Scaling up to form marine protected area networks:

The role of coordination of initiatives and institutional collaborations in the Philippines

Thesis submitted by

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Statement on the declaration of human ethics

This research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council (NHMRC) National Statement on Ethical Conduct in Human Research, 2007. The proposed research study received human research ethics approval from the JCU Human Research Ethics Committee Approval Number # H3995.

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THESIS ABSTRACT

Approaches to management of coastal resources have been evolving consistently over the past decades. Integrated and ecosystem-based approaches to management have been advocated increasingly to address continuous degradation of coastal and marine resources. Examples of these large-scale approaches are the establishment of networks of marine protected areas (MPAs). Networks of MPAs are believed, and to some extent have been proven, to provide higher ecological, social, and economic benefits than small, isolated MPAs. In order to provide more benefits, MPA networks have to be well-designed and well-managed. However, designing networks with consideration of ecosystem function can be difficult in certain governance contexts, because ecological and governance scales are rarely congruent. MPA networks can be challenging to establish and implement, particularly in countries with high dependence on natural resources and small, numerous, and disparate governance units. These conditions reduce the acceptability of ecologically-sound network designs, because more local communities that are highly dependent on coastal resources will be affected. Moreover, the governance of networks becomes challenging with increasing numbers of involved governance units, because of the increasing diversity of social, economic, and political interests that complicates consensus-building and implementation of concerted management efforts.

The Philippines is widely-known for its extraordinary biodiversity, considerable dependence on marine resources, decentralized government system, and extensive implementation of locally-established MPAs. However, because of the continuous decline of ecosystems and native species, and the deficiencies of existing management initiatives, scaling up to form networks is increasingly being advocated. Scaling up is facilitated by collaborations of neighbouring local governments. These collaborations are believed to help improve MPA design and management through coordinated activities, and sharing of resources and experience. Using the Philippines as a case study, the goals of this thesis were to:

1. Understand how scaling up operates to form MPA networks;
2. Examine the benefits and challenges of scaling up; and,
3. Document lessons on how effectively scaled-up MPA networks can be governed.

To achieve these goals, I first described the scaling up framework used in the Philippines and the role of institutional collaborations when scaling up. In Chapter 2, I reviewed the history of MPAs and coastal management that led to the development of networks, and identified fundamental elements of successful collaborative partnerships. I found that there were 40 networks in the country with varying histories and objectives, and that most conservationists and researchers perceived that scaling up had the following advantages: 1) enhanced enforcement; 2) cost-effective management; 3) improved design and coordination of responses to threats; and 4) facilitated resolution of conflict among neighbouring communities and local governments. However, these experts also recognized the following challenges: 1) low technical capacity and high dependence on bridging organizations to help with MPA design; 2) lack of funding to sustain joint efforts; and 3) conflict arising from the lack of shared visions.

In Chapter 3, I examined the benefits and challenges of scaling up in terms of the design and expansion of MPA networks. In this chapter, I defined scaling up as the coordinated expansion of locally-motivated MPA initiatives facilitated by collaborations of local governments and their communities. I simulated future scenarios of MPA expansion and compared these scenarios in terms of achievement of objectives for habitat representation. I found that coordinated expansion was better than uncoordinated community-based establishment. Coordination improved planning through its broader perspective, inclusion of more ecological and social information, and ability to transcend boundaries by sharing municipal waters. However, I recognized that scaling up required considerable technical input that was beyond the capacity of most local governments. Moreover, scaling up would require local governments and communities to understand and accept that the immediate benefits and costs of MPAs will not be equitably distributed, and to arrange for these spatially-uneven costs and benefits to be redistributed in some way agreeable to the parties involved.

I then examined the benefits and challenges of scaling up in terms of improving MPA management in Chapter 4. I evaluated the management performance of networks and the extent to which networks enhance the management of individual MPAs. I did this with existing and newly-designed tools to assess management performance, key informant interviews, and community perception surveys. The methods I used provided descriptions of management performance relative to a variety of criteria, and explanations of the successes and bottlenecks in management. I found that networks and MPAs are inter-dependent. On one hand, well-managed MPAs have experienced managers and local governments that share lessons and experiences with network members. On the other

hand, well-coordinated networks serve as platforms to convene these local governments and MPA managers to make decisions and share resources to help improve the MPAs.

Networks rely on the characteristics and interactions of people and social institutions. In Chapter 5, I evaluated the influence of governance context on participation, governance capacity, and management performance of networks. The contextual factors I examined included: network sizes (e.g. number of local governments), institutional arrangements (e.g. structure, objectives), and socioeconomic and political contexts. I did not find concrete evidence of the effect of sizes of the MPA networks on participation and governance capacity. Instead, institutional arrangements of these networks that stood out as positively influencing participation, capacity and performance, included: less complicated objectives, less demanding structures and interactions, more inclusive membership of representatives, and increased communication from network to community levels. Strong leadership combined with transparency, accountability, incentive systems, and participatory measures, contributed to increased participation, better coordination, and higher management performance.

The results of this thesis showed that scaling up local MPA initiatives through institutional collaborations is an effective approach to establishing MPA networks. In Chapter 6, I discuss the implications of scaling up and outline considerations to guide the development of MPA networks and promote their sustainability in areas with governance contexts similar to the Philippines. Although it makes sense to move from local-scale initiatives and promote "working together", we should be mindful of difficulties when prescribing scaled-up approaches. Institutional experimentation and "learning by doing" have provided examples of successful management interventions in the literature and in this study. However, key lessons learned from this thesis are that scaling up can entail large transaction costs when trying to organize and facilitate discussions among local governments, especially when the region has highly complex governance. We should aim to determine the feasibility of approaches to scaling up, identify ways to remove barriers to implementation, and consider the institutional capacity of local governments and communities, in order to increase the sustainability of MPA networks.

CHAPTER 1

GENERAL INTRODUCTION

1.1 Context and rationale for the thesis

1.1.1 Addressing the continuous decline of coastal and marine resources

Marine habitats such as coral reefs, seagrass beds, mangrove forests and their associated fisheries are critical to the livelihoods and food security of millions of people (Wilkinson and Salvat, 2012, Bruno and Selig, 2007, Bellwood et al., 2012). Fisheries from these associated habitats provide the primary source of animal protein and income for coastal populations (Foale et al., 2013, Wilkinson and Salvat, 2012, Wilkinson et al., 2006). However, these ecosystems are continuously and rapidly declining due to increasing population growth and economic development (Wilkinson and Salvat, 2012, Pauly et al., 2005, Bruno and Selig, 2007). Human demands contributed greatly to the tremendous decline of fisheries resources and marine ecosystems over the past decades through overfishing and use of illegal fishing practices (Anticamara et al., 2011, Wilkinson and Salvat, 2012, Pauly et al., 2005, Pauly et al., 2002). Development has also increased degradation of coastal ecosystems through shoreline development, deforestation, and land conversion, which have caused increased sedimentation and reduction of water quality of coastal and marine areas (Wilkinson and Salvat, 2012). Moreover, habitat loss caused by climate change and natural disasters has exacerbated further decline and stress on coastal ecosystems and fisheries (Salvat and Wilkinson, 2011, Hughes et al., 2003, Carpenter et al., 2008, McLeod et al., 2010).

Efforts to manage human activities and conserve marine biodiversity are underway and progressively evolving with increasing applications and research. For example, fisheries management usually employed single-species management approaches (Pauly et al., 2005, Walters et al., 2005). Single-species assessment and management have been used to determine limits of fishing mortality in order to design policies to regulate fishing. However, studies have shown that single-species management approaches were insufficient to avert depletion of fish stocks, because single-stock assessments underestimated the severity of declines and failed to incorporate responses to altered trophic interactions (Walters et al., 2005, Mace, 2001, Pauly et al., 2002). Moreover, regulations from single-

species management were poorly developed and implemented in most countries (Pauly et al., 2002).

As a way forward from single-species management of fisheries, establishing marine protected areas (MPAs) was seen as an initial ecosystem-based approach. It was believed that MPAs could address multiple objectives, including reduction of fish mortality and recovery of declining stocks, by conserving portions of marine ecosystems and fishing grounds (Lauck et al., 1998, Botsford et al., 1997).

IUCN defines an MPA as**,** "an enclosed intertidal or subtidal environment together with its overlaying waters, flora and fauna and other features that has been reserved and protected by law or other effective means" (IUCN-WCPA, 2008). Establishment of large MPAs was initially recommended because they can protect more species, at various life stages and with different movement patterns, as well as more populations and habitat types than small MPAs (PISCO, 2007, Botsford et al., 2003). However, larger MPAs were more difficult to implement than smaller ones, because larger MPAs incur higher opportunity- and management-costs that are beyond the capacity of some countries to pay (PISCO, 2007, Lauck et al., 1998). Moreover, social, economic, and political factors constrain design and implementation of MPAs, particularly in developing countries (Cinner and Pollnac, 2004, Christie and White, 2007). Hence, in some developing countries, local-scale approaches such as community-based MPAs have become the most accepted and used conservation tool. The community-based approach involves participatory decision-making and management, so is widely accepted and has proved to be successful in many cases (Christie et al., 2002, Alcala, 1998, Alcala and Russ, 2006). Studies on small coral-reef MPAs have shown increase in cover, species diversity, abundance and biomass of corals and associated fish assemblages (Stockwell et al., 2009, Selig and Bruno, 2010). Community-based MPAs in most cases have also become a very popular and effective fisheries management tools, because of the documented adult spill-over from MPAs to adjacent coral reefs (Abesamis and Russ, 2005, Abesamis et al., 2006, Russ et al., 2004). However, despite the success and popularity of implementing local-scale MPAs, they can be insufficient to achieve broader goals because they lack a regional perspective (Weeks et al., 2010a, Pressey et al., 2013).

Because of the increased awareness and knowledge about the deficiencies of both single-species management and local-scale initiatives for multi-species management, integrated and ecosystem-based approaches became widely recommended management initiatives (Pauly et al., 2002, White et al., 2005a). Integrated and ecosystem-based approaches address gaps in established approaches to coastal management by considering

and balancing the interactions and requirements of maintaining both natural resources and human well-being (Chua, 2006, FAO, 2003). Specifically, integrated and ecosystem-based approaches consider ecological processes and interactions to sustain ecosystem function and services, whilst accommodating human needs and complexities of management during planning processes and implementation of initiatives (Berkes, 2012, Leslie and McLeod, 2007). One of the management tools recommended by these approaches is the implementation of networks of MPAs (Green et al., 2014).

An MPA network is defined as a system of individual MPAs that complement each other and represent larger expanses of ecosystems in order to achieve ecological goals more effectively and comprehensively (IUCN-WCPA, 2008) than MPAs that are not coordinated (PISCO, 2007, IUCN-WCPA, 2008, WorldBank, 2006). For networks to be better than collections of individual MPAs, the design of networks should be comprehensive, adequate, and representative. Comprehensive networks protect a full range of biodiversity, by protecting a variety of species and the habitats they occupy during their various life stages, as well as community structures and functional diversity (Edwards et al., 2010, Mumby, 2006, McCook et al., 2009). Networks that are adequate effectively protect a sufficient proportion of the total area covered by various habitat types (e.g. 20% of all coral reefs in the region) (McCook et al., 2009). Representative networks protect a full range of ecosystems, their processes and interactions within each bioregion to support a range of processes at different spatial scales. These principles ensure, among other things, that networks are able to spread risks and protect connectivity at varying distances of larval dispersal (Fernandes et al., 2005, Almany et al., 2009, McCook et al., 2009).

Ideally, systematic conservation planning (hereafter referred to as conservation planning) should be used to develop regional designs for MPA networks (Fernandes et al., 2009, Fernandes et al., 2005). Conservation planning is a spatially explicit framework for designing and zoning initiatives for biodiversity conservation and coastal management (Pressey and Bottrill, 2009, Margules and Pressey, 2000). It is a favoured approach for locating actions, because it efficiently achieves conservation objectives and incorporates diverse considerations, including costs, opportunities, and the involvement of stakeholders (Hansen et al., 2011, Pressey and Bottrill, 2009). However, regional designs developed using conservation planning approaches have a poor track record of being implemented on the ground (Knight et al., 2008). The transition from regional designs to local actions is difficult in certain governance contexts, because ecological and governance scales are rarely congruent (Pressey et al., 2013, Mills et al., 2010, Erasmus et al., 1999).

Establishing and implementing regional MPA networks can be challenging, particularly in countries with large human populations, high dependence on natural resources, and small, numerous and disparate governance units (Mills et al., 2010, Green et al., 2014). To address this difficulty, some conservationists and researchers have suggested "scaling up" or coordinating local actions (White et al., 2014, IUCN-WCPA, 2008). Scaling up involves expansion of local actions using integrated and coordinated approaches with a regional perspective. It involves broadening perspectives by expanding from smaller to larger areas, involving more stakeholders, and forming collaborative partnerships (Junio-Meñez et al., 2007, Chua, 2006, WorldBank, 2006). Although it makes sense to scale up efforts and form collaborative partnerships, it seems likely that there will come a point where scaling up reaches its limits, partly by exceeding institutional capacity (Christie et al., 2009b). Governability of MPA networks will become more difficult as MPA networks extend to larger areas and increase the number of involved people and institutions. Presumably, the costs of organizing people and institutions would also increase as networks expand. Moreover, governability will become challenging because the increased diversity of social, economic and political interests of the institutions involved will impede consensus-building and implementation of management efforts (Kooiman and Bavinck, 2013, Jentoft, 2007, Christie et al., 2009a).

The benefits and process of designing and implementing MPA networks are well-known in theory. Scaling up initiatives has been widely recommended to improve effectiveness of existing MPAs, and accelerate establishment of MPA networks. However, there are still numerous gaps in knowledge as to how scaling up should be implemented, how effective it is in different governance contexts, and what limits in might have in relation to the extent of MPAs networks or number of governance units involved. This thesis aims to address these gaps by broadening the understanding of the contributions of scaling up to the development of MPA networks, particularly in countries with numerous social, economic, and political constraints, and small, numerous and disparate governance units.

1.1.2 The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security

The Coral Triangle was described as the global centre of marine biodiversity (Veron et al., 2009, Carpenter and Springer, 2005, Allen, 2008), and is under the jurisdiction of six countries (CT6) in Southeast Asia and Melanesia – Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor-Leste (White and Green, 2014, Cabral et al., 2013). The Coral Triangle comprises over 30% of the world's coral reefs, 76% of reef-building coral species, and 52% of coral reef fishes (Allen, 2008, Veron et al., 2009).

This immense diversity of coastal and marine resources supports over 120 million people living in coastal areas and 250 million people residing in the region (Foale et al., 2013).

The coastal and marine resources within the Coral Triangle are increasingly endangered by human activities and other perturbations. Direct human activities such as overfishing, illegal and destructive fishing, pollution from land-based sources, and shoreline development are contributing significantly to the decline of natural resources and services they provide. Climate-related threats such as increasing sea-surface temperatures, sea-level rise, ocean acidification, and other problems such as outbreaks of coral disease continue to increase the pressure on coastal and marine resources (McLeod et al., 2010, Burke et al., 2012).

The tremendous amount of stress and dependence on the extraordinary coastal and marine resources in the Coral Triangle have called for greater efforts for conservation and support for local communities to maintain their livelihoods and food security. As a response, the CT6 established the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) in 2007. In 2009, the Regional Plan of Action for 2010 – 2020 (RPOA) was approved and adopted to address five goals. The goals in the RPOA coincided with international development and conservation targets, which included the Millennium Development Goals, Convention on Biological Diversity and Aichi Targets. The goals were categorized into the following: 1) Seascapes; 2) Ecosystem-based approach to fisheries management; 3) Marine protected areas; 4) Climate change mitigation and adaptation; and, 5) Threatened species (CTI-CFF, 2009).

The goal identified for MPAs was to effectively establish and manage MPAs in the Coral Triangle region, with the target of a "region-wide Coral Triangle MPA system in place and fully functional." Specifically, the CTI-CFF aimed to "place 20% of each major marine and coastal habitat in the Coral Triangle under protection status by 2010 - 2020. Individual MPAs will be scaled up and linked to form a connected, resilient and sustainably financed Coral Triangle MPA System." This aim called for a broader perspective on planning, forging of collaborative partnerships, and establishment of cross-scale social and political linkages to improve and expand MPA initiatives in the region.

There are over 1,972 MPAs established in the Coral Triangle to date. This number translates to ~200,881 km2 under various types of protection (e.g. no-take areas, sanctuaries, reserves, national parks, and locally managed marine areas) (White et al., 2014). Most of these MPAs protected coral reefs, which translate to protection of 17.8% of the total reef area in the region (Cros et al., 2014). However, despite this achievement,

other habitats are still underrepresented and the effectiveness of many MPAs is still uncertain. Differences in the numbers, sizes, and types of MPAs between countries in the Coral Triangle largely depends on governance systems and contextual factors. Each of the six Coral Triangle countries has different governance systems that determine laws, policies, and institutional arrangements for the design and implementation of MPAs. For example, decentralization of government in the Philippines and Indonesia and customary marine tenure in Papua New Guinea and the Solomon Islands are the main governance systems used for natural resource management (Cabral et al., 2013, Fidelman et al., 2012). Moreover, each of the Coral Triangle countries has varying motivations for establishing MPAs and levels of institutional capacity, influenced by social, economic and political factors. Understanding these differences in order to address barriers for sustainability of MPA initiatives has remained one of the main concerns of many conservationists and researchers working in the region (Foale et al., 2013, Cabral et al., 2013).

To address the strengths and weaknesses of existing MPA efforts, scaling up MPAs to form MPA networks in the Coral Triangle has been recommended (White et al., 2014, CTI-CFF, 2009). Because most of the MPAs in the region have been established locally, conservationists, researchers, governments and some local institutions have suggested and facilitated efforts for neighbouring governance units – local institutions and their communities - to "work together" to share lessons, resources and responsibilities and to coordinate efforts for the formation of MPA networks. Advocating for local institutions and communities to "work together" by forming social, economic and/or governance networks was seen as a way to adapt to the different governance systems and local contexts that constrain initiatives, identify common problems and goals, and to increase institutional capacity of governance units to establish MPA networks in the Coral Triangle.

Although institutional experimentation and "learning by doing" were recommended in order to understand the factors affecting success of MPA network initiatives, we still do not know a lot about the workable governance structures and processes for establishing and sustaining networks. Some studies have shown that the key issues identified for sustaining MPA networks include: 1) lack of sustainable financing; 2) problems with boundary delineation; 3) lack of understanding of the limits of institutional capacity; and, 4) influence of institutional arrangements and other social, economic, and political factors on the success and sustainability of partnerships (White et al., 2014, Green et al., 2011, Christie et al., 2009b, Lowry et al., 2009). However, because the concept of forming MPA networks is still relatively new, there remain many knowledge gaps (Roff, 2014), and these include how to facilitate their formation, how they operate, their limits in terms of

governability, and what factors influence their success and sustainability. Moreover, there are still very few methods and approaches developed to evaluate MPA networks, particularly how institutional networks organize themselves, how they perform, their benefits and challenges, and how to relate their performance into management outcomes.

1.2 Case study area, goals and objectives

1.2.1 The Philippines: Diversity, dependence and decades of experience on MPAs

The Philippines is considered as the apex of the Coral Triangle, because of its high concentration of species per unit area (Veron et al., 2009, Carpenter and Springer, 2005, Allen, 2008). However, it is also characterized by high dependence of people on coastal and marine resources (Nañola et al., 2011, Cabral et al., 2013), and rapidly developing coastal areas (Cabral and Aliño, 2011). With a population of nearly 100 million people, 65% of which are living along and near the coast, shoreline development and dependence on fisheries resources have greatly reduced the health of coastal and marine ecosystems, and have caused depletion of natural resources, particularly fisheries (Cruz-Trinidad et al., 2014, Cabral et al., 2013, Nañola et al., 2011, Gomez et al., 1994). Moreover, rapid deforestation and conversion of land have increased sedimentation and greatly reduced water quality in most coastal areas (Burke et al., 2012).

Management of natural resources in the Philippines is largely the responsibility of local governments, due to the decentralization of some of the national government's responsibilities (Philippine Local Government Code of 1991). Local governments are mostly responsible for the planning, enforcement, and management of natural resources. Efforts to protect coastal and marine resources, mandates in the Philippine Fisheries Code, and the success of local MPA initiatives have greatly increased the implementation of small MPAs all over the country. Community-based implementation was seen to be a successful local-scale, fisheries conservation tool, because of the participatory processes it involved (Alcala, 1998, Uychiaoco et al., 2005, Christie et al., 2002). However, despite this growth in initiatives, community-based efforts were difficult to sustain due to lack of funds and difficulties of enforcement (White et al., 2002, White et al., 2006a). There was a clear need for local governments to get more involved, and co-management between communities and their local governments became highly recommended (Christie et al., 2002). However, further research into these community-based initiatives showed that the status of most of these local MPAs is unknown or ineffective (Arceo et al., 2008, Alcala et al., 2008). Moreover, these local MPAs are unable to address broader-scale conservation

objectives, because they were not designed to complement each other (Weeks et al., 2010a). Efforts to improve management, establish monitoring and evaluation schemes, improve coordination and design, and implement ecological MPA networks are some of the main priorities of government agencies, academics, and conservationists in the country.

