness of environmental impact investments and solicit investment.

3.2 Examples of Marine Impact Investments

3.2.1 Entrepreneurial Marine Protected Areas

Entrepreneurial marine protected areas (EMPAs) are marine reserves that are primarily funded by a profit-bearing business model, typically associated with tourism (Colwell 1995, 1997, 1998, Pascal et al., 2014). While over half of terrestrial protected areas have private sector involvement (Dearden, Bennett, & Johnston, 2005), a significantly smaller proportion of MPAs involve the private sector (de Groot & Bush, 2010).

There are a few examples of business models where private capital has been used to fund the designation, development, and management of an EMPA, and tourism profits have been used to repay the investments. Chumbe Island Coral Park Ltd was established in 1991 in Tanzania as arguably the world's first

entrepreneurial MPA and continues to provide ecological, socio-cultural, and economic benefits (Bush, Bottema, Midavaine, & Carter, 2015). Only a few other similar initiatives have been documented, such as Lankayan Island Dive Resort in Sabah, Malaysia (Teh et al., 2008) and Misool Eco-Resort, in Raja Ampat, Indonesia (Gjertsen & Niesten, 2010). In Fiji, an adventure shark diving company called Beqa Adventure Divers was established in 2003 with the intention of funding the establishment and management of a new shark-protection MPA (Brunnschweiler, 2009; Brunnschweiler, Abrantes, & Barnett, 2014; Brunnschweiler & Barnett, 2013; Brunnschweiler & Ward-Paige, 2014). In October 2014 the Fiji shark reserve was granted National Marine Park status.

3.2.2 Fisheries Finance

A second category of investments that could be considered as marine impact investments are in the area of fisheries finance. Fisheries generate more money when they are sustainably managed, but there are numerous costs associated with the transition from unsustainable to sustainable fisheries, and philanthropic and government grants alone are insufficient to fund transition costs (EDF et al., 2014). UNEP (2011) estimated that an investment of $240 billion USD in transition costs would yield $50 billion USD in annual gains from sustainable fisheries. Private impact investments could be used in the short- and medium- terms to achieve self-sustaining fisheries (EDF et al., 2014).

There are several examples around the world of using debt and equity to improve fisheries and return financial profits. Since 2008, the California Fisheries Fund has provided $2.5 million dollars in subsidised loans for "sustainable commercial fishing" businesses on the west coast of the United States. Root Capital, a social impact investor, has provided $6 million USD in subsidised loans to a crab processing company in Mexico to improve the sustainability of that fishery (Ormeno 2013). SeaChange Fund is a private equity firm that invests in "seafood companies that expand the market for environmentally preferable seafood." Oceanis Partners advises investors on how to capitalise on the transition to sustainable seafood and aquaculture.

3.3 Marine Impact Investing Components

This section describes the results of a critical analysis of each component of the impact investing industry (Figure 5-1) relative to the marine conservation context to investigate the potential of developing more marine impact investments. These results are based on both literature synthesis and the impact investor interviews.

3.2.1 Investors

A total of 21 investors were interviewed, including 12 individuals and 9 representatives of foundations. Respondents were located in Asia Pacific (n=9), Americas (n=8), and Europe (n=2; 2 undisclosed locations). All respondents self-identified as impact investors. Annual investment capital ranged from under $50,000 to over $1 million USD. Most respondents had an educational background in finance or business (n=18), and only 2 indicated an educational background in the environment or natural sciences.

Three respondents indicated that they had made a marine impact investment in the past, and 19 indicated that they were interested in making impact investments for marine conservation in the future. Almost all respondents (n=20) indicated that a marine impact investment industry would be limited by the number of "investible" deals, not by the availability of investors or funds, which is consistent with the impact investing industry as a whole according to the literature (Bugg-Levine & Emerson, 2011; Richter, 2014). For example, one respondent said "We are very interested in investing in marine, but we do not know of any projects that are ready."

Foundations noted the particular challenge that their funding is often partitioned into two or more separate pots of money, with very different objectives and investment strategies. The corpus is often invested traditionally to obtain market rate returns, while grant funds are made available for environmental and social benefits and no returns are expected. Impact investments would often fall in between these two partitioned funds and present a challenge to the infrastructure, staffing, and decision-making processes of

the foundation. This finding is consistent with the literature, which notes that many foundations remain "wary" of impact investing (Gose, 2015).