People in the Philippines have immense experience in coastal management and MPAs because of their institutional experimentation and "learning by doing". Coastal management in the country has evolved to more integrated and ecosystem-based approaches, after researchers and conservationists realised the deficiencies of existing efforts. Hence, scaling up to form MPA networks is believed - and has been proven to a certain extent (Toribio et al., 2013, Junio-Meñez et al., 2007, Aliño et al., 2006) - to be a cost-effective means of improving the management and design of MPAs. Scaling up is facilitated by collaborations of local governments and their communities. These collaborations help improve management and design by sharing experiences and resources, and coordinating efforts. There are still numerous gaps in knowledge about scaling up to form MPA networks in the other countries in the Coral Triangle. Hence, the Philippines can serve as an instructive case study to provide lessons and guide development of MPA networks with similar social, economic and/or governance contexts.

1.2.2 Goals and objectives of the study

To assist with initiatives and the urgent need to address issues on implementation of MPA networks in the Philippines and the Coral Triangle in general, I used the Philippines as a case study to achieve the following thesis goals:

1. Understand how scaling up operates to form MPA networks;
2. Examine the benefits and challenges of scaling up; and,
3. Document lessons on how effectively scaled-up MPA networks can be governed.

I used case studies to represent different spatial scales of governance and related challenges and opportunities. I also used various theories and research methods to gain a holistic understanding of the multi-faceted and multi-disciplinary nature of MPA networks. This thesis consists of six chapters, of which five address the listed thesis goals. To achieve the first goal, I conducted a literature review and key informant interviews of MPA experts to describe scaling-up efforts on a national scale. For the second goal, I selected case-study areas based on the literature review to examine the benefits and challenges of scaling up. The results and reflections from the first two goals were then documented to provide lessons, guidelines, and considerations for the development and governance of MPA

networks. The succeeding sections explain in more detail the specific objectives in each of the thesis goals.

Goal 1. Understand how scaling up operates to form MPA networks

To understand how scaling up operates, I described in Chapter 2 how the initiatives in the Philippines moved from local-scale initiatives to coordinated efforts. In the same chapter, I also described the framework used to scale up local initiatives to form a national network of MPAs, and identified and developed a geographical information system (GIS) database of MPA networks in the country. In Chapter 3, I used the experiences from scaled-up efforts to simulate MPA expansion scenarios. In Chapter 4, I determined standards of performance for management of networks based on the review in Chapter 2, and used the lessons learned to develop a management performance tool to be applied to MPA networks. During the assessment in Chapter 4 and the interviews in Chapter 5, I was able to understand more explicitly the functions of scaled-up MPA network initiatives and the differences between them.

Goal 2. Examine the benefits and challenges of scaling up

Based on the literature review and interviews with MPA experts in the Philippines in Chapter 2, I was able to identify and outline the benefits and challenges of scaling up. These results were used to guide the development of research questions and methods for Chapters 3, 4 and 5. I examined more closely the benefits and challenges of scaling up on: the design of MPA networks (Chapter 3), management performance of MPAs and networks (Chapter 4), and governability and limitations of networks (Chapter 5).

Goal 3. Document lessons on how effectively scaled-up MPA networks can be governed

Lessons from each of the data chapters (Chapters 2 to 5) are documented and outlined in each of the chapters. Each chapter also presents other considerations and future directions for research. Chapter 6 further summarizes the lessons from each of the data chapters by outlining considerations to guide development and support sustainability of MPA networks in countries with the same governance context as the Philippines.

1.3 Thesis structure and outline

. This thesis reflects the multi-disciplinary nature of MPA networks, and presents a range of theoretical frameworks and research methods. The thesis consists of six chapters,

which include this general introduction (Chapter 1), four data chapters (Chapter 2-5), and a general discussion (Chapter 6). The four data chapters are written in journal-article format, each of which has an introduction and sections for methods, results, and discussion. In this first chapter, I provide the background and describe the significance of my thesis, and indicate the contribution of my research findings to enhancing our understanding of MPA networks and scaled-up approaches.

The second chapter is a national review of MPAs and MPA networks in the Philippines, which provides the framework for scaling up MPAs to form networks, and summarises existing knowledge about benefits and challenges of scaling up to form MPA networks. The theoretical framework in this chapter includes integrated coastal management (ICM) and design, management, and governance of MPAs. Using these frameworks, I updated the historical timeline of MPAs and ICM of the Philippines. In this timeline, I was able to document the motivations of researchers, conservationists, and government agencies in the Philippines to move from local-scale MPA initiatives to more integrated approaches. I have also contributed to the existing knowledge on the locations and types of MPAs, by updating the MPA database of the Philippine MPA Support Network (MSN) to include information on MPA networks and new MPAs, and developing these data in GIS format.

The third chapter shows the benefits and challenges of scaling up network designs by simulating future MPA expansion scenarios in the Verde Island Passage using different approaches. In this chapter, I used systematic conservation planning and MPA design theory as the theoretical framework. I used spatially-explicit models to simulate future MPA expansion scenarios. The models and software used were Maximum entropy modelling (Maxent; Philips et al., 2006), and systematic conservation planning software – (Marxan; Ball et al. 2009). In addition, I developed spatially-explicit decision trees to simulate expansion of MPAs based on actual experiences of MPA managers and conservationists. This chapter contributes to bridging the gap between conservation planning and implementation by presenting potential solutions and considerations when implementing MPA network designs given governance constraints.

The fourth chapter presents the benefits and challenges of scaling up network management and the interdependencies of management of individual MPAs and MPA networks. I used MPA literature on governance and management performance as the guiding framework in this chapter. I developed a management-performance tool for MPA networks, because there were no tools to evaluate MPA networks. I tested this tool and used other social-science research methods – including interviews, focus group discussions,

and community perception surveys - to determine the performance of three established MPA networks in the Philippines. In this chapter, I determined how well the MPA networks performed and tested the applicability of the methods I developed. I also described the interdependencies of management of individual MPAs and MPA networks, and presented other factors that affect management.

The fifth chapter describes the influence of governance context on participation, governance capacity, and management performance of networks. I used the interactive governance theory (Kooiman, 2003, Jentoft et al., 2007, Jentoft, 2007) broadly to evaluate how governance context affects participation, governance capacity, and management performance of networks. I used the same case study areas as in the previous chapter, and used some of the data gathered from the interviews and discussions for this chapter. In addition, I used some of the data from government agencies (e.g. fisheries data, agricultural data) to explain the governance context in each of the case study areas. This chapter contributed to understanding how governance context limits scaling up and how to overcome these limitations.

Lastly, the sixth chapter is a general discussion of the implications of scaling up MPA network design and management, and an outline of the considerations to guide development of MPA networks in other areas with the same governance contexts as the Philippines. In this chapter, I presented research questions for future study and recommend multi-disciplinary approaches to answering these questions.

To summarise all the chapters, Table 1.1 outlines the specific objectives in each of the six chapters and the research methods used.

Table 1.1 Thesis chapters, objectives and techniques used

Chapter	Objective	Techniques
1	– Provide context for this study and explain its significance – Introduce concepts and theories that were adopted in the study	– Literature review
2	– Review history of MPAs and ICM in the Philippines to understand motivations for their implementation – Update the MPA database to include information on MPA networks – Conduct a gap analysis of MPAs and MPA networks – Document beliefs and existing knowledge on MPA networks by interviewing MPA experts in the country	– Literature review – Database and GIS – Gap analysis – Key informant interviews
3	– Model spatial suitability of municipal waters in the Verde Island Passage for MPA implementation – Simulate future MPA expansion scenarios based on three different approaches to conservation – Comparison of achievement of objectives for habitat conservation and comparison of spatial configuration of future MPA expansion scenarios	– GIS – Key informant interviews – Maximum entropy modelling – Scenario building and simulations, including spatially explicit decision trees – Use of systematic conservation planning software (Marxan)
4	– Evaluate management performance of networks and the extent to which network governance improves management of individual MPAs – Develop and test a method and tool to evaluate management performance of MPA networks – Infer the relationship and influence between management of networks and individual MPAs	– Management performance assessment – Key informant interviews – Focus group discussions – Community perception surveys
5	– Evaluate the influence of governance context on the management performance of networks – Infer the effects of participation on governance capacity and management performance – Determine the effects of size (number of participating institutions), institutional arrangements, and socio-economic and political context on participation, governance capacity, and management performance	– Database work – Key informant interviews – Focus group discussions
6	– Summarize findings of the thesis and outline key considerations for scaled-up development of MPA networks – Discuss the methods developed and approaches used in the thesis – Identify remaining knowledge gaps and future research questions	– Literature review

CHAPTER 2

MARINE PROTECTED AREA NETWORKS IN THE PHILIPPINES: TRENDS AND CHALLENGES FOR ESTABLISHMENT AND GOVERNANCE[1]

2.1 Abstract

Marine protected areas (MPAs) are the most extensively implemented fisheries management and conservation tool in the Philippines. Most MPAs have been established and managed by communities together with local governments in a variety of community-based and co-management schemes. This approach has proven successful in gaining community acceptance and achieving local-scale fisheries and conservation objectives. However, the contribution of these MPAs to ecologically connected networks of MPAs is variable since most MPAs were not designed to be parts of networks. Nevertheless, there is growing support for the development of MPAs within the national integrated coastal management framework which supports the "scaling up" of MPAs to establish networks. Scaling up in the Philippine context is achieved by forging inter-institutional collaboration among neighbouring local governments (i.e. village to provincial level), with the assistance of other institutions such as non-government organizations, academe, government agencies, and development partners including donors. In this chapter, I review the history of MPAs in the Philippines and the development of inter-institutional collaborations and present examples of scaling up of MPAs to form networks. To further the establishment of social and ecological MPA networks in the Philippines, I describe approaches to forming MPA networks and discuss the fundamental elements of successful collaborative partnerships.

[1]A version of this chapter was published as: Horigue V., Aliño P.M., White A.T., Pressey R.L. 2012. Marine protected area networks in the Philippines: Trends and challenges for establishment and governance. *Ocean & Coastal Management.* 64:15-26.

2.2 Introduction

Marine protected areas (MPAs) are defined by the World Conservation Union (IUCN) as parts of intertidal or subtidal environments, together with their overlying waters, flora and fauna and other features, that have been reserved and protected by law or other effective means (IUCN-WCPA, 2008). An MPA network is a group of individual MPAs that are ecologically and/or socially connected (White et al., 2006b, Christie et al., 2007, TNC-WWF-CI-WCS, 2008). Establishing networks of MPAs is widely recommended because networks offer broader ecological benefits than unconnected collections of MPAs (PISCO, 2007, IUCN-WCPA, 2008, UNEP-WCMC, 2008). A well designed ecological network of MPAs incorporates principles of adequacy, connectivity, representativeness, and resilience (IUCN-WCPA, 2008, Almany et al., 2009, McCook et al., 2009, UNEP-WCMC, 2008). The planning process for MPA networks considers hydrodynamic processes, ecological linkages, and ecosystem processes that help preserve ecosystem function. These dynamics are important in sustaining ecologically and economically important fish and invertebrate populations (White et al., 2006b, Planes et al., 2009). Socially, MPA networks can connect individuals and organizations to promote collaboration and sharing of information and experiences (White et al., 2006b, UNEP-WCMC, 2008).

The development and management of MPA networks is also linked to broader trends in international conservation policy (e.g. Millennium Development Goals, Convention on Biological Diversity). International policies advocate ecosystem-based management, integrated coastal management (ICM), and regional designs of ecological MPA networks. These management schemes are based on the premise of the importance of conservation and sustainable use of biodiversity to preserve ecosystem function and support human uses and activities (Chua, 2006, Bensted-Smith and Kirkman, 2010). However, management and governance of large-scale marine systems is very complex and requires innovative approaches to link various institutions across multiple scales (Fidelman et al., 2012). Moreover, MPA establishment and management particularly in most developing countries, have been largely initiated by local communities without emphasis on the development of ecological or social networks (Alcala and Russ, 2006, Johannes, 1998, King and Faasili, 1998).

Among the benefits of community-based establishment and management of MPAs are increased participation and acceptance by the people affected by the constraints on resource use (Aswani et al., 2007, Christie et al., 2002). Community-based MPAs have been effective at achieving local-scale fisheries and conservation targets (Alcala and Russ,

2006, Govan, 2009). However, the resulting MPAs are typically small (usually <1 km^2) and do not consider ecological connectivity (Weeks et al., 2010a). These small MPAs have the capacity to contribute to local biodiversity conservation and fisheries targets. However, these might not contribute substantially to wider objectives such as connectivity and resilience to climate change due to the lack of consideration of regional-scale ecological processes and broad-scale gaps in and objectives for biodiversity conservation (Sala et al., 2002, Weeks et al., 2010a). There are however, numerous efforts to scale-up locally managed MPAs to establish social and ecological MPA networks through collective action (Lowry et al., 2009).

Scaling up individual, locally established MPAs to form networks is seen as a means to attain conservation objectives and accelerate enhancement of coastal resource and ecosystems. These aims are achieved by improving the design (e.g. size and location) and management of MPAs, both typically hindered by governance and financial constraints (Aliño et al., 2006). Theoretically, scaling up to form MPA networks, in the context of integrated coastal management, involves three kinds of considerations for expansion: 1) geographical, 2) functional and 3) temporal (Chua, 2006). Geographical expansion refers to the shift in attention and coordination from smaller to larger areas (e.g. local jurisdictions to entire habitats or coasts). Design and management of the MPAs then encompasses larger areas, and hence requires functional (or operational) expansion with regards to management issues. Functional expansion involves adding more personnel and restructuring the management bodies in charge of the MPA networks. Members of management committees should have clear roles and responsibilities for MPA network design, enforcement, monitoring and other management activities (Junio-Meñez et al., 2007). Temporally, expansion will involve prioritization of activities, and incorporating MPA management into broader and institutionalized schemes (Pomeroy et al., 2010). In terms of temporal expansion, scheduling and establishment of new MPAs should consider where to place additional MPAs to minimize loss of biodiversity in the face of continuing threat (Visconti et al., 2010). MPA management should be institutionalized locally to prevent lapses in governance due to changing political figures and/ or termination of donor-assisted projects (Chua, 2006).

The call for scaling up MPAs to form networks coincides with the call for integrated coastal management (ICM) in the Philippines (Aliño et al., 2006, Chua, 2006, White et al., 2005a). The main focus of ICM is the management and sustainable use of coastal and marine uses in a spatial context that supports participatory planning and sustainable development. Establishing and managing MPA networks is linked to ICM since MPAs are

affected by human activities outside their boundaries (Chua, 2006, Junio-Meñez, 2008). Hence, incorporating MPA networks into ICM is complementary and needed to promote collective action and address transboundary problems related to human activities (Chua, 2006).

There are numerous efforts to form MPA networks in the Philippines. These involve collaborative efforts of communities, municipal governments, and other institutions (Armada et al., 2009, Eisma-Osorio et al., 2009). However, the process of scaling up and development of MPA networks has not yet been properly documented and described in the literature. Moreover, there is also a need to gather and consolidate information on MPA networks that are being established and maintained in the country. Herein we review the history of MPAs in the Philippines, the development of inter-institutional collaborations, and efforts to scale up MPAs and their management. I describe moves to create MPA networks and examine the approaches used, with the aim of defining the minimum requirements for collaborative efforts to establish social and ecological MPA networks. Key challenges experienced in establishing and managing MPA networks are also identified.

The Philippines offers an instructive case study due to its high biodiversity (Carpenter and Springer, 2005, Nañola et al., 2011), high dependence on coastal and marine resources (Nañola et al., 2011, Gomez et al., 1994), rapidly developing coastal areas, decentralized government system, and long history of MPA establishment and governance (Aliño et al., 2004). While Philippine experiences in MPAs and ICM are well documented and cited, this review provides planners, resource managers and policy makers with current and strategic lessons on how scaling up MPAs to form networks can be achieved, and what associated constraints and limitations need to be addressed.

2.3 Methods

I conducted a review of literature to gather and summarize relevant legislation, projects and events related to MPA establishment and management, inter-institutional collaboration, and MPA networks in the Philippines. The search criteria were MPAs (including marine reserves, sanctuaries, and no-take areas), biodiversity conservation, fisheries management, inter-institutional collaboration, ICM, and Philippines. The references used included peer-reviewed journal articles, book chapters, technical reports, legislation, and conference and workshop proceedings. These references were either downloaded online or obtained from various libraries and/or resource persons.

I compiled a database on MPA networks and local government alliances from the literature review and added this to the MPA database from the University of the Philippines Marine Science Institute and MPA Support Network (MSN). The information in MSN's database is limited to individual MPAs and does not include information on collaborative efforts to establish and manage MPA networks. The addition of information on MPA networks updated the MPA database (e.g. new MPAs as of 2010 and amendments to MPA sizes and geographic coordinates).

I also conducted semi-structured qualitative key informant interviews. The key informants were comprised of government officials, members of non-government organizations, and academics with experience in MPAs, MPA networks, and institutional collaboration. The aims of the interviews were to validate the history and timeline of events from the literature review and verify locations of the MPA networks and collaborative efforts implemented. Moreover, the interviews were used to document lessons and experiences of the key informants to describe the process of scaling up MPAs and identify challenges encountered when establishing and managing MPA networks and maintaining collaborative partnerships. The challenges identified were based on historical accounts on inactive alliances from the literature and from interviews.

2.4 The Philippine experience with MPAs

Established MPAs in the Philippines vary in objectives (Aliño and Uychiaoco, 1999), level of protection and allowed use, and mode of establishment and management. The first MPA established in the Philippines was the Hundred Islands National Park in 1940 (Table 2.1). The Hundred Islands was declared a marine park (Act No. 3915) to preserve its pristine state (Alcala, 1988). From the 1930s until the 1970s, declaring fishing refugia, sanctuaries and marine parks was largely centralized at the national level (Alcala, 1988, White et al., 2005a). In 1978 a task force was created to propose sites for marine park establishment, and over 60 coastal areas and islands in the country (Presidential Proclamation 1801) were identified as tourist zones and marine reserves under the jurisdiction of the Philippine Tourism Authority (White et al., 2005a). However, it was also during that time that the development of fisheries and aquaculture was being promoted as a lucrative source of income by the national government (White et al., 2006a). This trend was in conflict with the establishment of MPAs and contributed to the degradation of coastal habitats and resources.

Table 2.1 Summary of events, laws and projects in the establishment of MPAs and development of inter-institutional collaborations. L – Legislation or events leading to policy creation and/ or amendment; M – Relevance to MPA establishment; R – relevance to MPA networks.