In the EMPA examples (Section 4.2), the impact investors are a heterogeneous group of individuals, foundations, and corporations. Investors in fisheries finance, in contrast, appear to be purpose-built organisations that exclusively focus on impact investing in sustainable fisheries. In light of the interview responses, this could be interpreted as the fisheries sector has more investible deals than marine tourism, but further research would be required to explore this.

3.3.2 Investees

Investors who were interviewed indicated that the capacity of marine conservation practitioners and organisations to accept impact investments was very limited (n=18). The two primary reasons given included: 1) insufficient staff capacity in finance or business and 2) insufficient projects that can produce financial returns. Respondents often described the situation with a mix of hope and frustration: hope that impact investing has the potential to scale-up marine conservation outcomes, yet frustration that investor-ready organisations are few and far between.

In the examples in the literature (Section 4.2), the investees are most often for-profit businesses. In fisheries finance, they tend to be established businesses in the fishing industry who are accepting capital from a new source. The investees range in size from small and local to global. In the EMPA examples, the investees are most often new businesses established for the creation of a new MPA, and are small and site-based. This may partly explain insufficient deal flow in marine tourism.

In the search for existing marine impact investments, we found examples of enterprises that marketed themselves as social enterprises with marine benefits. On closer inspection, however, these examples were found to be: 1) social enterprises with predominately community benefits and potential future marine benefits (e.g., Synergy Reef Sailing Tours, Port Douglas, Australia which permanently closed in 2015) and/

or 2) predominantly grant-funded marine initiatives which are aiming to diversify by adding revenue-generating mechanisms, but did not meet the GIIN definition of impact investments (e.g., Namena Marine Reserve, Fiji).

These findings are consistent with the literature. There are numerous marine non-profit organisations that want to diversify their revenue sources (Bos et al 2015). However, the transition from a grant-funded non-profit organisation to a social enterprise or other impact investment model appears to be extremely difficult. This transition requires major organisational cultural shifts (Gose 2015), changes to board and staff capacities, risk assessments and new insurances, and substantial up-skilling or changes to organisational capacities (Huwyler et al., 2014). The transition also requires significant up-front capital, which is difficult to finance. There are a limited number of grant programs available to help organisations become investor-ready, such as the National Australia Bank's "Impact Investment Readiness Fund." Most often, these sources of transition capital are aimed at individuals, not organisations, which adds to the challenge of developing investor - ready projects at scales that are large enough to tackle marine conservation issues.

We propose that it may be easier to build new marine impact investment structures from scratch rather than retrofit grant-based, non-profit models. The exception may be large non-profits that can attract enough philanthropic capital to fund the development of new finance mechanisms, such as Conservation International's Verde Ventures.

3.3.3 Mechanisms

The examples of existing marine impact investments above have used both debt and equity as mechanisms to create marine outcomes alongside financial returns. EMPAs have employed debt in developing countries, and fisheries finance employs both debt and equity in developed countries (predominately the United States). This is consistent with the impact investing industry as a whole (Saltuk et al 2011; Salamon 2014).

Beyond debt and equity, there appears to be untapped potential to develop novel marine impact

investments. For example, improving water quality that enters marine environments from agricultural areas could be incentivised through a revolving loan fund (Walsh et al in review), and this could be expanded to finance other types of development in the coastal zone with minimal impacts to the marine environment. As another example, a key objective of many marine conservation programs is to raise awareness and educate communities about the marine environment. For-profit marine education models, such as parent-funded after-school programs and vacation care programs, could deliver ocean messages without needing grants.

3.3.4 Intermediation capacity

There does not appear to be sufficient intermediation capacity for marine impact investments across all four necessary components - deal sourcing, due diligence, impact measurement, and technical assistance - and this is a critical limitation to marine impact investing. Survey respondents had little awareness of intermediation organisations specialising in marine impact investments beyond the fisheries finance organisation described in Section 4.2. The critical need for intermediation was mentioned by all but two respondents.

Deal sourcing - identifying deals and "matchmaking" - is sometimes done by investors or specialists asking their professional contacts in conservation non-profit organisations (CFA 2014). Another approach within the marine conservation community is to use business competitions. Fish 2.0 is an example of a business competition that matches impact investors with sustainable seafood businesses. In addition to cash prizes for the winning businesses, the founders estimate that the competition will create $10 million in new investments for sustainable seafood impact investments. Another example is WWF's annual "International Smart Gear Competition" that provides $65,000 in prizes for technological improvements to fishing gear that reduces by-catch (the accidental take of non-targeted marine organisms). A third example is the "Blue Economy Challenge" which seeks on innovative business models involving aquaculture (and as a by-product reduction in wild-caught fish). With potential for marine impact investments beyond fisheries, a new business competition may uncover novel mechanisms that address other threats to the marine environment, such as climate change or invasive species.

Due diligence - analysing the risks and returns of potential investments - is an expensive and time-consuming process (CFA 2014). In fisheries finance, it appears from the examples in Section 4.2 that many of the investor organisations conduct their own due diligence (e.g., Oceanis Partners). This appears to be inconsistent with the literature which states that fisheries finance deals are impaired by a gap in understanding between the investors and the investees: investors may not fully understand fisheries ecology and management, and investees may not fully understand how to analyse risk-return profiles and assemble a business case for investment (EDF et al., 2014). Perhaps, as specialty fisheries finance organisations emerge, this understanding gap is narrowing.

However, outside of fisheries finance, we could only find one example of an organisation that specialises in due diligence for marine impact investments - Althelia Ecosphere - which through their "Oceans Fund" appears to aggregate investors, source deals, and attend to due diligence. Additional organisations that specialise in due diligence for impact investing could theoretically expand to include marine impact investing due diligence, although the barriers to expansion need further investigation.

It appears from the literature described above that impact measurement - monitoring and evaluating social and environmental impacts - is a key limitation to the impact investing industry. However, according to the investors interviewed, it is less limiting than other intermediation needs for marine impact investing at present. Investors stated that, while accurate, transparent, and replicable measurement of environmental impacts are a necessary long term objective, at the nascent stages of marine impact investing, robust qualitative and anecdotal evidence may be sufficient for many investors' needs. As long as financial objectives are met, a "good story" may motivate an investor who has discretion over their impact portfolio. Given that the existing impact measurement protocols - including IRIS and Root Capital's scorecards cited above - are not immediately applicable to marine impact investments, project-specific qualitative and quantitative data may be a necessary substitute until a standardised methodology is developed. This is an area for future research that ideally should be connected to ongoing research in the area of impact measurement for MPAs (R. L. Pressey, 2004; Robert L. Pressey, Visconti, & Ferraro, 2015).

The fourth component of intermediation - technical assistance, or the building capacity of investors and investees to source, implement, and evaluate investments - is critical for marine impact investments. Interviewed investors discussed the large gap in understanding between investors and marine conservation practitioners, and suggested that: 1) philanthropy is used to build knowledge on both sides, 2) ongoing assistance over the lifetime of investments may be necessary and should be budgeted for, and 3) specialists can play an important role in bridging the divide. Consistent with Richter (2014), interviewees advocated for the use of technical assistance to alter the risk-return ratios by lowering risks of default and poor financial decision-making.

3.3.5 Blended Value

Investors described blended value for marine impact investments through some of the following statements:

> "Communities who depend on the oceans for their livelihoods are more resilient"
>
> "Fisheries are more sustainable, providing jobs, income, and security for fishermen"
>
> "Farmers can still be productive while minimising harmful impacts to the waters"
>
> "Investors and communities benefit financially, without destroying the oceans"

In each of these responses, there is an inherent blend of environmental, social, and financial outcomes. This is the idealised triple-bottom line (Elkington 1997). In the examples of marine impact investments in the literature (Section 4.2), the focus was more often on the blending of two values with a third supporting value. In some instances, blended social and environmental values were sought, and financial outcomes were used to support this objective (e.g., Misool Eco-Resort). In other examples, blended environmental and financial objectives were targeted, with social benefits described as an additional benefit (e.g., California Fisheries Fund).