YEAR	NOTABLE EVENTS AND ACTIVITIES	L	M	R
1932	Enactment of a centralized system of establishing national parks (Act No. 3915)	√	√	
1940	Establishment of the Hundred Islands Natural Park		√	
1960 – 1970s	Expansion and development in fisheries and aquaculture	√		
1974	Establishment of the first municipal marine reserve in Sumilon Island, Cebu		√	
1975	Fisheries decree promoting development and use of fisheries. Centralized recommendation of fishing areas for utilization and for the establishment of fishing refugia and sanctuaries	√	√	
1978	Task force created to recommend sites for marine parks.		√	
1981	Philippines becomes signatory to CITES	√	√	
1982 – 1986	Apo, Pamilacan and Balicasag Islands were established as marine reserves under the marine conservation and development program of Silliman University		√	
1986 – 1992	First bay-wide management program initiated in Lingayen Gulf		√	√
1988	Establishment of Tubbataha Reefs National Marine Park		√	
1990 – 1997	Bay-wide management promoted by the Fisheries Sector Program (FSP) of the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR)		√	√
1991	Devolution of power for municipal governments to plan and manage natural resources and ecosystems through the local government code	√	√	√
1992	Passing of Republic Act 7586 – The National Integrated Protected Areas System (NIPAS) act	√	√	

YEAR	NOTABLE EVENTS AND ACTIVITIES	L	M	R
1993	First inventory of MPAs in the Philippines		√	
1994	National marine policy formulated as a framework for managing coastal and marine resources	√	√	
1995	Institutionalization of community participation by allowing fishermen to form fisheries and aquatic management councils	√	√	√
1996 – 2004	Coastal resource management program of DENR implemented			
1997	First national workshop on MPAs in the Philippines conducted by the Coral Reef Information Network of the Philippines (PhilReefs).		√	
1997 – 2005	The Fisheries Resource Management Project implemented as a continuation and improvement of the FSP			√
1998	Enactment of Republic Act 8550 - The Philippine Fisheries Code	√	√	√
1999	More than 400 MPAs established in country. 16% of the MPAs were strictly enforced as no-take zones.		√	
1999	Establishment of PAMANA Ka sa Pilipinas, a network of community-based MPA managers		√	√
2000 - 2004	Annual workshops conducted towards the formulation of the National Fish Sanctuary Strategy. More than 500 MPAs established in the country in 2000. Reviews of MPA effectiveness initiated.	√	√	√
2001	Sulu-Sulawesi Marine Ecoregion tri-national agreement among the national governments of the Philippines, Indonesia and Malaysia	√	√	√
2003	Executive order mandating the use of integrated coastal management framework passed	√	√	√
2004	Philippine sustainable archipelagic development framework replaced the national marine policy	√	√	√
2004	The Philippine Marine Sanctuary Strategy formulated. Process of establishing a MPA network summarized after a series of national workshops.	√	√	√
2005	Formalization of the MPA Support Network (MSN)		√	√

YEAR	NOTABLE EVENTS AND ACTIVITIES	L	M	R
2005 – 2008	First phase of the Sulu-Sulawesi Seascape project. Conducted scientific studies as a basis for MPA network establishment in four marine biodiversity conservation corridors in the country		√	√
2006 – 2008	MSN conducted a series of MPA forums, organized a national MPA congress, and initiated an awards and recognition system for effective community-based MPAs		√	√
2006	Executive order on the national policy for biodiversity conservation to be implemented throughout the country, most especially in the Sulu-Sulawesi Seascape and Verde Island Passage MBCC	√	√	√
2008	First inter-local government unit alliance summit			√
2008	More than 1,100 MPAs established in the country. Initiation of the Coral Triangle Initiative	√	√	√
2009	CTI National Plan of Action finalized	√	√	√
2009	Second inter-local government unit alliance summit			√
2009	Social and ecological MPA networks advocated as a means to enhance MPA governance, effectiveness and resilience to external stressors particularly climate change.		√	√
2011	Third review of the national MPA Bill in Congress	√	√	√

Sources: (Alcala, 1988, Alcala and Russ, 2006, Lowry et al., 2009, White et al., 2002, White et al., 2005a, White et al., 2006a, Pajaro et al., 2010b, Pomeroy et al., 2010, Aliño and Junio-Meñez, 1995, Alcala, 2000, Aliño et al., 2002, Arceo et al., 2004, Campos et al., 2002, Bleakley and Wells, 1995, DENR-UNDP-MERF, 2004, EU-PDF, 2010, GTZ, 2008, Miclat et al., 2006, Miclat et al., 2008, PAMS, 2008, SSME, 2004, Uychiaoco et al., 1999, Uychiaoco et al., 2010)

In the late 1970s and 1980s many fishery biologists noticed declining incomes and catches of small-scale fishers as fisheries exploitation consistently increased (Pauly, 2004). Several marine scientists then realized the need to improve fisheries management and accelerate the establishment of marine parks or MPAs to protect marine habitats of coral reefs, seagrass beds and mangroves and to improve fisheries associated with coral reefs. Establishing small locally managed marine reserves, which originally started as a method for resource management (Alcala, 1998), were promoted to complement the national marine park system (Castañeda and Miclat, 1982, White and Cabanban, 1982). Community-based approaches became the most popular mode for MPA establishment following the declaration of Sumilon Island and Apo Island marine reserves with the assistance from Silliman University in 1974 and 1984, respectively (Alcala, 1998, Alcala and Russ, 2006). The decentralization of national government responsibilities to municipal governments in 1991 and the enactment of the Fisheries Code of 1998 encouraged the establishment of more MPAs (White et al., 2006a, Arceo et al., 2008). The Fisheries Code promoted the establishment of fish sanctuaries (strictly no-take areas) and marine reserves (within which activities are regulated, e.g. restrictions on fishing gear). Donor-assisted projects also encouraged increased involvement of communities in resource management (e.g. Coastal Resource Management Project, Fisheries Improved for Sustainable Harvest Projects) (White et al., 2005a). Following these important legislative changes in the 1990s, MPAs consistently increased in the country (Alcala, 2000, Arceo et al., 2008), reflecting the nation's efforts to arrest declines in fish populations and degradation of coastal habitats (Alcala, 2000, Alcala and Russ, 2003). The aforementioned events lead to the institutionalization of community-based management or co-management (between communities and municipal governments) as the models of MPA governance in the Philippines (Christie et al., 2002, Christie and White, 1997).

Due to this rapid increase in the establishment of MPAs, several marine scientists formed the Coral Reef Information Network of the Philippines (PhilReefs) and held the first national workshop on MPAs in 1997 (Uychiaoco et al., 1999). Various experts and local community members participated and produced an agenda for the future of MPAs in the Philippines. The agenda included efforts to: a) identify and increase the number of well managed MPAs; b) establish comparable methods for biological monitoring and evaluation to detect changes in the MPAs (e.g. Coral Reef Monitoring for Management by Uychiaoco et al. (2010)); c) define the criteria for successful MPAs in terms of biophysical attributes and socio-economic benefits; and, d) identify ways in which MPAs could be incorporated into broader management schemes such as ICM while involving local communities in management. The workshop also recommended improving coordination of MPA

initiatives by developing information networks and establishing linkages among different levels of government and other institutions including non-government organizations (NGOs) and academic institutions (Aliño, 1999, Miclat et al., 2008).

After the first national MPA forum in 1997, efforts to improve management and effectiveness of MPAs flourished throughout the country. Measures of MPA effectiveness (Pomeroy et al., 2005, Pajaro et al., 1999, Aliño et al., 2002, Alcala et al., 2008, PAMS, 2008) and methods for monitoring and evaluation (Uychiaoco et al., 2010, White et al., 2006b, White et al., 2006c) were developed, applied and improved. Experiences and lessons learned were shared in biennial MPA forums, MPA awards, and recognition activities at symposia of the Philippine Association of Marine Science. The MPA events and marine science symposia are coordinated to occur within the same year (Miclat et al., 2008, PAMS, 2008). Information networks such as the *Pambansang Alyansa ng mga Maliliit na Mangingisda at Komunidad na Nangangalaga ng Santuwaryo at Karagatan sa Pilipinas*[2] (Pajaro et al., 2010b, Tiburcio and Ancog, 2004) and the MPA Support Network (MSN) were formed (Miclat et al., 2008), and the Philippine Marine Sanctuary Strategy (PhilMarSaSt) was formulated (Campos et al., 2002, Arceo et al., 2004). The MSN is a multi-sectoral group composed of more than 20 organizations from academe, government agencies, NGOs, and people's organizations. It builds on the work done by PhilReefs and pursues the vision and goals stated in the PhilMarSaSt to improve MPA management effectiveness and to protect at least 10% of the country's coastal areas by 2020 (Campos and Aliño, 2008, Miclat et al., 2008).

The idea of inter-local government alliances (hereafter referred to as alliances) was initiated by the Department of Agriculture - Bureau of Fisheries and Aquatic Resources. In the 1990s, the Department implemented programs that facilitated establishment of bay-wide fisheries management projects. However, most of these alliances became dormant due to problems with leadership and finances (Pomeroy et al., 2010). Alliances of local governments and various other institutions re-emerged in the late 2000s as a means of coordinating MPA efforts to form networks and incorporating MPAs into ICM (White et al., 2005b) and ecosystem-based management (Armada et al., 2009, Eisma-Osorio et al., 2009). Various donor-assisted projects that support ICM and the implementation of MPA networks (e.g. (White et al., 2005b, GTZ, 2008, EcoGov, 2011) have increased in response to the PhilMarSaSt strategies for MPA management in the Philippines. These strategies

[2] PAMANA KA *sa Pilipinas*; A national alliance of fishermen and community-based MPA managers in the Philippines

promote increased linkages between MPAs, people and institutions (Arceo et al., 2004, Aliño et al., 2006).

There are now ~1,200 MPAs in the Philippines (Arceo et al., 2008). The Sustainable Archipelagic Development Framework (DENR-UNDP-MERF, 2004) and the Coral Triangle National Plan of Action (CTI, 2009) advocate the implementation of the PhilMarSaSt as the national framework for MPAs. One of the requirements in the Archipelagic Development Framework and National Plan of Action was to have at least one functional MPA network by 2008. There are several MPA networks in the Philippines to date. Establishing MPA networks in the country begins with existing MPAs, formation of alliances, and coordinating MPA establishment and governance (Aliño et al., 2006).

2.5 The process of scaling up and how it contributes to MPA effectiveness

There are over 1,200 MPAs (UPMSI-MSN unpublished database) established to date. Most of these MPAs can be considered as "paper parks" since they are not being implemented, and this lack of support has contributed to the continuous decline of the ecological status of the MPAs (Arceo et al., 2008, Campos and Aliño, 2008). Scaling up MPAs to form networks is a means to improve management of individual MPAs and coordinate MPA establishment through collective action and sharing of information and experiences (Aliño et al., 2006, TNC-WWF-CI-WCS, 2008). This section describes the current status of MPAs and the strategies used to scale-up MPAs in the Philippines.

The PhilMarSaSt outlines the objectives, processes and strategies for establishing MPAs and MPA networks. It provides a framework for sustaining and increasing effective MPA management in the country. The strategies focus on: 1) enhancing the planning and management processes; 2) improving the monitoring, evaluation and feedback systems; and 3) institutionalizing networks of people and ecosystems. The PhilMarSaSt advocates community-based participation matched with good governance practices from municipal governments and support from other institutions such as NGOs and government agencies to improve management practices (Campos et al., 2002, Arceo et al., 2004, Campos and Aliño, 2008).

It is commonly accepted that management effectiveness contributes to the ecological and socioeconomic success of MPAs (Pomeroy et al., 2005). Management effectiveness according to IUCN is "the degree to which management actions are achieving the goals and objectives of a protected area" (Hockings et al., 2000). Many MPAs in the Philippines

are still considered to be poorly managed or "paper parks," since these MPAs are legislated either nationally or under local governments but not fully enforced or implemented (Alcala and Russ, 2006, White et al., 2006c). Hence, previous assessments only considered 10-15% of the MPAs in the Philippines as effective (Bleakley and Wells, 1995). Recent studies have shown an increase of effective MPAs to 20-30% (Alcala et al., 2008). A key factor in this trend towards improved management has been the adoption and application of an MPA management effectiveness rating system devised through the collaboration of the core organizations that established the MSN (White et al., 2006c, Arceo et al., 2008).

A strategy promoted by the PhilMarSaSt and the MSN is the establishment of networks of people and MPAs. MPA networks are characterized by both social and ecological connectivity (White et al., 2006b, EcoGov, 2011). Establishing MPA networks promotes sharing of information and experiences and coordination of responsibilities and capabilities for management (Green et al., 2011, White et al., 2006b). Since community participation and decentralization are key in shaping how most MPAs were established in the country, MPA networks begin with the formation of alliances (Junio-Meñez et al., 2007, Eisma-Osorio et al., 2009, EcoGov, 2011).

Alliances are now being advocated to manage coastal resources more effectively (TNC-WWF-CI-WCS, 2008, Lowry et al., 2009, Pomeroy et al., 2010). An alliance is an example of a social network. A social network is defined as a pattern of "linkages that establish relations among individuals and organizations (and their institutions) across time and space" (Kofinas, 2009).

Alliances usually begin with a series of consultations facilitated and supported by an external party (e.g. NGO, academe, government agency). Neighbouring municipal governments and communities in shared fishing grounds are invited to discuss management problems related to MPAs and fisheries. Invited stakeholders identify their common problems, particularly the challenges of enforcing fishery ordinances in municipal waters when these are hampered by political jurisdictions. Formation of collaborative partnerships or alliances allows local government units to share experiences, resources and responsibilities. Alliances can ease problems of enforcement by sharing patrolling responsibilities and management costs (Pomeroy et al., 2010, Eisma-Osorio et al., 2009, Armada et al., 2009).

Alliance members have individual and shared responsibilities within their networks. Individually, each municipality still provides the basic management requirements for their individual MPAs. Collectively, all the member municipalities conduct participatory

biophysical monitoring, patrol their MPAs in their shared and contiguous municipal waters, and share experiences and expenses for joint activities. As the alliances grow older and gain more experience, the members jointly plan to establish new MPAs and invite other neighbouring municipalities and coastal areas to join (Junio-Meñez et al., 2007, GTZ, 2008). Membership of the alliances extends to include all of the municipalities surrounding entire bays, gulfs, and coasts. Management responsibilities are shared by alliances. There are also circumstances wherein provincial governments are involved in the alliances, and act as facilitators in place of organizations such as NGOs and academic institutions. Scaling up to entire bays or gulfs can enhance protection of ecological connectivity between and within ecosystems in the area (EcoGov, 2011, Campos and Aliño, 2008).

Combined with the formation of alliances in the Philippines, there are also efforts to incorporate science-based design concepts (CI-Philippines, 2009). It is widely believed that the MPAs already established are "ecologically connected", with larval dispersal facilitated by hydrodynamics influenced by the archipelagic nature of the country and the monsoon cycles (P.M. Aliño pers.comm; G. Russ pers. comm.; (ECOGOV, 2005)). Moreover, as the distances between MPA units are small (mostly 10-50 km), MPAs can be considered to be ecologically connected already (Weeks et al., 2010a). Scaling up then implies enhanced and strategic planning for establishment of new MPAs for biodiversity conservation or fisheries management. Designing new MPAs is now based on habitat representation, presence of species of special interest (e.g. turtles in the Sulu-Sulawesi Seascape; (SSME, 2004)), larval connectivity and entrainment potential, coastal and resource uses, shoreline development and threats (Miclat, 2008, CI-Philippines, 2009). Moreover, efforts to increase the no-take portions of existing MPAs to greater than 20 hectares are being promoted and beginning to take effect ((Arceo et al., 2008); MSN unpublished data). Efforts to scale up to marine biodiversity conservation corridors and entire seascapes are currently underway (CI-Philippines, 2009). Theoretically, scaling up to fishing grounds, entire bays and gulfs, marine biodiversity corridors and seascapes will eventually contribute to the formation of a national network of MPAs (DENR-UNDP-MERF, 2004).

2.6 Alliances in the Philippines: a step towards socio-ecological MPA networks, regulating resource use, and reducing threats to coastal and marine areas

Numerous local government alliances have been established in the Philippines to promote MPA networks (Lowry et al., 2009), ecosystem-based management (Pomeroy et

al., 2010), and integrated coastal management (Aliño and Junio-Meñez, 1995, Balgos, 2005). The establishment of most of these alliances was facilitated by bridging organizations – those with the ability to support and connect collaborations between institutions. Government agencies, NGOs, donor-assisted projects and the academe have initiated and funded coastal management programs (e.g. Fisheries Sector Project, Coastal Resource Management Project) that promote multi-stakeholder participation and attendance at meetings, trainings, and workshops. Discussions on coastal and marine resource problems ensue, identifying similar, if not mutual problems, among local governments and communities (usually represented by fisher folk associations). There are some cases, however, when alliances are self-organized. In these cases, a mayor would initiate discussions with neighbouring mayors, playing a crucial role in founding and leading the alliance (EU-PDF, 2010).

Many municipal governments and communities recognize that fisheries problems are related to the delineation of municipal waters and enforcement. Since there is no customary tenure in the Philippines, municipal fishermen are displaced by commercial fishers, by existing MPAs and/ or, privatization of coastal and marine areas (Cabral and Aliño, 2011), and are constrained by poor fishing grounds in their own municipalities. Municipal fishers complain to their respective local governments about commercial fishermen encroaching on municipal waters (PhilReefs, 2008, PhilReefs, 2010). Moreover, municipal fishers also complain about other neighbouring municipal fishermen fishing in their fishing grounds. Generally, fishermen oppose establishment of MPAs because their livelihoods would be adversely affected. However, helping them understand the evidence for increasing fish catch and habitat health related to MPAs enables them to shift their perceptions (EcoGov, 2011).

The formation of alliances and MPA networks facilitates the creation of ordinances and contiguous municipal waters that aid in reducing illegal fishing practices and territorial disputes among municipal fishermen (Junio-Meñez, 2008) (EcoGov, 2011). Scaling up also provides livelihood opportunities for fishermen (Junio-Meñez, 2008). Fishermen who participate in the management of the MPAs and networks can get financial incentives and subsidies. For example, fishermen who volunteer to patrol MPAs get health insurance (Junio-Meñez, 2008). In the province of Batangas in the VIP MPA network, fishermen who have been trained in SCUBA diving and coral reef monitoring get extra income when they are outsourced to conduct MPA assessments in other municipalities within their province (L. Solestre pers. comm.). Fishermen involved in MPA management and networks can be empowered by seeing first-hand the benefits of their efforts (Uychiaoco et

al., 2005). They also become environmental advocates, because they share their experiences with other members of the community (A. Ebue, pers. comm., (EcoGov, 2011).

After consulting with their respective communities and other local government units, municipal governments create and sign a memorandum of agreement, signalling their interest and participation in an alliance. The members of the alliance also draft a constitution or by-laws. The agreement and the alliance's constitution serve as a binding contract and facilitate increased accountability and transparency among local governments and their constituents (EU-PDF, 2010).

The municipal governments in an alliance create common fisheries ordinances to mitigate their mutual fisheries problems. These laws can include a more organized system of fisher and gear registration, and improved judiciary processes for fishing violations. Creating a unified fisheries ordinance can also establish contiguous and shared municipal waters to prevent overlapping claims on municipal waters. Based on the Fisheries Code, municipal waters extend outwards from the shoreline for 15 km. However, narrow bays and gulfs lead to territorial disputes among municipalities. Establishing contiguous municipal waters can ease jurisdictional conflict and improves cost-effectiveness of enforcement through sharing of costs and patrolling responsibilities by government officials and local fishermen (Aliño et al., 2006, Campos and Aliño, 2008).

Once contiguous municipal waters have been organized, other joint management activities are pursued, such as awareness campaigns and biophysical monitoring. These activities are financially supported by creating municipal funds and ringfencing funds, or trust funds earmarked for conservation use (P.M. Aliño pers. comm.; (Junio-Meñez et al., 2007, Cabral and Aliño, 2011). Moreover, municipalities also outsource staff (e.g. fishermen trained in participatory coral reef assessments) to monitor their MPAs (L. Solestre pers. comm., P. Beldia pers. comm.). It has also been observed that municipalities, with or without the support of bridging organizations, initiate joint planning activities to set up new MPAs or expand existing ones (D. Maramba pers. comm.). Larger MPAs can then be established that straddle two or more municipalities and include entire ecosystems (e.g. entire reefs). Additionally, alliance members can increase their membership by inviting other neighbouring municipalities to participate (L. Solestre pers. comm., P. Beldia pers. comm.). Another advantage of alliances is their potential to reduce threats such as land degradation arising from poor land use practices. Land degradation increases siltation and pollution in coastal areas. It is believed that municipalities that are part of alliances can

work together to jointly manage their watersheds, conduct reforestation projects, and mitigate effluents coming from industries and agriculture (R. Mancao pers. comm.).

Some 40 alliances have been proposed or established in the Philippines (Figure 2.1, Table 2.2). Three of these alliances are inter-barangay (village) alliances. These are located in Puerto Princesa City and in the municipalities of Dauin and Masinloc. Thirty-nine alliances have data on the participating municipalities and barangays, 34 have data on the existing MPAs, and 29 have information on the total area protected (no-take and fishery reserve areas). A total of 270 cities and municipalities are in collaborative engagements. There are 484 existing MPAs that have been recorded within the jurisdictions of these partnerships. The total area protected within alliances, for those MPAs with data on size, is ~815 km^2.

Figure 2.1 presents the distributions of the alliances and the MPAs within their jurisdictions. Based on the MPA goals of the Coral Triangle National Plan of Action, there should be at least one operational MPA network in each of the marine biodiversity corridors (n = 10) and biogeographic regions (n = 6) in the Philippines (CTI, 2009). Most of the MPA network initiatives are located in the Visayan Sea biogeographic region, which is also the part of the Philippines with the highest number of established MPAs. In this region, most of the alliances are located in the Bohol Sea and Panay Gulf corridors. There is a big gap in terms of representation of MPAs and networks in the other biogeographic regions, particularly in the North and South Philippine Sea. There are no networks in the Babuyan, Balabac Strait, Tapiatana and Sibutu Passage corridors.