4. Conclusions

Marine impact investments could theoretically both decrease the existing marine conservation finance gap and prevent it from widening in the future. There is insufficient money to fund marine conservation (Bos et al 2015), and impact investments offer the opportunity to generate new private capital and to recycle capital. The blending of values - financial, social, and environmental - offers an alternate paradigm for economic development on our "blue planet." Through literature review and interviews with self-described "impact investors," we found evidence that marine impact investing is a viable approach, yet the scale to which this approach could be applied appears to be limited presently by "investible" deals and intermediation capacity needs. While there are only a limited number of examples of existing marine impact investments, it appears that the potential to develop marine impact investments is strong, particularly in eco-tourism and fisheries. As Rangeley and Davies (2012) noted, while example projects have generated financial returns and produced localised marine benefits, "none have made an impact at the scale required."

Impact capital is available. Necessary additional developments include a business plan competition to uncover new profit-bearing models, property rights adapted to investments, research on how and where to grow and replicate existing models, and the identification of transition capital for non-profits ready to pursue impact capital. Most importantly, we need greater capacity to liaise between the marine conservation realm and the impact investing industry to develop for-profit marine conservation initiatives.

Chapter 6. General Discussion and Conclusions

This thesis investigates strategies and financial mechanisms to reduce the marine conservation finance gap through a multi-scale approach. A novel, comprehensive review and synthesis of relevant literatures articulated the need for and scope of a "new and emerging field" and recommended that all types of business – from profit-maximising to social enterprises – should be engaged to reduce the marine conservation finance gap, but that the tool of engagement was dependent on the intention of the business (Chapter 2). This chapter addressed research gaps 1 and 2 (systematic analysis of the reasons for and solutions to fill the marine conservation funding gap, and how to integrate financial planning into conservation planning).

The research then focused on three detailed examples of mechanisms to engage businesses across a spectrum of intent (Figure1-1). For profit-maximising businesses, this research investigated the more effective design and implementation of marine biodiversity offsets, concluding that offsets can be an important tool for sustainable development of the Great Barrier Reef World Heritage Area with improvements to the full cost accounting of environmental damages, third-party design and implementation of offsets, and strategic selection of offset implementation areas (Chapter 3).

For businesses that intend to voluntarily mitigate some of their environmental damage, a case study of a loan fund mechanism for agribusinesses in the Great Barrier Reef was selected. Through interviews with multiple stakeholder representatives, this research demonstrated that a loan fund is a feasible and desirable mechanism to incentivise improved water quality outcomes through the investment of private, profit-seeking capital (Chapter 4).

For businesses that are designed with the intent to produce net positive environmental outcomes, alongside positive financial returns, this research explored the opportunities and challenges associated with a category of tools called impact investments. The global-scale analysis revealed that opportunities do exist for creating new business ventures that, instead of contributing to the conservation finance gap, could

generate marine benefits and private profits (Chapter 5).

Chapters 3-5 addressed research gap 3 (how marine conservation programmes can engage with businesses to seek private capital), and Chapter 5 also addressed research gap 4 (identification of "investible" marine conservation projects).

6.1 Limitations of Research

This thesis research has fundamental limitations that should be considered when applying, extrapolating, or interpreting the results. First, despite the global reach of two of the four papers, there are no detailed case studies in developing countries. The two site-based case studies were conducted in the Great Barrier Reef, Australia, a developed country with a strong, diversified economy (by global standards) and a robust system of environmental laws and regulations. On one hand, focusing on case studies in a developed country is a strength of the research, given that the majority of environmental and social finance research is focused on emerging countries (O'Donohue et al., 2010; Huppe & Silva, 2013). On the other hand, the case study chapters have limited direct applicability to developing country contexts. Chapter 3, on marine offsets, could be useful in investigating the efficacy of marine offsets in other sites that have coastal development and regulatory offsets for permitted impacts, but may not be particularly useful in contexts where governments do not require permits or offsets for impacts. Although there are corollaries of sustainable agricultural revolving loan funds in developing countries (e.g., Verde Ventures; Chapter 4), the specific recommendations for how to design and implement the reef rescue loan fund are particular to the Australian economy and context and would not be directly extrapolated to other sites.

Second, due to the qualitative nature of the research methods, there are limitations in replicability and objectivity of results (Taylor et al 2015). The analysis of the offset system in Chapter 3, while compared to the literatures and international best practice, may have been influenced by biases in the primary researcher due to professional experiences related to offset assessment and implementation. The interview responses for Chapters 4 and 5 may have been influenced by the amount of trust between the primary

researcher and the subjects, and the responses may have been different if the interviews were conducted by an alternate researcher with more or less trust with the subjects. Furthermore the interview responses for Chapter 4 may have been significantly influenced by the political context at the time the interviews were conducted; the balance between regulation and voluntary action in sustainable agriculture can change relatively quickly and can have effects on industry willingness to engage in best practices.

6.2 Original Contributions and Effectiveness of Research (By Chapter)

This body of research lays the foundation for marine conservation finance research and practice for many years to come. This research is unique because it successfully crossed many boundaries – academic research and applied practice, and economic sciences and natural sciences. There are no other known examples of PhD theses exclusively focused on conservation finance, and this type of work is normally conducted by conservation non-profit organisations (Salamon 2014). It was a difficult and rewarding challenge to bring additional academic rigour and systematic analyses to this topic. Original contributions by chapter are summarised next, followed by a thematic cross-chapter analysis.

Chapter 2

Presented a novel systematic analysis of the global challenges and opportunities for marine conservation finance in the peer-reviewed literature

Effectively synthesised many peer-reviewed literatures, grey literature, practice and personal professional experience

Laid the groundwork for future research and practice in the field

Chapter 3

Applied and adapted global biodiversity offset principles to a regional case study

Provided robust scientific analysis to inform international (World Heritage Organisation) and national debates on marine offsets, which was reflected in media coverage of the research

Interpreted theory into actionable recommendations for governments

Facilitated direct uptake of research principles by government policy makers in the drafting of new policy by

the Great Barrier Reef Marine Park Authority and in the internal communication of effective offset practice by the Department of the Environment (common discussion of the "Bos Principles")

Laid foundation for future research, some of which has already been funded by the Australian Government since the paper was published (National Environmental Science Program research project; Department of the Environment Reef trust consultancy)

Chapter 4:

Despite common discussions of revolving loan funds for marine outcomes in the conservation non-profit space, there were no known analyses of this topic in the peer-reviewed literature until this paper

Provided a case study example of the theoretical potential to use private capital to subsidise water quality improvements

Involved participatory research that drew on the expertise of key stakeholders

Provided a basis for research priorities of government going forward

Chapter 5:

Provided a literature review of the impact investing industry, which will benefit impact investing and conservation finance beyond marine environments

Contributed to both the impact investing literature as well as the marine conservation literatures

Identified examples of investible marine conservation projects

Articulated the opportunities and barriers for progressing marine impact investing industry

6.3 Cross-cutting Findings

6.3.1 Capacity

The need for greater human capacity focused on marine conservation finance - specialists who can liaise between disciplines and sectors - emerged strongly throughout the research results. A recommendation from Chapter 2 was the need for more marine conservation finance specialists to "catalyse … collaborations,

synthesise outputs from many fields of work, leverage funding opportunities, and improve the capacity to address the problems of marine conservation funding" (Chapter 2, Section 2.5). Important roles need to be played government, non-profit, for-profit, and academic sectors (Figure 2-1), but without specific and focused capacity, it is unlikely that the marine conservation finance gap will close.

Chapter 3 identified the need for third-party specialists to design and implement marine biodiversity offsets, partly due to perceived conflict of interest between governments and industries (Grech et al 2014), but also due to the capacity limitations within existing parties (Gane 2010).

In Chapter 4, the need for third-party capacity to administer a loan fund emerged from interviews with government, industry, and academic representatives. Consistent with Chapter 3, reasons included both perceived conflict of interest and also the "potential for a high level of trust from all sectors, and the ability to coordinate diverse interests and capacities through an un-biased platform" (Chapter 5, Section 4.2.3). The issue of capacity and trust is echoed strongly in Chapter 5 in the discussion of the role of 'intermediaries' in the impact investing industry. Intermediaries are "vitally important and almost always used" in deal sourcing, due diligence, impact measurement, and technical assistance (Bugg-Levine & Emerson, 2011; Richter, 2014; Salamon, 2014). Figure 5-1 illustrates how intermediaries operate in the impact investing industry, and Chapter 5, Section 3.3.4 discuss the lack of intermediation capacity for marine impact investments and recommends that "this gap must be addressed."