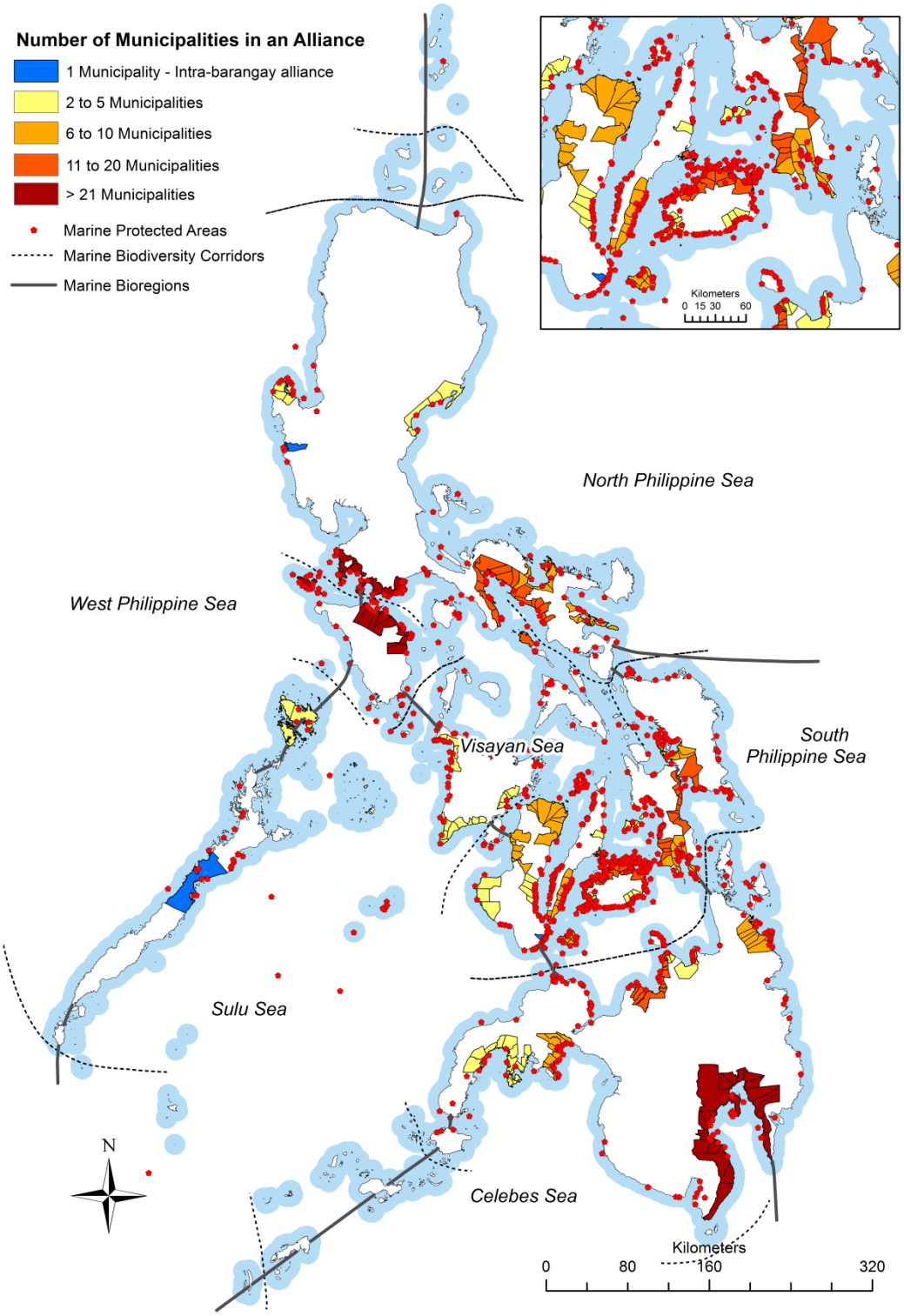


Figure 2.1 Local government alliances shown as clusters of shaded administrative units and the marine protected areas within their networks and municipal waters (municipal waters are within 15 km of the coastline). The inset shows the MPAs and alliances in 3 provinces in the Visayan Sea biogeographic region. Note the high number of MPAs.

Table 2.2 List of alliances of local government units managing MPAs in the Philippines

	Name of Alliance	Area and Province(s)	Year Established	# LGUs	# MPAs	Total MPA Area (km^2)
1	San Miguel Bay Integrated FARMC	San Miguel Bay, Camarines Norte & Camarines Sur	1993	7 municipalities	U	U
2	Banate Bay RM Council	Banate Bay, Iloilo	1996	4 municipalities	6	2.53
3	Ragay Gulf Integrated Management Council	Ragay Gulf; Camarines Sur, Quezon & Masbate	1996	17 municipalities	8	11.7
4	Southern Negros Coastal Development Management council	Southern Negros Occ; Negros Occidental	1996	2 cities, 1 municipality	4	89.5
5	LIPASECU Baywide Management Alliance	Pandan Bay, Antique	1997	4 municipalities	18	0.3
6	Lagonoy Inter-LGU Alliance	Lagonoy Gulf; Albay	1998	1 city, 4 municipalities	U	U
7	Sogod Bay Inter-LGU Alliance	Sogod Bay; Southern Leyte	1998	11 municipalities	U	U
8	Council of Anini-y, San Jose, Tobias Fornier and Hamtic for Viable Environmental Management	Antique	1999	4 municipalities	9	1.7
9	Davao Gulf Management Council	Davao Gulf, Davao del Sur; Davao del Norte; Compostella Valley; Davao Oriental	1999	5 cities, 18 municipalities	41	156.3
10	Illana Bay Regional Alliance 9	Illana Bay, Zamboanga del Sur	1999	1 city, 7 municipalities	17	9.3

	Name of Alliance	Area and Province(s)	Year Established	# LGUs	# MPAs	Total MPA Area (km^2)
11	Northern Iloilo CRM Council	Northern Iloilo; Iloilo	1999	10 municipalities	U	U
12	Northern Negros Aquatic Resources Management and Advisory Council	Northern Negros Occidental	2000	5 cities; 3 municipalities	6	21.9
13	Lanuza Bay Development Alliance	Lanuza Bay, Surigao del Sur	2002	7 municipalities	16	7.2
14	Southern Iloilo CRM Council	Southern Iloilo; Iloilo	2002	5 municipalities	U	U
15	ABBA LGU Alliance	Lingayen Gulf, Pangasinan	2003	4 municipalities	16	22
16	Inte-LGU CRM Committee (Baler Bay MPA Network)	Baler Bay, Aurora	2003	4 municipalities	4	6.9
17	PaDaYon Bohol Marine Triangle Management Council	Bohol Marine Triangle; Bohol	2004	3 municipalities	15	1
18	Alliance of Seven	Eastern Samar	2005	7 municipalities	U	U
19	Central Negros Council for Coastal Resource Development	Negros Occidental	2005	1 city; 6 municipalities	U	U
20	Masinloc MPA Network	Masinloc-Oyon Bay, Zambales	2005	4 barangays	4	2
21	Southeast Cebu CRM Council	Cebu Strait, Cebu	2005	8 municipalities	22	3.0
22	Maribojoc Bay Integrated Resource	Maribojoc Bay; Bohol	2006	1 city; 4	17	1.4

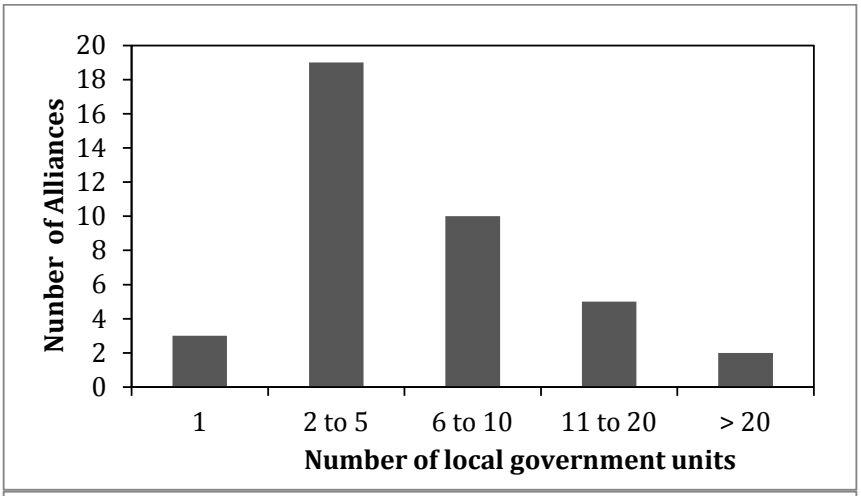
	Name of Alliance	Area and Province(s)	Year Established	# LGUs	# MPAs	Total MPA Area (km^2)
	Management			municipalities		
23	Camotes Sea CRM Council	Camotes Sea, Cebu	2006	1 city, 4 municipalities	9	5.0
24	BATMan Marine Protected Area Network	Tanon Strait, Negros Oriental	2008	4 municipalities	17	2.1
25	Dauin Municipal Federation and Fisherfolk Association	Dauin, Negros Occidental	2008	7 barangays	9	0.59
26	DuGJan MPA Network	Bohol	2008	3 municipalities	3	0.4
27	Verde Island Passage MPA and Enforcement (Provincial) Network	Verde Island Passage, Batangas; Occidental Mindoro; Mindoro Oriental	2008	2 cities, 20 municipalities	69	170
28	Macajalar Bay Development Alliance	Northern Macajalar Bay,	2009	2 cities, 12 municipalities	13	U
29	Alliance of Local Fisheries & Resource Mgt. & Devt. Council	Leyte Gulf, Leyte and Samar	2010	1 city, 10 municipalities	4	1.7
30	Ginoog Bay LGU Alliance	Ginoog Bay, Misamis Oriental	2010	5 municipalities	15	127.7
31	Carigara Bay Integrated FARMC	Carigara Bay, Leyte	mid-1990s	U	U	U
32	Calamianes Islands LGU Alliance	Calamianes Islands, Palawan	proposed	5 municipalities	13	92.2
33	Danajon Municipal Cluster Network (Danajon Bank MPA Network, Cluster	Danajon Bank; Bohol, Cebu, Leyte & Southern Leyte	proposed (2009)	17 municipalities	56	22.5

	Name of Alliance	Area and Province(s)	Year Established	# LGUs	# MPAs	Total MPA Area (km^2)
	Law Enforcement Councils)					
34	ATOM LGU Alliance	Dumanquillas Bay, Zamboanga Sibugay	proposed (2008)	4 municipalities	2	U
35	MalaBu LGU Alliance	Dumanquillas Bay, Zamboanga Sibugay	proposed (2008)	2 municipalities	1	U
36	SiNPaK LGU Alliance	Sibuguey Bay, Zamboanga Sibugay	proposed (2008)	4 municipalities	2	U
37	TRI LGU Alliance	Sibuguey Bay, Zamboanga Sibugay	proposed (2008)	3 municipalities	4	U
38	South Maqueda Bay Fisheries Network	Maqueda Bay; Samar	proposed (2009)	6 municipalities	6	1.5
39	Puerto Princesa City-wide FARMC and barangay clusters	Puerto Princesa Bay, Honda Bay, Western Coast; Palawan	U	66 barangays	7	43
40	Siquijor MPA network	Siquijor province	U	6 municipalities	17	1.93

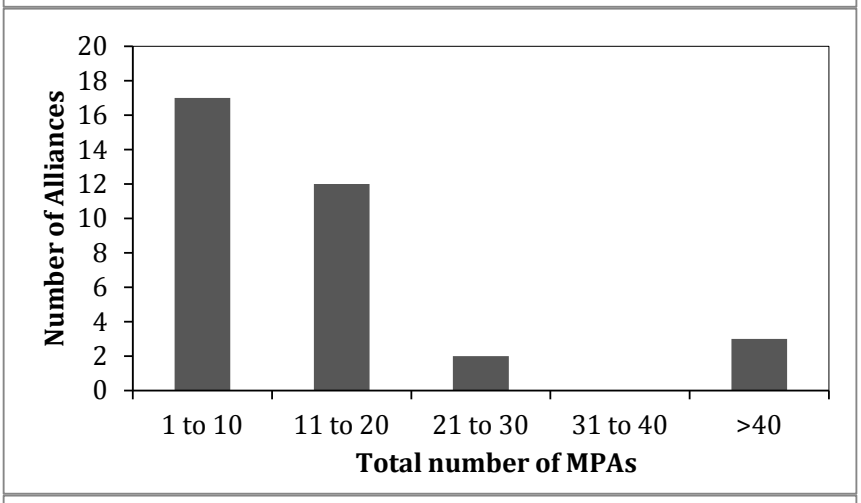
Note: U – undetermined; Sources: (Armada et al., 2009, Lowry et al., 2009, Eisma-Osorio et al., 2009, Pomeroy et al., 2010, Alcala et al., 2008, GTZ, 2008, EU-PDF, 2010, CI-Philippines, 2009, PhilReefs, 2010, PhilReefs, 2008)Alcala et al., 2008, UPMSI-MSN Database unpublished MPA database

The current status of most of the alliances listed in Table 2 is still relatively unknown. There is very little information in the literature indicating whether the alliances are still operating. Most of the alliances consist of just 2 to 5 municipalities (Figure 2a). This could indicate the limitations of municipal governments in terms of management capacity and degree of coordination. Larger alliances (e.g. bay-wide management councils) are harder to organize and maintain. There was not enough information in the literature to provide an in-depth assessment of management effectiveness. However, based on the literature, 60% of the 40 alliances are formally established by virtue of a memorandum of agreement and 24% are active and regularly meet and conduct joint activities. Around 13% of the active alliances are still supported by bridging organizations. The LIPASECU alliance is notable in being the oldest existing network that is self-organized and still active.

(a)



(b)



(c)

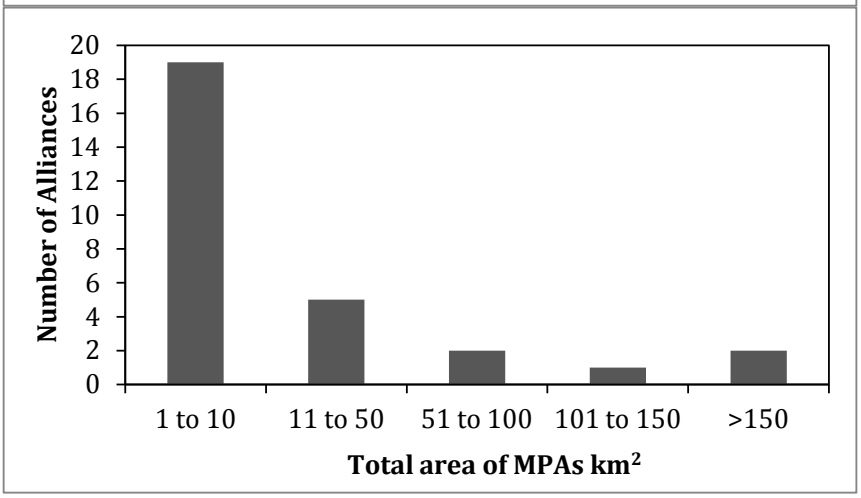


Figure 2.2 Frequency distribution of alliances in relation to (a) number of local government units, (b) total number of MPAs, and (c) total area of MPAs under collaborative agreement.

Not all of the municipalities participating in alliances have established MPAs, so membership of alliances is an opportunity for them to improve the design of their MPA

network in terms of representation, connectivity and resilience. About 52% of alliances have between 1 and 10 MPAs (Figure 2b). Around 65% of the alliances with data on MPA size have networks of MPAs totally between 1 and 10 km^2 (Figure 2c). About 10% of the alliances have total MPA areas that are greater than 100 km^2.

The efforts to scale up MPAs in the Verde Island Passage (VIP) grew from the executive order on biodiversity (E.O. 578 Establishing the National Policy on Biological Diversity prescribing its implementation throughout the country particularly the Sulu Sulawesi Marine Ecosystem and the Verde Island Passage Marine Corridor). The VIP MPA network then became the model for scaling up MPAs to form MPA networks. Planning for this network was implemented by CI-Philippines. CI-Philippines conducted a series of workshops with various MPA and CRM experts and stakeholders (e.g. fisherfolk representatives) to create suitability layers for new MPAs to enhance the network (Quibilan et al., 2008; CI-Philippines 2009). CI-Philippines also collaborates with the provincial governments surrounding the passage to scale up management. The network is divided into three provincial clusters, comprised of Batangas (11 municipalities and 1 city), Oriental Mindoro (7 municipalities and 1 city), and the local governments of Lubang and Looc in Occidental Mindoro (P. Beldia pers.comm. & L. Solestre pers.comm.). Other alliances that can be considered as both social and ecological MPA networks are: Camotes Sea CRM Council, Danajon Municipal Cluster Network, Southeast Cebu CRM Council, Illana Bay Regional Alliance 9, and the MPA clusters in the Bohol Sea. These alliances have benefited from the technical and financial support of various bridging organizations to establish themselves, design their MPA networks, and fund their activities. Examples of bridging organizations are the Philippine Environmental Governance Project (for Camotes Sea and Illana Bay), the Coastal Conservation Education Foundation (for Southeast Cebu), and Silliman University (for the Bohol Sea). Support has also been provided by respective provincial governments

2.7 Challenges and potential solutions for MPA network establishment, management and governance

Formation of alliances is crucial to developing socio-ecological MPA networks in the Philippines. However, there have been challenges to designing and sustaining the joint MPA initiatives that are the motivation for forming alliances. Alliances are sometimes hindered by their lack of capacity to design their MPA networks, to expand into new municipalities, and to initiate innovative management activities. Moreover, both the

alliances and individual municipalities also depend on continuity of leadership and sustainable financing to maintain MPAs and coastal management activities. Lastly, the alliances have been constrained by the backgrounds and interests of members, particularly those of political leaders.

Alliances have limited capacity to design MPA networks with regional-scale and ecosystem-based perspectives. Members of alliances are still highly dependent on bridging organizations for technical guidance on designing MPA networks. Bridging organizations generally act in specific areas (e.g. FISH Project in Danajon Bank and Lanuza Bay). Hence, it is important for bridging organizations to communicate with each other and coordinate their own efforts to improve the design of MPA networks. This reinforces the importance of information networks such as MSN (Pajaro et al., 2010). The MSN has the combined expertise of various marine scientists and coastal managers from different sectors throughout the country. Members of the MSN can work cooperatively to enhance MPA network design nationally and facilitate scaling down of regional MPA network designs.

Scaling down involves the implementation of regional-scale designs at local scales. Inevitably, this requires extensive negotiation with and participation of local interests, with changes to the overall design when local preferences have not been accounted for with regional data and objectives (Pressey et al. in review). This highlights an unresolved problem in marine spatial planning: the gap between regional designs and local actions. Regional designs consider the spatial context of individual conservation efforts. Designs provide spatial and temporal context for, and promote integration of, individual local actions (Margules & Pressey, 2000). However, regional designs have a poor track record in terms of implementation, due largely to the lack of local buy-in (Hviding, 2006). Hence, for regional designs to be used to guide local actions, scaling down is necessary for acceptance by communities. For example, implementing large national MPAs in the Philippines is challenging, since they are not widely accepted by communities and are only deemed to work in areas without any communities dependent on marine resources (Hind et al., 2010). Higher-level government institutions implementing national MPAs should then engage with communities for regionally designed MPAs to be effective.

Scaling up and scaling down are both constrained by the lack of information flow and coordination at various levels of planning and decision-making. To address the challenges of information flow and coordination, it is necessary to strengthen institutional capacity and governance, and support continuous engagement among government and non-government institutions and communities (Mills et al., 2010; Lowry et al., 2009). The ways in which scaling up and scaling down can be integrated have still to be explored.

Better coordination between communities and institutions is necessary if scaling up local actions and scaling down regional designs are to be successful. Problems associated with coordinating efforts of various institutions can be remedied by following the mandate of the executive order on ICM (E.O. 533 ICM). The EO 533 mandates the implementation of ICM in all coastal and marine areas and incorporation of management considerations for watersheds, estuaries and wetlands. The order also mandates various institutions (e.g. government agencies, private sectors) to coordinate their efforts and mainstream ICM programs from national to local government levels. Government agencies need to increase their participation in mainstreaming and implementing ICM programs. The potential role of agencies is significant, because they have offices throughout the country and could aid in disseminating information through their regional development councils and working closely with provincial governments. A few provincial governments are increasingly aware of coastal and resource management issues. Some of these provincial governments are facilitating and hosting alliance meetings (e.g. Verde Island Passage MPA network) and providing financial support for municipal governments in alliances that are working well (e.g. Cebu province for Camotes Sea CRM Council and the South Cebu CRM Council). Most of the provincial governments are, however, still disconnected from municipal government officials. This can be remedied by establishing environment and natural resource offices at the provincial level. Establishing provincial environment offices is a means to increase involvement in coastal and resource management by providing financial and organizational support to municipal MPAs and other environment-related efforts. Municipal governments could then coordinate directly with provincial governments on the state of their coastal areas.

Similar to individual MPAs, alliances are also constrained by political changes in leadership and lack of sustainable financing. Leaders or hosts - roles usually played by bridging organizations - are needed to facilitate and fund meetings and liaise with members. Most alliances become inactive when support from bridging organizations lapses (e.g. established alliances by the Fishery Sector Program) (Pomeroy et al., 2010), highlighting the importance of leadership. A "champion" mayor can take the role of facilitator and organizer, but mayors can be replaced in elections if communities believe they are not benefiting from the management initiatives (EU-PDF, 2010). It is then crucial to include and empower community members and other local government officials to pursue coastal management initiatives and MPAs. Furthermore, members of alliances should assert themselves and their legal foundations (e.g. memoranda of agreement, by-laws) when other members lag behind in management performance and support. Alliances

can also initiate incentive systems to recognize good management practices and can apply for conservation grants to establish trust funds (EcoGov, 2011).

Relationships between people and institutions within alliances are also influenced by their backgrounds, interests, and available resources. Differences between municipalities in development objectives and economic status affect their participation and commitment. For example, municipalities that are highly industrialized and have higher incomes might prioritize development to maintain income over conservation and resource management. It is important that members continue to attend alliance meetings to allow discussions on experiences and build rapport. Moreover, it is also important for members to understand that their contributions are important and will benefit them (EcoGov, 2011).

Assessment of the management effectiveness of alliances has not been done in the Philippines. It is important to evaluate the effectiveness of alliances to determine if they are implementing activities and to document and acknowledge good management practices. Although each alliance will have different governance arrangements to suit its objectives and needs, there are generic management indicators applicable to the effectiveness of any alliance. Tools for assessing the management effectiveness of alliances should consider programmatic and management standards vital to effective management. Programmatic indicators determine whether management is actually undertaken. They measure the activities of alliances for their MPAs and MPA networks. Management indicators evaluate the outcomes of the management initiatives, by assessing whether the objectives of alliances are being met (USAID, 2001). Analysis of the social network dynamics of alliances should also be considered. Social network analysis provides graphical representations of relationships within and between alliances. These relationships can be related to information flow, level of coordination, contributions to management, influence and trust (Bodin and Crona, 2009, Bodin et al., 2006), so network analysis can identify key individuals and institutions and blockages in flows of information and help to identify ways of improving governance.

2.8 Summary and Conclusion

The motivation for forging local government alliances comes from recognizing common threats or crises threatening heritage and pride (e.g. declining fisheries production threatening food security and livelihoods). The formation of local government alliances and institutional collaborations began in the Philippines in the 1990s. The potential advantages that have motivated formation of alliances are: enhanced enforcement of

MPAs; more cost-effective management of MPAs and MPA networks; improved design of MPAs and MPA networks; better coordination of responses to threats to marine ecosystems from terrestrial activities; facilitation of conflict resolution; and empowerment of communities and institutions. Alliances contribute to scaling up community-based and co-managed MPAs into socio-ecological MPA networks. Members from neighbouring municipalities jointly plan, establish and manage MPAs and MPA networks using scientific design principles. These collaborative efforts also establish linkages among different levels of governments and other institutions such as academe, government agencies, NGOs and people's organizations. However, the benefits achieved from coordinating MPA establishment, although potentially large, and the effectiveness of institutional collaborations are still largely unknown. Most of the alliances depend heavily on bridging organizations to help them design their MPA networks. Some of the institutional collaborations that have been established are no longer active due to problems with leadership and funding and the lack of shared visions and community empowerment. There is, therefore, a need to assess the effectiveness of these institutional collaborations by developing programmatic and management indicators and assessing how governance is influenced, negatively or positively, by the social and institutional dynamics within and between alliances. Knowledge of the relationships between members and the factors that affect their relationships can contribute to enhancing management and governance initiatives.

CHAPTER 3

BENEFITS AND CHALLENGES OF SCALING UP MARINE PROTECTED AREA NETWORK EXPANSION IN THE VERDE ISLAND PASSAGE, CENTRAL PHILIPPINES

3.1 Abstract

Locally-established marine protected areas (MPAs) have been proven to achieve local-scale fisheries and conservation objectives. However, since these MPAs were not designed to form ecologically connected networks, their contributions to broader-scale goals such as complementarity and connectivity are limited. In contrast, integrated networks of MPAs designed with systematic conservation planning are assumed to be more effective and to have larger benefits than collections of locally-established MPAs. However, there is little empirical evidence that clearly demonstrates the supposed advantages of systematic MPA networks due to their poor record of implementation related to lack of local buy-in. An intermediate scenario for the expansion of MPAs is scaling up of local decisions, whereby locally-driven MPA initiatives are coordinated through collaborative partnerships among local governments and their communities. Coordination has the potential to extend the benefits of individual MPAs and perhaps to approach the potential benefits offered by systematic MPA networks. I evaluated the benefits of scaling up local MPAs to form networks by simulating seven expansion scenarios for MPAs in the Verde Island Passage, central Philippines. The scenarios were: uncoordinated community-based establishment of MPAs, two scenarios reflecting different levels of coordinated MPA expansion through collaborative partnerships, and four scenarios guided by systematic conservation planning at different spatial scales of governance. I measured benefits through time in terms of achievement of habitat representation in each scenario. The outcomes of this research provide evidence for the benefits of coordinating MPA initiatives, contributing to better understanding by researchers, conservation planners, natural-resource managers, and policy-makers of the potential benefits of scaling up local MPAs.

3.2 Introduction

International conservation policies have encouraged the formation of a global network of marine protected areas (MPAs) as one approach to mitigating the continuing decline of fisheries and marine ecosystems (Sala et al., 2002). Ideally, systematic conservation planning (hereafter referred to as conservation planning) should be employed to create regional designs of ecological MPA networks (Fernandes et al., 2005). Conservation planning is a spatially-explicit framework for designing and locating actions that promote biodiversity conservation and sustainable use of natural resources to help preserve ecosystem function and support human activities (Margules and Pressey, 2000, Pressey and Bottrill, 2009). This approach is promoted for selecting MPAs because, at least in principle, it is an efficient means to attain conservation objectives and can incorporate diverse types of data and views of stakeholders (Pressey and Bottrill, 2008, Hansen et al., 2011). However, conservation planning has a poor track record of translating into local actions (Knight et al., 2008). Initially, conservation planning was based on purely biophysical information (Cowling et al., 2004), but efforts to incorporate socioeconomic considerations are increasing (Klein et al., 2008, Ban and Klein, 2009). Beyond the considerations that have been made operational in conservation plans, successful implementation of protected areas still depends on numerous social, economic, and political factors, including institutional capacity and priorities, financial constraints, and tenure (Knight and Cowling, 2007, Aswani and Hamilton, 2004, Berkes, 2007). Moreover, management and governance of extensive marine systems is very complex and requires innovative approaches to link various institutions across multiple scales (Fidelman et al., 2012).

Establishment and management of MPAs, particularly in the Coral Triangle, have been initiated mainly by local communities (Alcala and Russ, 2006, Johannes, 1998). Locally-established MPAs have been effective at achieving local-scale fisheries and conservation objectives (Alcala et al., 2005, Govan, 2009). Examples of local-scale objectives are to maintain and/or increase the abundance and biomass of economically important fish species and to maintain or improve habitat condition (Abesamis et al., 2006, Russ et al., 2004). These local MPAs are relatively easy to implement because of the direct and tangible benefits to local communities, increasing support from the people affected by the constraints on resource use (Aswani et al., 2007, Christie et al., 2002). Community members are directly involved in the decision-making processes and management, which enables them to perceive the benefits from their initiatives (Pollnac et al., 2001, Alcala, 1998, Junio-Meñez, 2008). However, locally established MPAs are typically small (usually <1 km^2) and were not intended to form ecological networks (Govan, 2009, Weeks et al.,

2010a). These small MPAs might not contribute substantially to broader objectives, due to the lack of consideration of regional-scale ecological processes and complementarity between MPAs across regions (Weeks et al., 2010a, Sala et al., 2002). Examples of broader objectives are to maintain connectivity between MPAs by 1) spacing them to allow for varying larval dispersal distances; and, 2) protecting all habitat types whenever possible, to cater for species that require different habitats at various ontogenetic stages (McCook et al., 2009).

Most of the MPAs in the Coral Triangle region are small, locally established, and locally managed due to decentralization of government or customary marine tenure (Mills et al., 2010). These MPAs are assumed to be insufficient to contribute to the regional and global networks of MPAs that are mandated by international policies (Weeks et al., 2010a). However, there is a growing understanding of the need to match ecological scales with governance scales in the region (Mills et al., 2010). Conservation planning recognizes the broad spatial extents over which ecological systems and processes occur. It creates regional designs that can be "scaled down" or used to guide local actions (Pressey et al., 2013). Alternatively, local actions can be "scaled up" or coordinated to address broader-scale conservation objectives.

Scaling up is one approach to bridge the gap between regional conservation planning and local actions. It involves the expansion of local actions using coordinated and integrated approaches with a regional perspective. It entails widening the context for local decisions from smaller areas to larger areas (e.g. bays to seascapes) to address both local and broader-scale objectives, which requires involvement of more people and institutions (Chua, 2006, Junio-Meñez et al., 2007, Horigue et al., 2012). In the context of forming MPA networks, coordinated expansion is defined here as establishing additional MPAs based on joint planning through collaborative initiatives to address objectives across multiple governance units.

Examples of collaborative initiatives in the Philippines are the inter-local-government alliances (hereafter referred to as alliances). These alliances are formed amongst neighbouring local governments within a bay or fishing ground that are usually facilitated and supported by bridging organizations, including academe, non-government organizations, and NGOs. The formation of alliances is catalysed by the urgency and understanding of local governments' needs to share responsibilities to address mutual problems, such as overfishing and pollution, that they cannot solve on their own. Initially, the purpose of the alliances is to share experiences and management activities of existing MPAs (e.g. enforcement, awareness campaigns) and create mutual funds systems. As the

alliances gain more experience, they are able to coordinate establishment of additional MPAs to form MPA networks. These MPAs can be larger, sometimes straddling municipal boundaries and addressing broader-scale objectives such as improved habitat representation and connectivity (Horigue et al., 2012, Junio-Meñez et al., 2007).

While scaling up shows much promise in addressing regional objectives, there is still no empirical evidence that demonstrates the benefits of coordinated establishment of MPAs. This paper builds on the work by Mills et al. (2012) that compared two ways in which locally-managed marine areas (LMMAs) could be expanded in Fiji. They compared the efficiency of the ad hoc, uncoordinated approach to MPA expansion with conservation planning in terms of attaining habitat representation objectives. As expected, they found that the uncoordinated LMMA approach was less efficient than conservation planning, achieving only half of the objectives for habitat representation over 10 years with the same rate of MPA expansion. In this chapter I add another dimension to the work of Mills et al. (2012), by demonstrating how coordinated MPA establishment in the Philippines is done, and describing its benefits compared to both conservation planning and establishment of MPAs without coordination. The two levels of coordination in my scenarios reflect the realities of MPA establishment in the Philippines, since coordination of initiatives is affected by various geopolitical, social, and economic factors.

I aim to describe how much benefit can be gained from coordinating initiatives as compared to uncoordinated community-based initiatives in terms of achieving habitat representation objectives. Specifically, the goals in this chapter are to: a) simulate the expansion of MPA networks using seven different scenarios; b) determine the difference between scenarios in achieving objectives for habitat representation; and c) assess the potential advantages of coordinating initiatives as compared to uncoordinated community-based efforts and systematic conservation planning.

3.3 Methods

3.3.1 Policy context and the study region

In 2006, the Philippines National Policy on Biological Diversity (Executive Order 578) identified the Sulu-Sulawesi Marine Ecoregion and the Verde Island Passage as national priorities for marine conservation. The Verde Island Passage is deemed to be at the "centre of the centre" of marine diversity in the Indo-Malay-Philippines archipelago (Carpenter and Springer, 2005). It is home to many marine species, including marine mammals, turtles, economically important species of pelagic and reef fish, corals, and other invertebrates. The Verde Island Passage is also subject to numerous threats such as overfishing, shipping, and pollution from upland agriculture and shoreline development and industries. The call to protect the Verde Island Passage has made it the model for building MPA networks in the Philippines (Quibilan et al., 2008). For all these reasons, I used the Verde Island Passage as the planning region for this study.

Efforts to establish the Verde Island Passage MPA network have been made by Conservation International–Philippines (CI-Philippines), together with the local governments responsible for the region's coastal ecosystems. The region is surrounded by five provinces, namely: Batangas, Marinduque, Occidental Mindoro, Oriental Mindoro, and Romblon (Figure 3.1). It is characterized by generally narrow and fringing marine habitats, with very steep drop-offs in the centre of the Passage, such as the narrowest portion where Isla Verde is located, around the islands of Romblon and Marinduque, and in some coastal areas of Occidental Mindoro. The shallowest portions of the Passage are located in Batangas, and some portions of Lubang Island in Occidental Mindoro (Figure 3.2) (Quibilan et al., 2008). The Verde Island Passage MPA network is currently administered by three clusters of collaborating local governments. The two provincial networks are the Batangas Province MPA and enforcement network and the Oriental Mindoro Province MPA and enforcement network. Enforcement teams assist the MPA managers by coordinating patrolling activities and sharing information on illegal fishers in MPAs and commercial fishers encroaching on municipal waters. The enforcement teams are comprised of fisher volunteers, police, and coast guards. In addition, the third administrative cluster consists of the municipalities of Lubang and Looc in Occidental Mindoro, which have initiated collaborations to form their own MPA network within the Verde Island Passage.

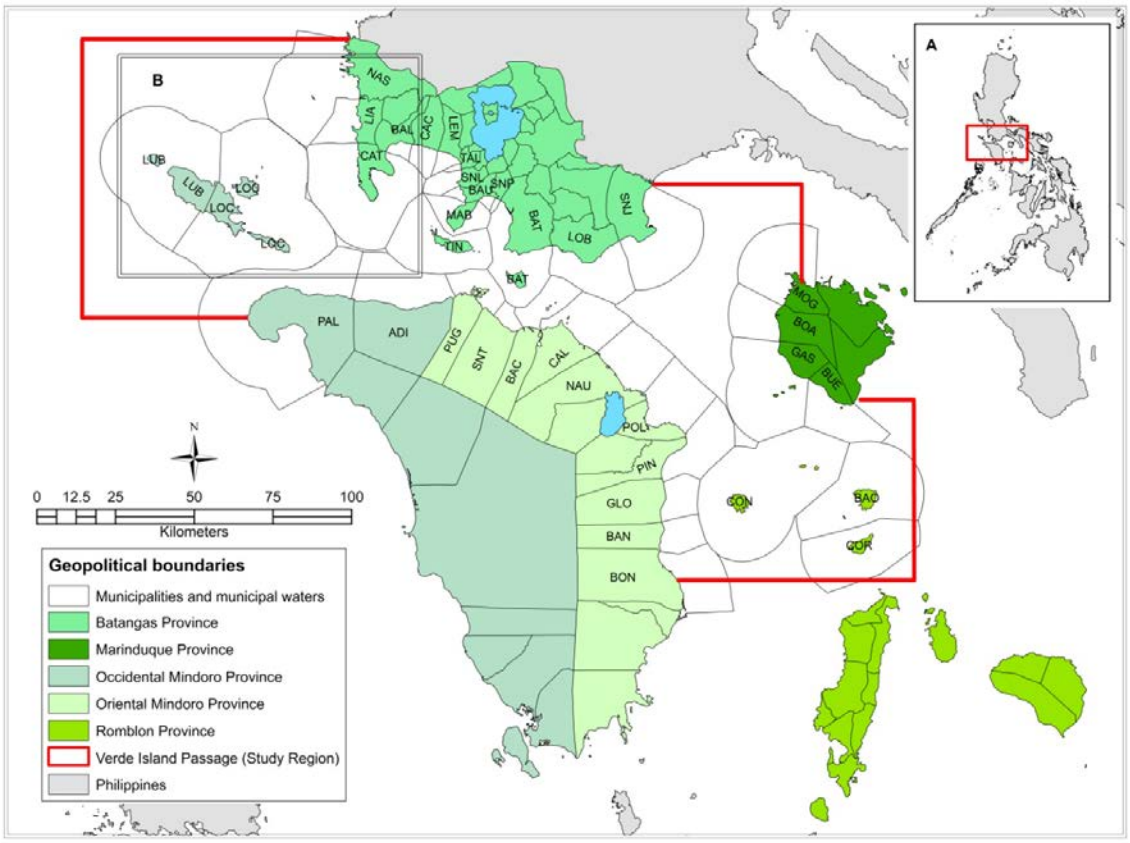


Figure 3.1. Geopolitical scales within the Verde Island Passage. The five provinces surrounding the study region are indicated by colours. Inset A) Location of the Verde Island Passage within the Philippines. Inset B) Area shown in detail in Figure 3.2 to illustrate the habitat mapping that covers the entire study region. The 36 coastal municipalities surrounding the Verde Island Passage are listed here for each province. Batangas Province: NAS – Nasugbu, LIA – Lian, CAT – Calatagan, BAL – Balayan, CAC – Calaca, LEM – Lemery, TAL – Taal, SNL – San Luis, BAU – Bauan, MAB – Mabini, TIN – Tingloy, SNP – San Pascual, BAT - Batangas City, LOB – Lobo, SNJ – San Juan. Marinduque Province: MOG – Mogpog, BOA – Boac, GAS – Gasan, BUE – Buenavista. Occidental Mindoro Province: LUB – Lubang, LOC – Looc, PAL – Paluan, ADI – Abra de Ilog. Oriental Mindoro Province: PUG – Puerto Galera, SNT – San Teodoro, BAC – Baco, CAL – Calapan City, NAU - Naujan, POL – Pola, PIN – Pinamalayan, GLO – Gloria, BAN – Bansud, BON – Bongabong. Romblon Province – CON – Concepcion, BAO – Banton, COR – Corcuera.

Around 1.5% (~170 km^2) of the Verde Island Passage's marine extent was protected as of 2011. This total area consists of 69 established MPAs, zoned as permanent no-take areas or permanent marine reserves where fishing is restricted only to hook and line. Most of these no-take zones and marine reserves protect coral-reef habitats. Efforts to increase the number and extent of MPAs in the region, and to protect non-coral habitats, are underway to fulfil the targets for habitat representation urged by various international policies, such as the Conservation on Biological Diversity and Coral Triangle Initiative (CTI).

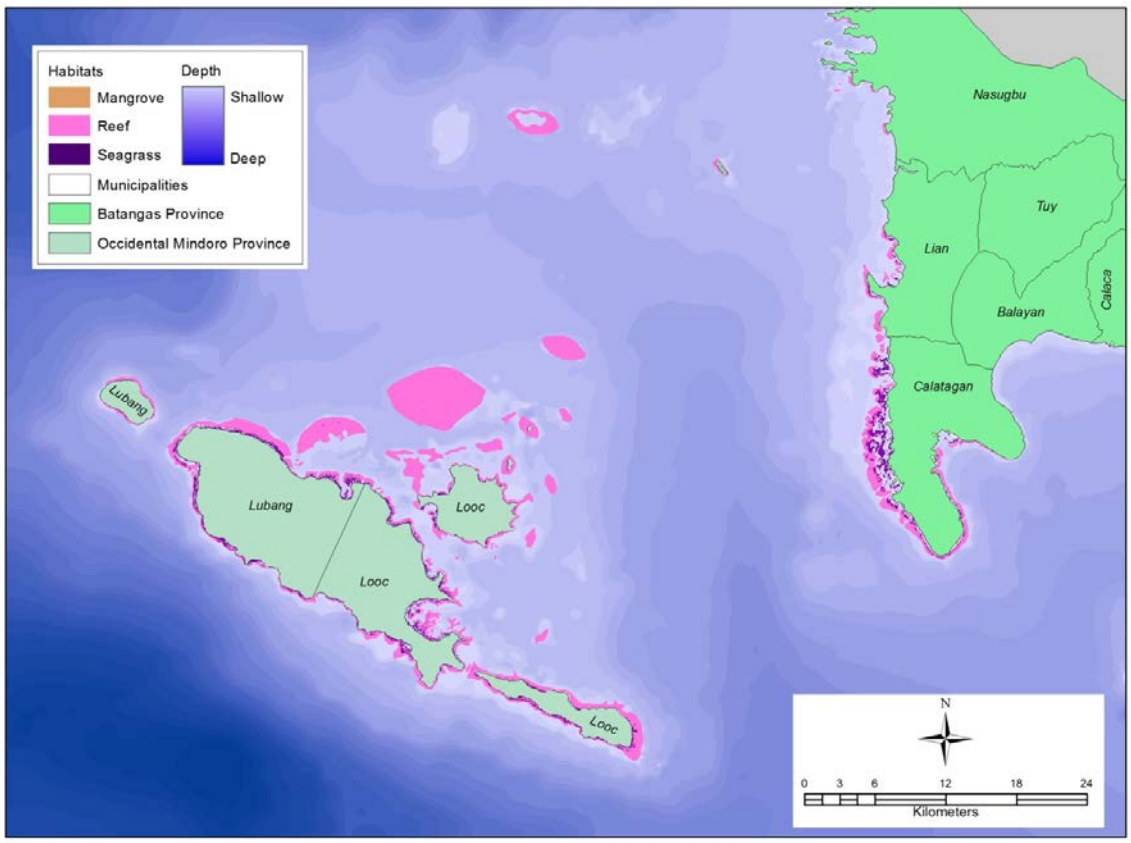


Figure 3.2. Habitat classification used in the scenarios. The Verde Island Passage typically has narrow fringing shallow-water formations with steep descents into deep water. The most extensive shallow portions of the region are shown in this figure, including the largest areas of coral reefs, seagrass, and mangrove habitats in the Verde Island Passage. These areas are surrounded by the municipalities of Nasugbu, Lian, and Calatagan in Batangas Province and the municipalities of Lubang and Looc in Occidental Mindoro Province.