Figure 6-1 below synthesises the findings about capacity across all thesis chapters. Investors, practitioners, and specialists can partner together to use marine conservation finance mechanisms to produce blended value - including reducing the marine conservation finance gap while also delivering social and environmental impacts - which ultimately benefits beneficiaries through social, environmental, and financial profits.

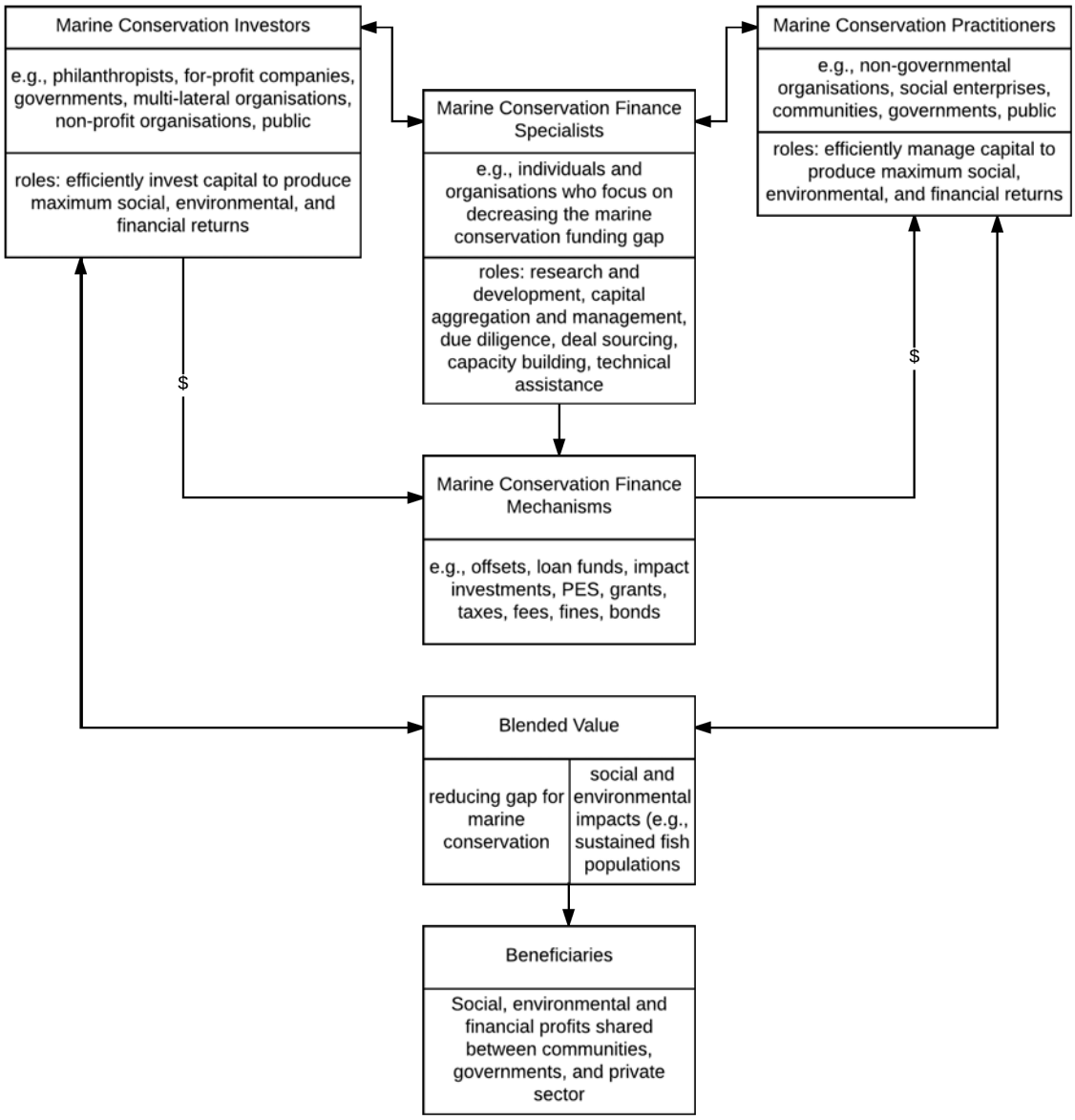

Figure 6-1. Capacity Needs for Marine Conservation Finance

6.3.2 Transition capital

Transition capital is funding that enables a change from one state to another. In the context of marine conservation finance, transition capital is the funding needed to change from the current situation of a large and growing marine conservation finance gap toward a future desired situation of a shrinking marine conservation finance gap due to: 1) less impacts to the marine environment, and 2) adequate and effective investment in marine conservation outcomes.