3.3.2 Study design

I simulated seven spatially-explicit expansion scenarios for the MPA network in the Verde Island Passage. These expansion scenarios were developed to demonstrate and compare their benefits in terms of achievement of habitat representation. I simulated MPA expansion from 2012 until 2020 to determine how much of the objectives for habitat representation would be achieved. I used the same rate of expansion per scenario. Each expansion scenario was characterized by a combination of a suitability layer, expansion rules, and spatial context (Figure 3.3). Once all the simulations were run, I compared their achievement of conservation objectives for the study region at year 2020.

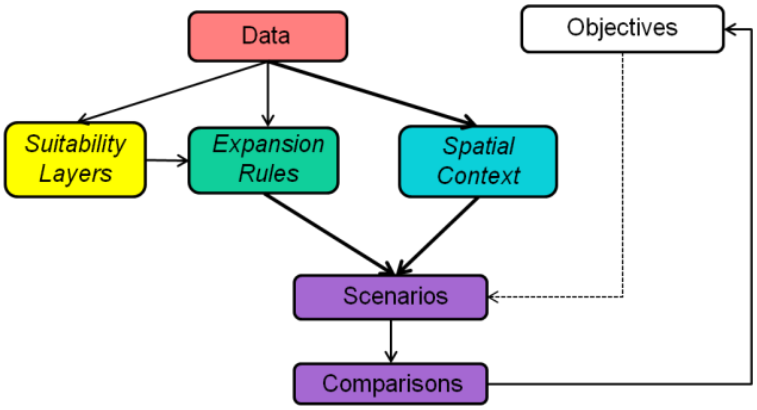


Figure 3.3. Study design. Scenarios were defined by a combination of spatial context, suitability layer, and expansion rules, and compared in terms of achieving objectives for each mapped marine habitat.

3.3.3 Data, sources of information, and conservation objectives

I obtained spatial data for existing MPAs, resource uses, threats, habitats, and fisheries from CI–Philippines. These datasets were used to develop the suitability layers for additional MPAs in the expansion scenarios. The spatial context and expansion rules for the scenarios were based on policy information, a database of existing MPAs (e.g. size and number of MPAs per municipality and province), and interviews with key informants. A map of near-shore marine habitats was used for the suitability layers, expansion rules, and to interpret national conservation objectives.

I supplemented habitat maps from CI–Philippines with new maps of coral reefs that I created using LandSat 7 ETM+ satellite images acquired from 1999 to 2008. The habitats considered in the analyses were coral reefs, mangrove forests, seagrass beds, and "other benthic substrata", including rocky and soft-sediment seabed. For "other benthic substrata", I used five depth classes (0-10 m, 10-20 m, 20-30 m, 30-40 m and >40 m) to reflect expected changes in species composition with depth (Campos, 2003, Bach et al., 1998, Dolorosa and Schoppe, 2005). I based our conservation objectives on the CTI - National Plan of Action (2009) which recommends that 20% of the extent of each major coastal and marine habitat should be set aside in permanent no-take zones.

3.3.4 MPA expansion scenarios

3.3.4.1 Defining scenarios

Each scenario simulated the expansion of MPAs in the Verde Island Passage. Table 3.1 summarises the characteristics of the seven scenarios. The uncoordinated scenario (1) depicts establishment of MPAs by communities or local governments in the waters of individual municipalities. The partially coordinated scenario (2) involves coordination between two or more local governments within an alliance. The fully coordinated scenario (3) involves coordination of all the local governments in each province with their corresponding provincial government. These three scenarios reflect how collaborative partnerships are initiated and scaled up to higher governance levels in the Philippines (Horigue et al., 2012). The uncoordinated scenario was based on the MPA efforts initiated by individual municipalities and their corresponding communities prior to coordination. The partially and fully coordinated scenarios were based on the existing institutional arrangements by the provincial and local government alliances in the Verde Island Passage. The four systematic scenarios were designed to reflect MPA establishment guided by explicit objectives in conservation planning software, but varied in the spatial contexts considered for objectives and selection of areas (Table 3.1). The spatial contexts for three

systematic scenarios (4-6) matched those of the non-systematic scenarios (1-3) to allow direct comparisons.

The varying levels of coordination in scenarios 1-3 reflect different constraints on and opportunities for local governments to coordinate their planning and management of MPAs. Coordination can be constrained by logistical concerns, spatial extent, and availability of funds. Local governments closer together, such as those surrounding a single bay, will work together more readily because it is easier for them to communicate and share meetings, and some local governments work well together because of similar interests and goals. Coordinating efforts across larger spatial extents, regardless of the number municipalities, presents challenges. Hence, scaling up begins in alliances of two or more local governments. Coordination also depends heavily on funding. Lack of finances or lack of willingness to contribute to a mutual funds system strain relationships and lead to partial coordination (Horigue et al., 2012). I defined partial coordination as subject to logistical and spatial constraints. Alliances of two to five neighbouring local governments are formed, since they are easier to organize and mobilize due to their proximity to each other. I defined full coordination as collaboration between all coastal local governments, across whole provinces with support from provincial governments.

Table 3.1 Summary of the seven MPA expansion scenarios.

Detailed explanations of the scenarios are in Appendix A.

Scenario	Spatial context	Suitability layer	Expansion rules	Selection rules/ conservation objectives
1. Uncoordinated	Individual municipal waters (36 governance areas)	Uncoordinated	Uncoordinated	Selection rules designed to simulate uncoordinated community-based establishment and to protect 15% of marine waters in each municipality
2. Partially coordinated	Municipal waters shared among two to five municipalities in each alliance (10 areas)	Coordinated	Coordinated	Selection rules designed to simulate coordinated establishment by two or more local governments, and to protect 15% of marine waters in each shared governance area
3. Fully coordinated	Municipal waters shared among all the municipalities in each province (5 areas)	Coordinated	Coordinated	Selection rules designed to simulate coordinated establishment by local governments in a province, and to protect 15% of marine waters in each province
4. Systematic - municipality	Individual municipal waters (36 governance areas)	Uncoordinated	Marxan	Protection of 20% of each habitat in each municipality
5. Systematic – alliance	Municipal waters shared among two to five municipalities in each alliance (10 areas)	Coordinated	Marxan	Protection of 20% of each habitat in each alliance
6. Systematic - province	Municipal waters shared among all the municipalities in each province (5 areas)	Coordinated	Marxan	Protection of 20% of each habitat in each province
7. Systematic – Verde Island Passage	Municipal waters shared among all the municipalities in the region	Coordinated	Marxan	Protection of 20% of each habitat across the Verde Island Passage

3.3.4.2 Spatial contexts for selecting areas for MPAs

The Philippine national government does not have a specific mandate describing the explicit distribution of MPAs to address biodiversity conservation objectives. Although the national government has powers to establish MPAs, much of the responsibility for planning and management of natural resources has been devolved to local governments. The mandates of the Local Government Code (Republic Act 7160) and the Fisheries Code give local governments the task of establishing MPAs within their waters. However, local governments can also share responsibilities and combine their efforts to co-manage resources in contiguous waters (e.g. shared bays, gulfs). I used this information to identify four governance contexts for expansion of MPA networks: 1) individual municipal waters (36 governance areas); 2) contiguous shared municipal waters in bays and coasts within provinces (10 areas); 3) contiguous shared municipal waters for all local governments within each province (5 areas); and, 4) the entire Verde Island Passage.

3.3.4.3 Planning units

For all scenarios, I subdivided the planning region into grids of 1 km^2 planning units (n=15,121), cut around existing MPAs and cut to coastlines and governance boundaries (municipalities, alliances, provinces). Depending on the scenario, I assigned each planning unit in the region to different governance areas, but retained the same number of units for all scenarios. Planning units contained one or more habitat types. One of the implications of multiple habitats occurring in single planning units was incidental representation, whereby one or more habitats were represented even when they were not the reasons for selection (Pressey and Logan, 1998). To help explain how much was protected incidentally, I measured the co-occurrence of selected habitats in planning units.

For the systematic scenarios, selected planning units were fully protected. In contrast, and to reflect the observed establishment of different sizes of MPAs, the decision trees for the non-systematic scenarios differed from the systematic selections. Varying proportions of selected planning units, always less than 1.0 km^2, were protected in the uncoordinated scenario (1). For the coordinated scenarios (2 and 3), the varying proportions of planning units protected extended to 1.0 km^2, reflecting the larger MPAs established through coordination.

3.3.4.4 Suitability layers for the MPA expansion scenarios

For all scenarios, I modelled the suitability of planning units outside existing MPAs for potential establishment of new MPAs. Each planning unit had one value representing

its suitability for MPA establishment. The uncoordinated and coordinated suitability layers were shaped by different factors that determined the selection of planning units as potential MPAs. The suitability of planning units for each scenario was based on spatial predictors derived from characteristics of existing MPAs and interviews with key informants. Key informants were selected based on their understanding and experience working on MPAs in the region and in the Philippines. The informants included managers of community-based local MPAs, local-government officials, and MPA experts in universities and bridging organizations.

I used Maxent to model the two suitability layers based on the spatial predictors identified by informants (Appendix B). Maxent was developed to predict the suitability of areas for species (Phillips et al., 2006), but has characteristics that make it appropriate for modelling suitability for establishment of different kinds of MPAs (Mills et al., 2012). Maxent can use presence-only data to predict areas of interest based on observed characteristics, and the input data on existing MPAs were presence-only. The modelled suitability layers were then incorporated into the expansion rules (below) for selection of new MPAs.

The suitability layer for the uncoordinated scenario used spatial predictors derived from MPAs established by communities and single local-government authorities. The four predictors were: a) distance from another MPA; b) distance from shoreline; c) distance from roads; and, d) habitat type (Appendix B). These four predictors influenced the location of potential MPAs by communities and local governments. The suitability layer for the coordinated scenarios used six spatial predictors: a) distance from shoreline; b) habitat type; c) distance from shoreline development; d) presence of marine threats; e) larval retention potential; and, f) presence of threatened species and marine megafauna (Appendix B). The suitability layer for coordinated MPAs was influenced by CI-Philippines conducting scientific studies in partnership with academic institutions to improve the design of the MPA network in the Verde Island Passage (Quibilan et al., 2008). Through collaborations with academic partners, the MPA network in the Verde Island Passage was the first network in the Philippines to incorporate objectives related to larval connectivity objectives. Estimates of larval retention potential came from a passive dispersal model of connectivity and field observations of ichthyoplankton and chlorophyll, helping to identify larval source-sink areas (Weeks et al., 2014, Campos et al., 2007, Villanoy et al., 2007). Retention potential, as used in the suitability model, was a continuous measure representing distance from areas with the highest concentrations of ichthyoplankton.

For the systematic scenarios, we used the inverse of the uncoordinated (scenario 4) and coordinated suitability layers (scenarios 5-7) as the cost layers in Marxan (Table 3.1), thereby allocating lower costs and higher likelihood of selection to more suitable planning units. This allocation of cost layers also facilitated direct comparisons of systematic and non-systematic scenarios in three governance contexts (Table 3.1).

3.3.4.5 Expansion rules

I included all the existing MPAs as starting points for all the scenarios. The simulations required an annual rate of expansion of MPA networks, so I calculated the average annual area protected in the region. From 1991 to 2007, establishment of MPAs was opportunistic and done by individual by local governments. MPAs during that time were very small with an annual average rate of expansion of 0.22 km^2 for all MPA types. Additional, larger MPAs were established from 2008 onwards, with an annual area protected of approximately 82.8 km^2 for all types of MPAs. This later rate of establishment reflects efforts to coordinate MPA establishment and is the rate used for all seven scenarios.

All scenarios involved simulation of the expansion of MPA networks by establishing MPAs beginning in 2012 and ending until 2020. I assumed equal contributions to objectives of different MPA zones. There are different types of MPAs established in the Philippines, based on the establishing government level (e.g. national government, local government), legislation, and consultation with different stakeholder groups, particularly fishers. Locally-established MPAs usually have different zones such as fish sanctuaries (strictly no-take zones), marine reserves (regulated fishing zones), and fisheries management areas (temporal closures) (White et al., 2014). Because we did not have data on the relative effectiveness of different MPA zones for protecting different species and habitat types, we assumed that all the MPA zones had equal contributions to achieving conservation objectives. This provides an optimistic picture of achievement of conservation objectives during the simulations.

There were two decision trees for the three non-systematic scenarios (Table 3.1, Appendices C-F): one for uncoordinated decisions (scenario 1) and one for coordinated decisions (scenarios 2 and 3, applied within different governance contexts). The decision trees depicted annual additions to MPA networks prior to and during coordinated MPA expansion efforts. They were intended to reflect how local governments, MPA managers, and their corresponding communities decide on the locations and sizes of MPAs within each spatial context. The decision trees were based on information on existing MPAs, policy information, and interviews with key informants. Information on existing MPAs

guided the design of the decision trees, by providing frequency distributions of MPA sizes and inter-MPA distances from which values were chosen in the simulations. I used the policy information from the Fisheries Code to nominate a percentage ceiling of protection of waters at 15% per spatial context. The informants were asked about the histories of MPAs in the region and the process of establishing them. I ran the decision-tree simulations for 8 years (2012-2020) unless the percentage ceiling was reached in all governance units before 2020. I ran each simulation 100 times, because of the stochastic elements in the decision trees.

For the four systematic scenarios (4-7), I used Marxan (Ball et al., 2009) to select new MPAs to achieve conservation objectives for habitats. I set objectives for habitats within the governance areas relevant to each scenario (Table 3.1): 20% of each habitat in each municipality (scenario 4); 20% of each habitat in each alliance (scenario 5); 20% of each habitat in each province (scenario 6); and 20% of each habitat across the Verde Island Passage (scenario 7). For some of the planning units that included the depth class >40 m, I increased costs by multiples of 10 (e.g. 10, 100, 1000) in proportion to distance from the shore to counteract the stochastic element in Marxan that randomly selected from the 14,136 equal-cost planning units containing this depth class. This encouraged Marxan to select suitable planning units closer to the shore, and to increase the compactness of potential MPAs. I ran Marxan for each scenario 100 times, and maximized achievement of conservation objectives by adjusting the species penalty factor. However, I constrained annual contributions to 82.8 km^2 per year to allow for comparison with the non-systematic scenarios, and assumed that the planning units with highest suitability would be protected first.

3.3.5 Comparisons of expansion scenarios

After all the MPAs had been selected in each expansion scenario, I compared scenarios in terms of achievement of conservation objectives. This involved three kinds of comparisons: 1) between non-systematic scenarios to reflect the influence of different spatial contexts, using objectives set across the whole Verde Island Passage; 2) between systematic scenarios for different spatial contexts, using objectives set across the whole Verde Island Passage; and 3) between non-systematic and systematic scenarios for the same spatial contexts (scenario 1 vs. 4, 2 vs. 5, 3 vs. 6), using objectives set across municipalities, alliances, and provinces as appropriate.

For each of these comparisons, I used three sets of calculations. First, across the 100 repeat runs for each simulation, I calculated the average percentage of each habitat

protected at each annual time step to determine the efficiency of achieving habitat conservation objectives. More efficient scenarios achieved objectives for habitats sooner, or to a greater degree at the same time step. Second, for each scenario, I calculated the total area protected that contributed to conservation objectives across all habitats at each single time step. This was the sum of the areas protected for all habitats annually, excluding areas in excess of the conservation objectives. Third, I calculated at each time step the total area, across all habitats that exceeded the conservation objectives. For each scenario and time step, the sum of the second and third calculations was the total extent of MPAs added. The second and third calculations produced single metrics for each scenario to facilitate comparisons.

I used maps of selection frequencies to compare scenarios spatially. To compare the non-systematic and systematic scenarios within the same governance areas, I created difference maps by subtracting the selection frequencies of each non-systematic scenario from those of its corresponding systematic scenario. The difference maps showed which planning units were selected more or less frequently in non-systematic or systematic scenarios. I considered the planning units with selection frequencies >90% as important in any scenario.

3.4 Results

The suitability layers created for the uncoordinated and coordinated scenarios using Maxent produced good fits to the existing distribution of MPAs in the region (cross-validated AUC values >0.9). Because the predictors used in each of the models were significantly correlated, I investigated the suitability produced by Maxent for each individual predictor in isolation to get an accurate understanding of its influence on the model (Figure 3.4). Based on the Maxent model for uncoordinated MPAs, the distances to both an existing MPA and the shoreline were good predictors of suitability for new MPAs, contributing 60% and 38% to the explanatory power of the model, respectively. For coordinated MPAs, the most important predictors contributing to the model were: distance to shore (34.7%), distance to land-based threats (27.6%), coastal and marine threats (13.4%), habitat type (13.1%), and larval retention potential (10%). Suitability was higher in planning units closer to the shoreline for both models (Figure 3.4). For the coordinated model, planning units with mapped habitat had high suitability, as did planning units threatened by illegal fishing practices and anchor damage.

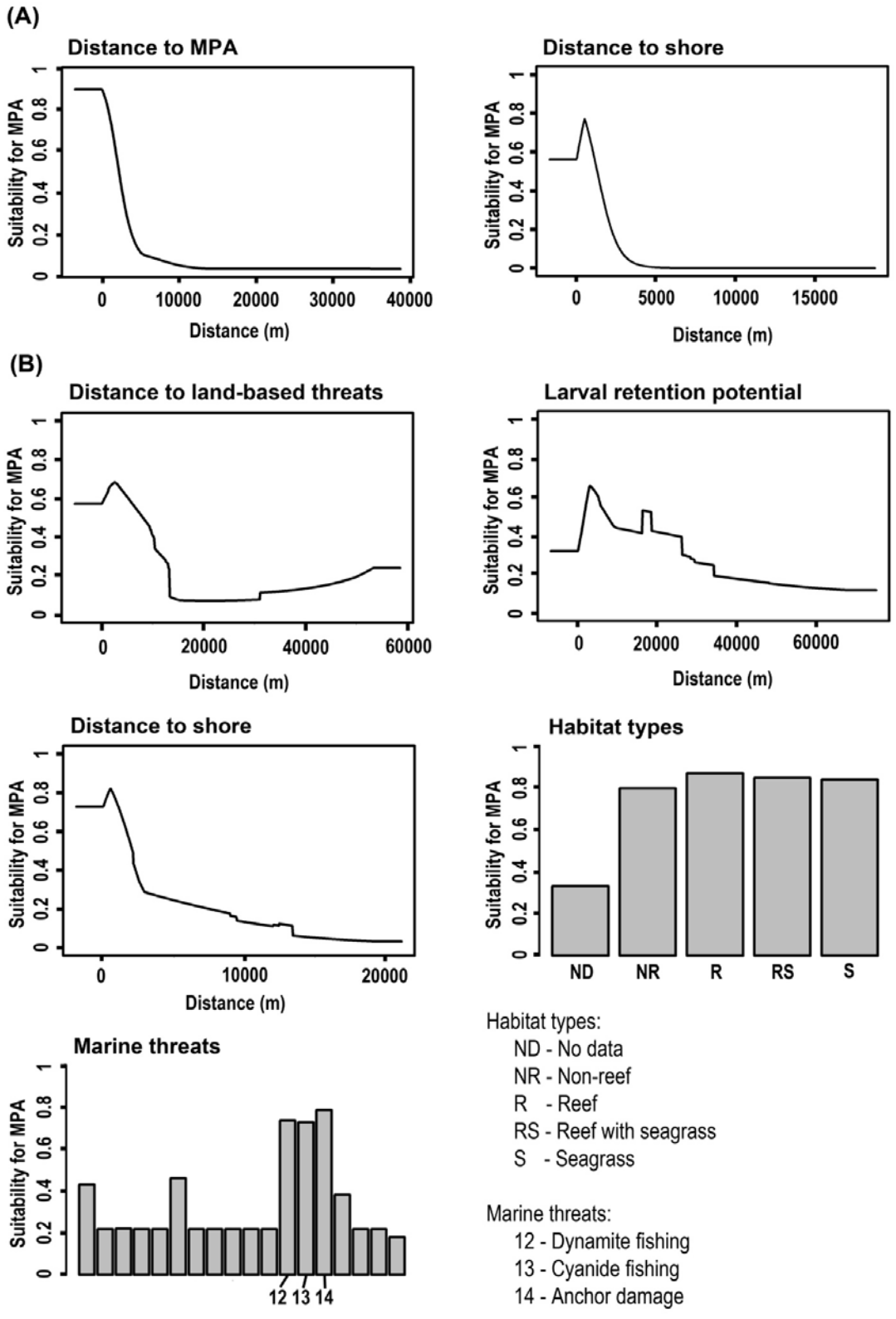


Figure 3.4. The most important predictors of suitability for new MPAs for the uncoordinated (A) and coordinated (B) expansion scenarios, based on the Maxent models. The response curves and the bar graphs show the suitability of planning units for MPA establishment in relation to each of the predictors used by the models. These graphs do not incorporate the interactions

between the predictors. Distances and categories with suitability values >0.5 indicate potential for MPA establishment in both scenarios.