The need for transition capital emerged in all four research chapters. In Chapter 2, the literature review identified the need to access transition capital to conduct research and development on new finance mechanisms, identify and train marine conservation finance specialists, and to develop financial strategies for marine conservation programmes. In Chapter 3, to transition from ineffective offsets towards more effective offsets for the Great Barrier Reef World Heritage Area, transition capital is recommended to develop an advanced offset programme, identify strategic implementation zones and counterfactual baselines, and to conduct further research and development of marine restoration techniques. In Chapter 4, transition capital was identified as a need to pilot the proposed loan fund, to bring together partners, fund demonstration cases, and implement extension and outreach to complement and incentivise loan uptake. In Chapter 5, transition capital is identified as a key limitation to marine impact investing, and transition capital is also identified as an important strategy to develop self-sustaining revenue mechanisms (e.g., fisheries finance).

The above paragraph represents a larger issue than just a laundry list of funding needs. The reason transition capital is so difficult to access is that capital is often partitioned according to financial objectives, and transition capital does not easily fit within existing partitions. For example, foundations often have two very distinct pots of money: 1) grant funds with the objective of achieving social or environmental outcomes, and 2) corpus investments with the objective of achieving market-rate financial returns. Cultural and social norms within the non-profit sector often create barriers to using grant funds for activities that can generate a financial return (CFA 2014). Extremely few marine conservation projects can generate market-

rate financial returns. The transition capital sits between these two pots of money. Very few foundations recognise that there is a need for a third pot of money.

This situation is not limited to foundations: it is often the case for individual donors / investors, governments, and corporations who invest in marine conservation. In terrestrial conservation finance and social finance, this hurdle is present but is being mitigated through specialised funds that target social and environmental finance and expect zero to concessionary financial returns. Marine conservation investors could dedicate funds specifically to address marine conservation finance to systematically and significantly reduce the finance gap.

6.4 Conclusion

Global natural capital - including marine ecosystem goods and services - sustain human wellbeing. The economic cost of environmental degradation is greater than the investment into conservation and management, resulting in a large and growing conservation finance gap. There is ongoing research in sustainable development and environmental finance, but much of this is focused on terrestrial ecosystems. Due to unique features of the marine environment, explicit focus on marine conservation finance is also needed.

The results of this thesis indicate that finance does appear to be a rate-determining step for the progression and success of marine conservation, and increased systematic and rigorous study in this emerging field appears to be needed. Funding for marine conservation is inadequate in terms of the size, duration, and diversity of revenue. There are numerous finance mechanisms available to increase investment into marine conservation, but the type of mechanism must be suited to the ecological, social, political, and economic context of the site.

Sufficient private capital appears to be available, but analogous to the food scarcity issue, distribution and waste are primary concerns. Engagement with the private sector - to unlock private capital through numerous mechanisms - is essential. When engaging with businesses, the finance mechanism or strategy

must be suited to the objective of the business. Biodiversity offsets, for example, can be an effective tool to make businesses compensate for permitted damage to the marine environment, but numerous improvements to the assessment and implementation of offsets are needed to make them more effective, as illustrated by the Great Barrier Reef case study. As another example, loans can be used to deliver both marine outcomes and private profits for businesses so that they can account for the natural capital in their value chains. Impact investing - producing social or environmental outcomes alongside financial returns - has a large potential to deliver marine conservation outcomes, but is currently limited by the availability of "investible" deals to accept the available capital.

Specialist capacity and transition capital are required to advance marine conservation finance. A balance of effort between preventing impacts and funding recovery / management is needed to squeeze the marine conservation finance gap from both sides. This research identifies actionable solutions for addressing both prevention and funding, and articulates how cross-sector partnerships and specialist capacity are needed to advance marine conservation finance.

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