I found that the existing MPA network in the region had exceeded the objectives for seagrass, coral reef, and mangrove habitats. The non-systematic scenarios achieved the objectives for most of the habitats by the end of the simulations, but missed the objective for depth class >40m by 80-82%. Additionally, the uncoordinated scenario (1) also missed the objective by 5% for depth class 30-40m (Figure 3.5A, B). Initial comparison of the three non-systematic scenarios (Figure 3.5B) showed that the fully coordinated scenario (3) was the most efficient, achieving objectives for most the depth classes 0 – 30m in years 6-7. Next in efficiency was the partially coordinated scenario (2). However, achievement of objectives for depth >40m was 2% higher in the uncoordinated scenario (1) than in the coordinated scenarios (2-3). The 2% difference led to the uncoordinated scenario (1) contributing the largest total area to objectives (Figure 3.5C, top), amounting to 44 – 48 km^2 more than the coordinated scenarios (2 and 3). Correspondingly, over-achievement of objectives was less for the uncoordinated scenario (1) than for the coordinated scenarios (2 and 3) (Figure 3.5C, bottom).

Planning units selected more frequently in the uncoordinated scenario (1) were evenly distributed with respect to municipalities and close to the shoreline (Figure 3.6A). The spread of selections across municipalities was due to the limit on MPA establishment of 15% of municipal waters, combined with some municipalities having small marine extents and more established MPAs at the beginning of the simulations. Compared to the uncoordinated scenarios, planning units selected more frequently in the coordinated scenarios (2 and 3) were less evenly distributed across municipalities but more evenly distributed with respect to distance from shoreline. The latter tendency reflected the different factors contributing to suitability for the coordinated scenarios (Figure 3.4), leading to frequent selection of some planning units close to the shoreline and others in the deeper portions of the Passage (e.g. middle portion and next to Looc municipality) (Figure 3.6B,C). The limit of 15% of shared municipal waters was not met for any governance areas in the coordinated scenarios because of the larger tracts of municipal waters available for protection.

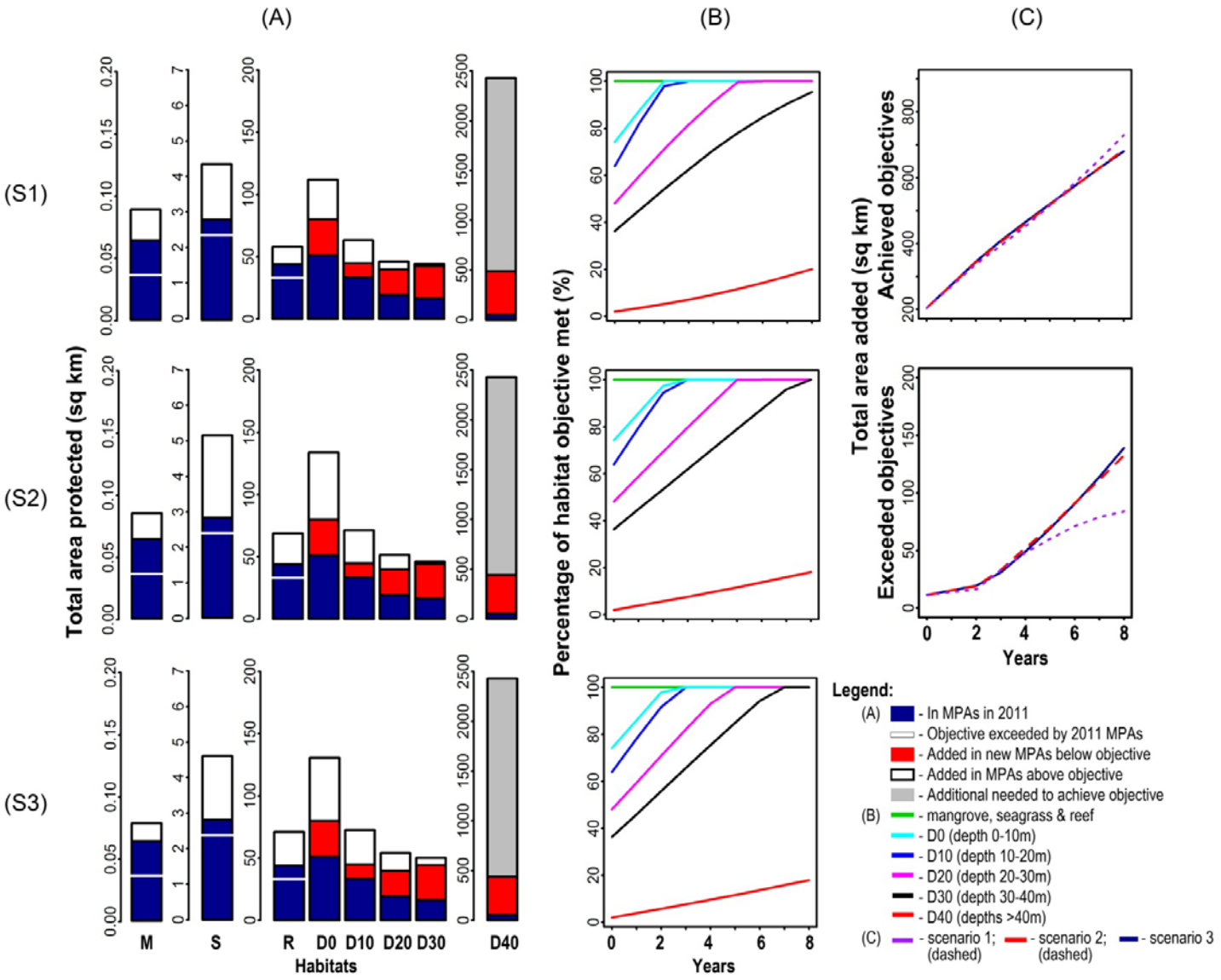


Figure 3.5. Achievement of objectives for the whole Verde Island Passage in the non-systematic scenarios (1-3). The barplots (A) show the total area of each habitat protected in each scenario (S1-S3) at the end of each simulation (2020). The three line graphs (B) indicate the percentage of objective met for each habitat in each scenario (S1-S3) in each year of the simulation, not counting areas added in excess of objectives. The fourth and fifth line graphs (C) show for each scenario (S1-S3) the total area, summed across habitats, contributing to objectives (top) and exceeding objectives (bottom) in each year of the simulation.

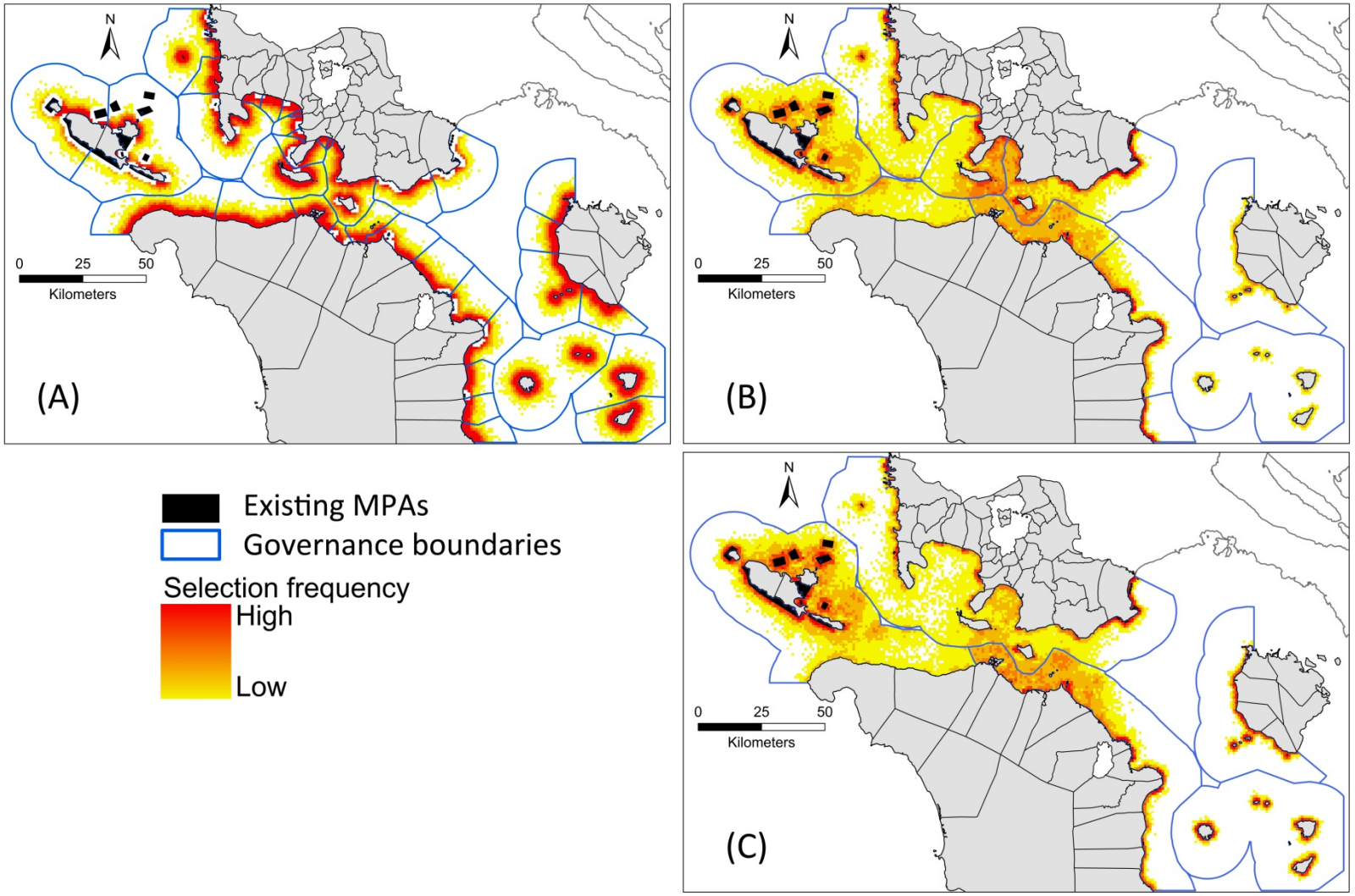


Figure 3.6. Selection frequencies of planning units across 100 simulation runs for the non-systematic scenarios (A- Scenario 1; B – Scenario 2; C - Scenario -3). Planning units selected more frequently are indicated by warmer colours.

All the systematic scenarios achieved objectives for all habitats except depth class >40m (Figure 3.7A). The efficiency of the systematic scenarios varied. The systematic whole-of-region scenario (7) was the most efficient, achieving the objectives for the depth classes 0 – 30m in year two (Figure 3.7B) and achieving 24% of the objective for depth class >40m. The remaining systematic scenarios (4-6) achieved objectives for the depth classes 0 – 30m between years 2 and 5, and achieved 20 – 22% of the objective for depth class >40m at year 8. The whole-of-region systematic scenario (7) also contributed more total area to achievement of objectives across the Verde Island Passage, with scenarios within progressively narrower governance contexts (6,5, then 4) contributing progressively less total area (Figure 3.7C, top). Conversely, scenarios with progressively narrower governance contexts (4,5,6 then 7) contributed progressively larger areas in excess of objectives (Figure 3.7C, bottom). Selection frequencies varied between the systematic scenarios. As the governance boundaries widened from individual municipalities to the whole Verde Island Passage, selection frequencies became less even across municipalities (Figure 3.8), reflecting the progressive relaxation of spatial constraints on achieving objectives.

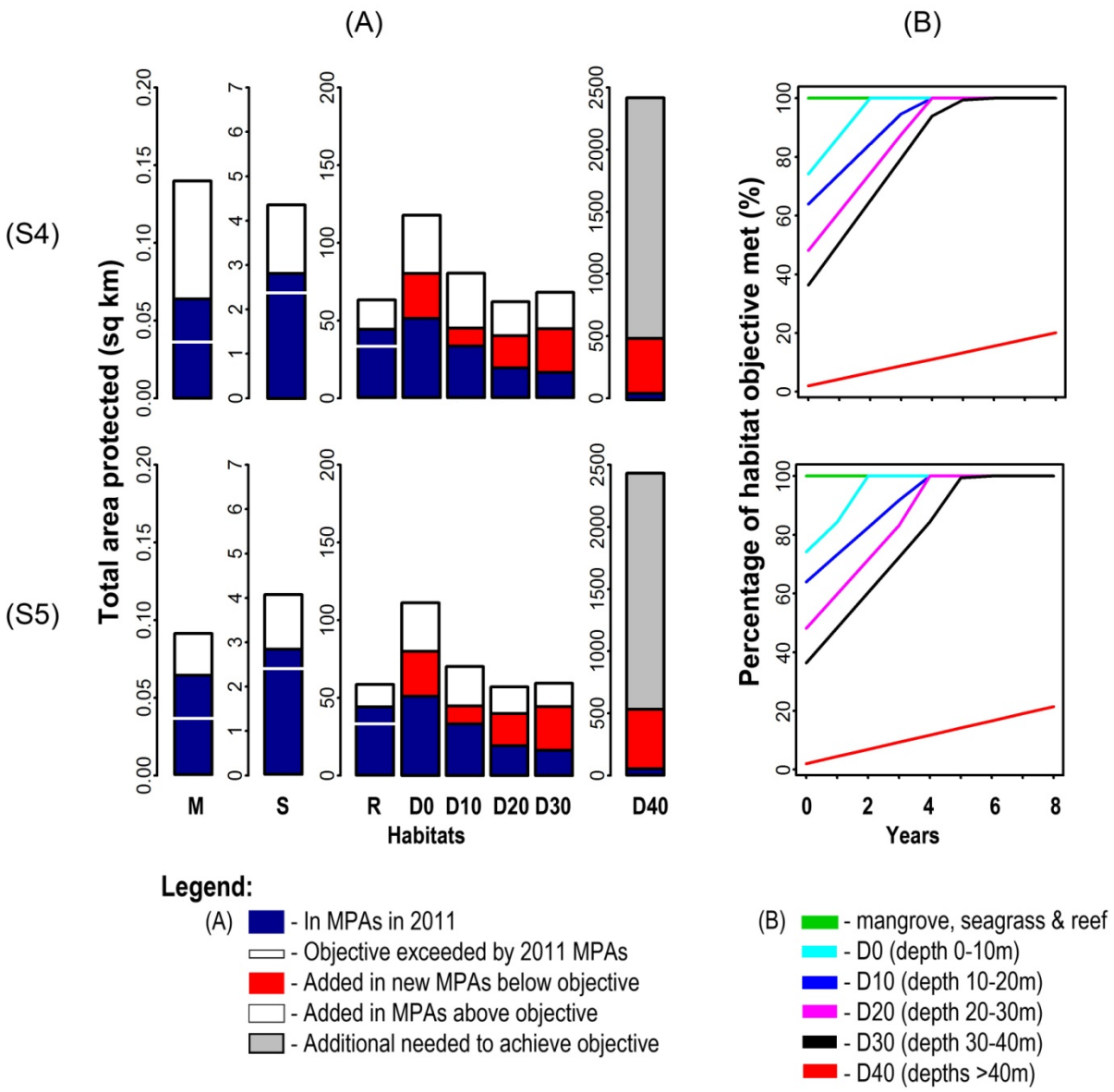
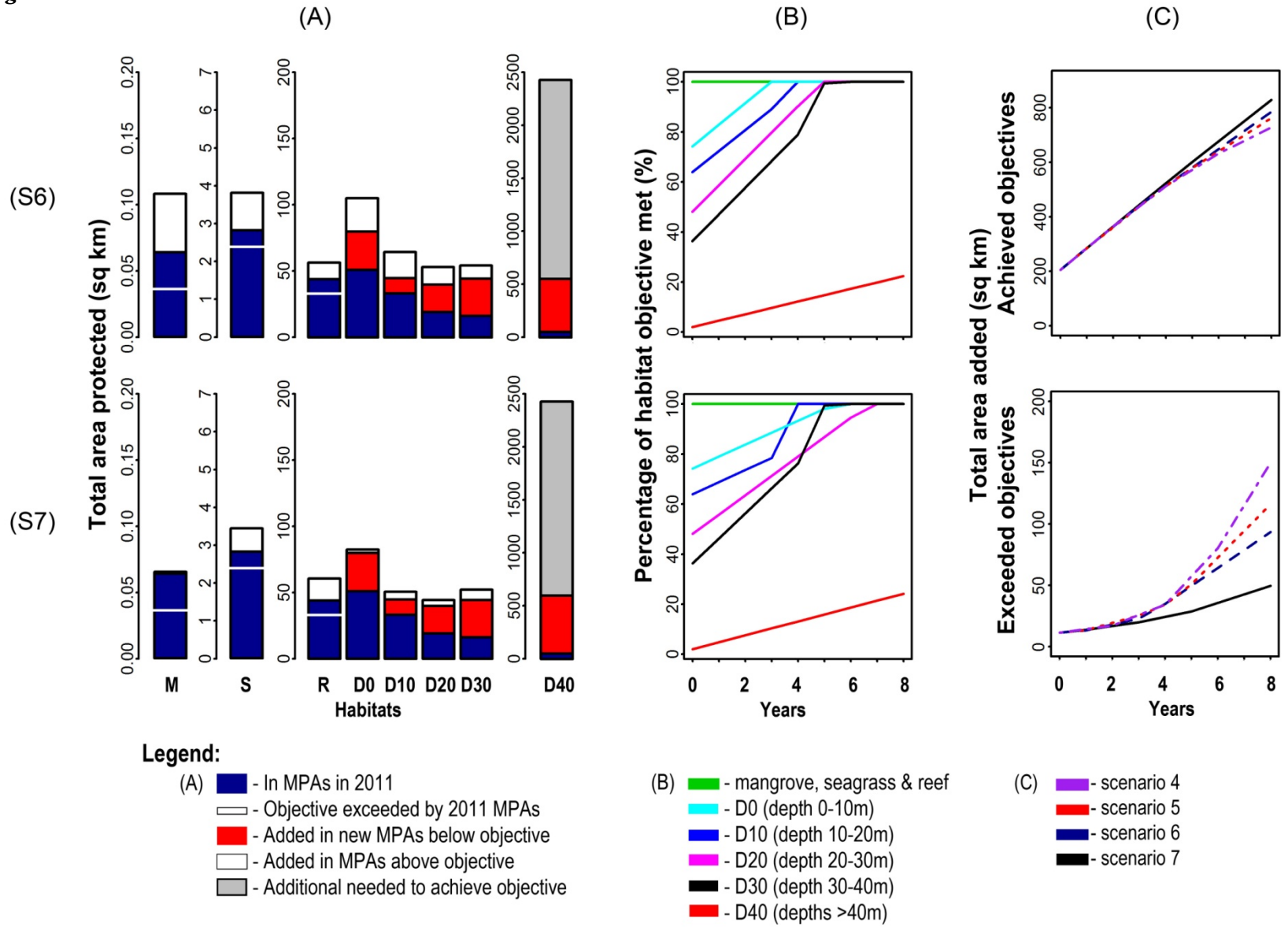


Figure 3.7. Achievement of objectives for the whole Verde Island Passage in the systematic scenarios (4-7). The barplots (A) show the total area of each habitat protected in each scenario (S4-S7) at the end of each simulation (2020). The four line graphs (B) indicate the percentage of objective met for each habitat in each scenario (S4-S7) in each year of the simulation, not counting areas added in excess of objectives. The fourth and fifth line graphs (C) show for each scenario (S4-S7) the total area, summed across habitats, contributing to objectives (top) and exceeding objectives (bottom) in each year of the simulation.

Figure 3.7 continued



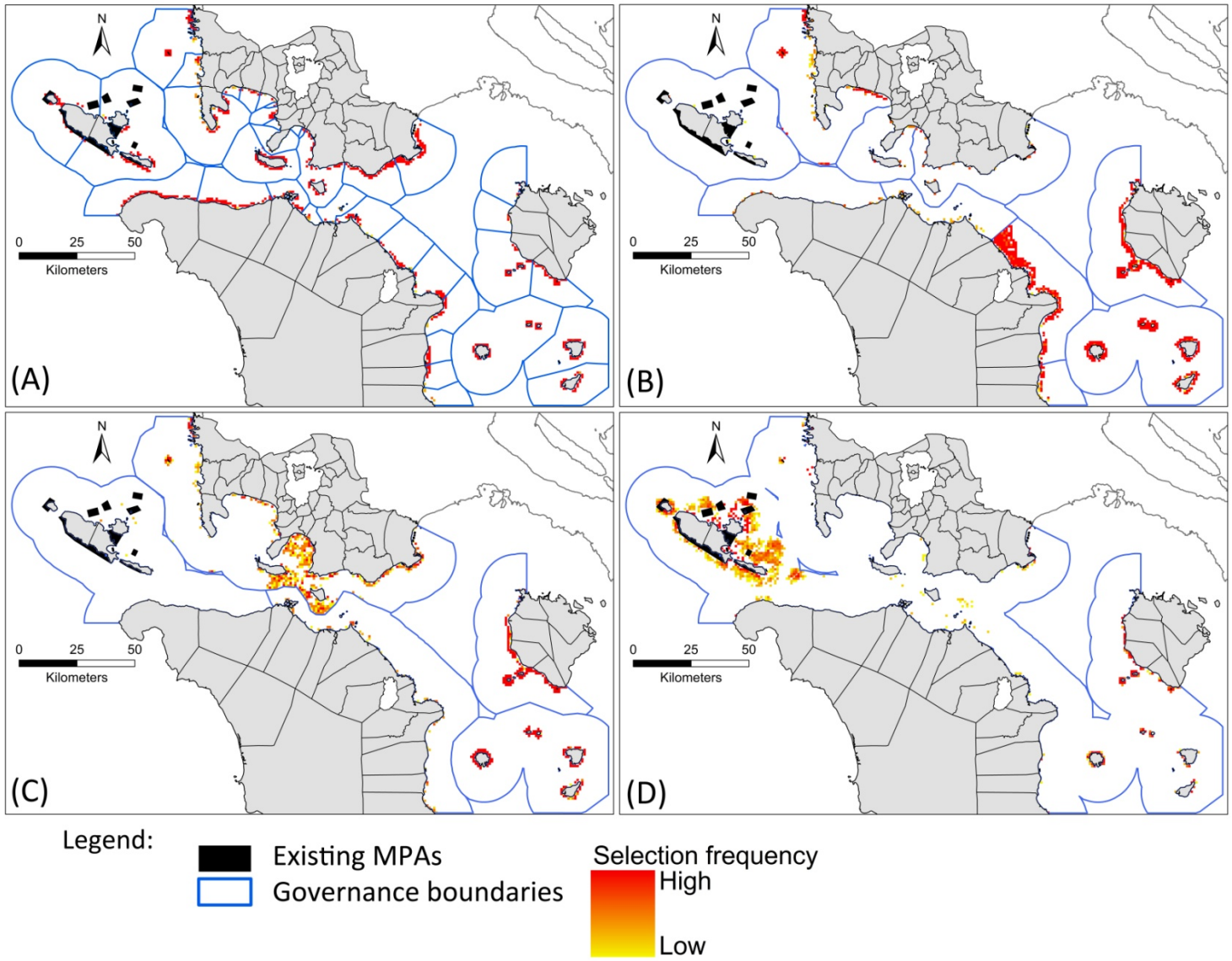


Figure 3.8. Selection frequencies of planning units across 100 simulation runs for the systematic scenarios (A- Scenario 4; B – Scenario 5; C – Scenario 6; D- Scenario 7). Planning units selected more frequently are indicated by warmer colours.

Comparison of the non-systematic and systematic scenarios for each spatial context showed that the systematic scenarios were consistently more efficient in terms of achievement of objectives (Figure 3.9A). For alliances of local governments, scenario 5 (systematic) contributed ~116 km^2 more to objectives by 2020 than scenario 2 (non-systematic). For provinces, scenario 6 (systematic) contributed ~64 km^2 more to objectives than scenario 3 (non-systematic). For municipalities, the difference between scenarios 1 and 4 was slight, with scenario 4 (systematic) contributing about 24 km^2 more to objectives than scenario 1 (non-systematic). The non-systematic scenarios 2 and 3 allocated more areas in excess of conservation objectives than their systematic equivalents, with differences of ~41 km^2 and ~61 km^2, respectively (Figure 3.9B). This over-achievement of objectives was due largely to continuous expansion of MPAs in certain governance areas with higher suitability for establishing MPAs. However, the systematic scenario 4 exceeded objectives by more than its non-systematic equivalent. The added area in the non-systematic scenario was contributing more to achieving objectives, because MPAs were being distributed more evenly among the municipalities.

Spatial comparison of scenarios 1 and 4 (Figure 3.10A) showed that most planning units along the shoreline were selected frequently in both scenarios, reflecting the suitability layer for uncoordinated establishment that influenced the decision tree (scenario 1) and the cost layer in Marxan (scenario 4). The influence of the suitability model is also apparent in more frequent non-systematic selection of areas in the same municipalities as existing MPAs. Comparisons of scenarios 2 and 5 (Figure 3.10B), and scenarios 3 and 6 (Figure 3.10C) showed that planning units selected more often in the systematic scenarios were more evenly distributed across governance units, reflecting the influence of conservation objectives. In contrast, the non-systematic scenarios for alliances and provinces selected planning units unevenly between governance units, based on the coordinated suitability layer and decision tree. For alliances and provinces, planning units adjacent to existing MPAs were selected frequently in both systematic and non-systematic scenarios, reflecting the influence of proximity to established MPAs on the model of suitability.

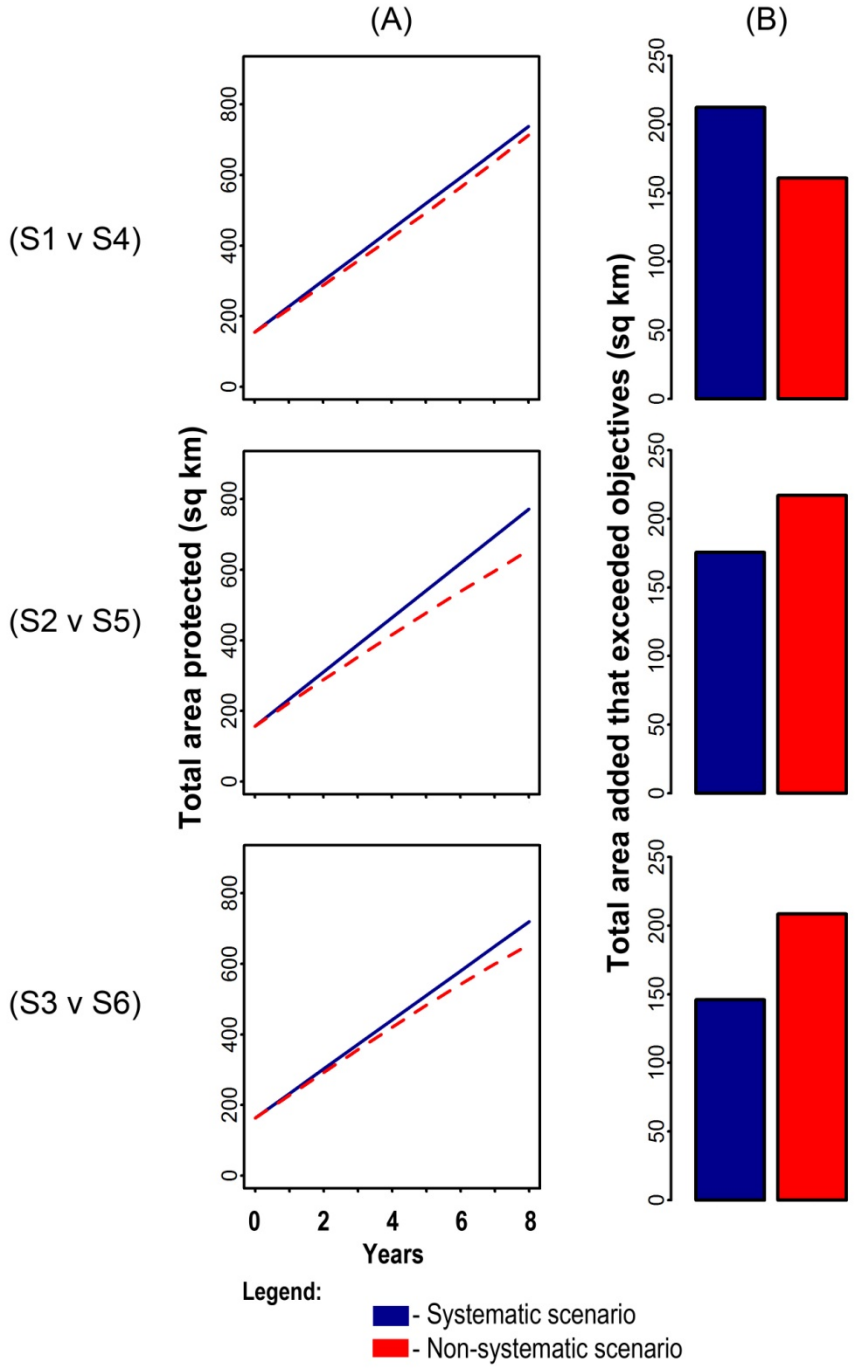


Figure 3.9. Addition of MPAs relative to habitat conservation objectives in three spatial contexts at each annual time step of non-systematic and systematic scenarios with the same spatial contexts. For both (A) and (B), top graphs are for municipalities, middle graphs for alliances, and bottom graphs for provinces. (A) Comparison of total areas contributing to conservation objectives across habitats, averaged across the 100 repeat runs, at each annual time step. (B) Comparison of total areas added in excess of objectives across habitats, averaged across the 100 repeat runs, to 2020.

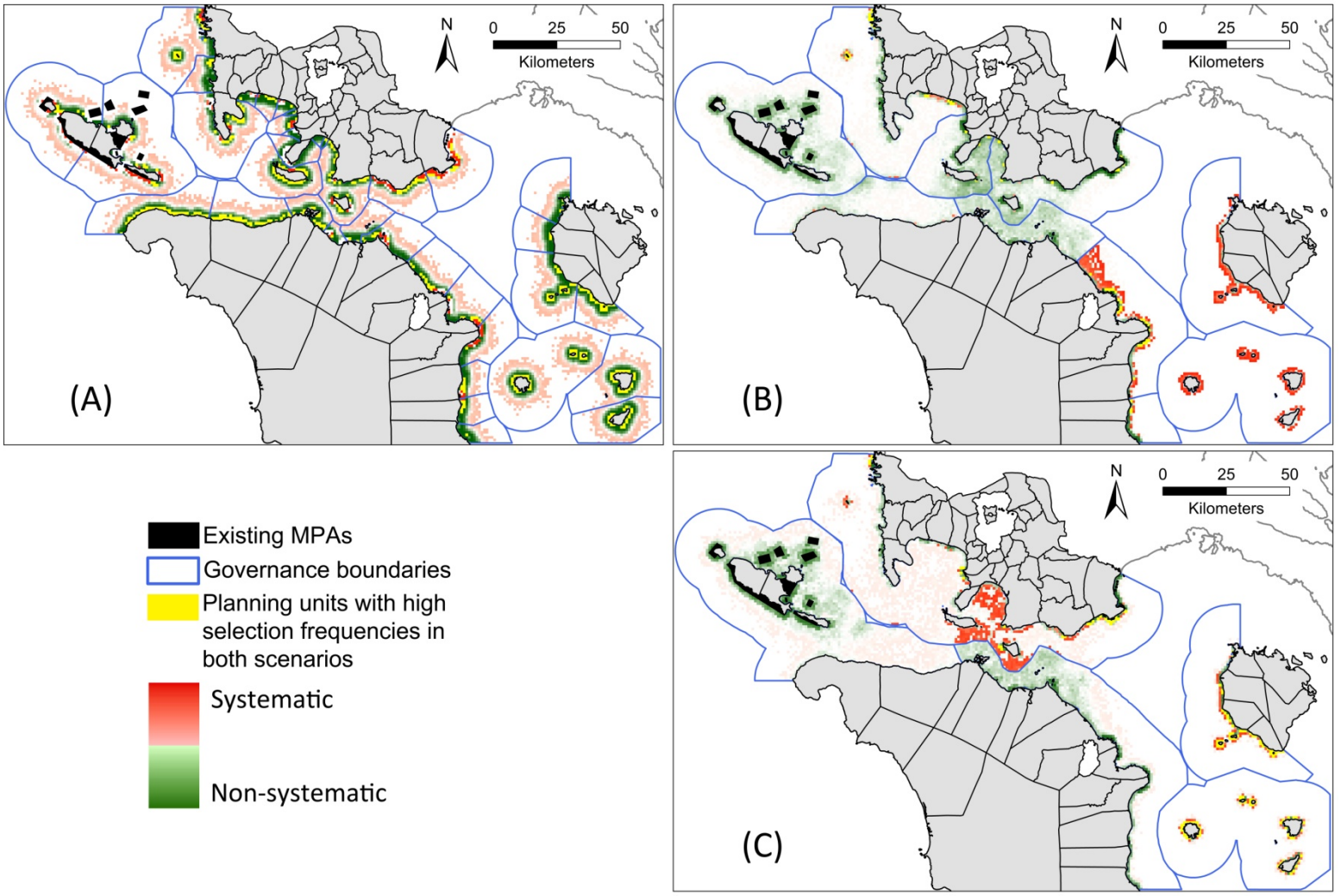


Figure 3.10. Spatial differences between non-systematic and systematic scenarios applied in the same governance contexts. (A) Selection within 36 municipalities, non-systematic (S1) vs. systematic (S4). (B) Selection within 10 alliances, non-systematic (S2) vs. systematic (S5). (C) Selection within 5 provinces, non-systematic (S3) vs. systematic (S6).

Darker red indicates planning units selected more frequently in the systematic scenarios. Darker green indicates planning units selected more frequently in the non-systematic scenarios. Paler colours indicate planning units selected in roughly equal frequency in both non-systematic and systematic scenarios. Yellow indicates planning units with selection frequencies >90% in both non-systematic and systematic scenarios.

3.5 Discussion

In this chapter, I described and compared different approaches to MPA expansion to demonstrate their relative benefits. First, I compared, for both systematic and non-systematic approaches, the effects of governance context on efficiency of achieving regional conservation objectives. Second, I compared, for each of three difference governance contexts, the relative benefits of systematic and non-systematic approaches for achieving conservation objectives framed within municipalities, alliances, and provinces, respectively.

3.5.1 Non-systematic scenarios in three governance contexts

The three non-systematic scenarios achieved regional conservation objectives for most habitat types. Both coordinated scenarios were able to achieve the conservation objectives for all the habitat types except for depth class >40m. The uncoordinated scenario (1) missed objectives for depth classes 30-40m and >40m. However, comparison of total areas contributing to the achievement of objectives showed that, overall, the uncoordinated scenario (1) was more efficient than the coordinated scenarios (2 and 3) because it selected more planning units with depth class >40m. Consequently, both coordinated scenarios selected larger areas in excess of objectives than the uncoordinated scenario. These differences between scenarios can be understood in relation to the suitability layers, decision trees, governance context, and the geomorphology of the Verde Island Passage.

For the non-systematic scenario (1), distance to shore and distance to existing MPAs were the main variables in the model of suitability. Hence, the selected planning units were closer to shore and to existing MPAs, causing poorer achievement of objectives for one open-water habitat. However, the suitability layer for the uncoordinated scenario was overruled in many places by the decision rule based on the Fisheries Code that limited allocation of MPAs to 15% of municipal waters. Although municipalities with higher overall suitability (e.g. those with existing MPAs) tended to be selected more frequently, the 15% limit was reached in many suitable municipalities with existing MPAs and/or small marine extents, shifting selection of MPAs to other municipalities. This spreading of MPAs across municipalities was increased by the selected annual rate of establishing MPAs, which was much higher than rates before 2008. Spreading of MPAs led to higher overall contribution to objectives because less suitable municipalities with very steep morphologies (e.g. those in Romblon and Marinduque) were protected, contributing to the objective for depth class >40m and reducing over-achievement of other objectives.

The non-systematic coordinated scenarios (2 and 3) were based on one suitability layer and one decision tree, and differed only in governance context. The distribution of MPAs in these scenarios reflected the variables that were important in shaping the suitability layer, which included distance to shore, larval retention potential, and habitats. Hence, planning units selected frequently were not only close to the shore, for example in the shallower areas of Lubang Island in Occidental Mindoro Province and in Lian and Calatagan within Batangas Province, but also in the central, deeper portion of the Passage where larvae accumulate after spawning in the region (Weeks et al., 2014, Villanoy et al., 2007, Campos et al., 2007). Although the same 15% restriction on MPA allocation was applied to the coordinated scenarios, the limit was not reached because of the larger expanses of shared municipal waters. This led to selection driven mostly by suitability of planning units, which led to higher over-achievement of objectives.

3.5.2 Systematic scenarios in the four governance contexts

All the systematic scenarios achieved the conservation objectives for all the habitat types except for depth class >40m. The scenario without internal governance boundaries (7) was the most efficient, followed by those constrained within provinces (6), alliances (5), and municipalities (4). Over-achievement of objectives followed the opposite pattern: least for the scenario covering the entire Verde Island Passage, then increasing through provincial, alliance, and municipal contexts.

The relative efficiencies of the four systematic scenarios accord with results from previous studies that demonstrated reductions in efficiencies when selections were constrained within smaller governance contexts (Erasmus et al., 1999, Kark et al., 2009, Rodrigues and Gaston, 2002, Pressey and Nicholls, 1989, Weeks et al., 2010b, Strange et al., 2006). Objectives framed within smaller governance subdivisions of planning regions require more repetition of representation and therefore lead to more over-achievement of objectives framed across entire regions. In our study, however, the differences in efficiency between systematic selections in the different contexts were reduced by all scenarios having the same annual rate of establishment of MPAs and the same total allocated area over eight years. In contrast, previous studies have identified the total cost (in extent or funds) needed to achieve all objectives in different contexts.

3.5.3 Systematic vs. non-systematic approaches

In the contexts of municipalities, alliances, and provinces, the systematic scenarios were more efficient at achieving objectives than their non-systematic counterparts. These broad results were expected, and in line with previous studies (Mills et al., 2012, Hansen et

al., 2011, Pressey and Tully, 1994, Rebelo and Siegfried, 1992), because the systematic selections were directed primarily at achieving objectives with complementarity between newly-selected MPAs while also recognising the contributions to objectives of MPAs established before the simulations began. In contrast, the non-systematic scenarios were guided by rules in the decision trees that did not address objectives and by suitability layers that either ignored habitats (for municipalities) or were only weakly influenced by habitat types (alliances and provinces). The enhanced efficiency of the systematic scenarios was substantial for alliances and provinces, for which over-achievement of objectives was higher in the non-systematic scenarios, as expected from previous studies.

Contrary to expectations, within municipal boundaries, over-achievement of objectives was higher for the systematic than the non-systematic scenario. Further, the increased efficiency of the systematic scenario was negligible. This finding contrasts with that of Mills et al. (2012), who observed large differences between non-systematic and systematic selections in the context of local governance units, effectively my scenarios 1 and 4, respectively. There were three reasons for these contrasting results. First, because my non-systematic scenarios often selected parts of planning units, the effective average size of planning units was smaller. Consequently, incidental representation was reduced and efficiency increased relative to the corresponding systematic scenario that used whole planning units. The second reason was the 15% limit, in the non-systematic scenario, on MPAs in any one local government area, causing MPAs to be spread across municipalities and to contribute to objectives more effectively than the other non-systematic scenarios (2 and 3). The third reason was the different use of suitability layers in this study and that of Mills et al. (2012). Although my non-systematic scenarios were not directed at achieving objectives, the suitability layer and decision tree for the simulation within municipalities selected planning units close to the shoreline and to existing MPAs, causing protection of fringing habitats and shallower depths, similar to the corresponding systematic scenario. In contrast, the non-systematic scenario of Mills et al. (2012) protected areas without mapped habitats because their predictors of suitability included proportion of fishing ground closed, presence of provincial management support team, and distance from the nearest road.

3.5.4 Summary and real-world feasibility of the scenarios

Several studies have suggested that scaling up or coordinating local actions (e.g. Mills et al., 2012; Weeks et al., 2010b; Rodrigues and Gaston, 2002) will be more efficient at achieving conservation objectives compared to uncoordinated local actions. There are actually two sets of previous results that address this issue. The first is a series of studies that compare the efficiencies of systematic selections with or without the constraint of

governance subdivisions within planning regions (e.g. Weeks et al., 2010b; Rodrigues and Gaston, 2002). My results match these earlier findings, with efficiencies of achieving objectives progressively lower when selections were constrained within smaller governance subdivisions in the Verde Island Passage. The second type of previous result was the suggestion (Mills et al. 2012) that partial coordination of local decisions about MPAs would be intermediate in efficiency between uncoordinated local decisions and region-wide systematic planning. My results do not support this suggestion. The non-systematic scenario with no coordination was more efficient than either of the coordinated scenarios. However, there is a caveat on this result: neither of my non-systematic coordinated scenarios addressed conservation objectives directly; the coordination was related to groups of municipalities and a suitability layer and decision tree designed to reflect current approaches to establishing MPAs. I did not explore coordinated local decisions that were directed, fully or partially, at achieving conservation objectives. The higher efficiency of systematic scenarios in the context of provinces, alliances, and municipalities suggests that coordination of local actions focused on explicit objectives would at least partly support the prediction of Mills et al. (2012) in my study region.

A more important caveat on the apparent high efficiency of the non-systematic, uncoordinated scenario, relative to the non-systematic coordinated scenarios, is that the simulation for scenario 1 did not reflect all the significant real-world constraints on uncoordinated establishment of MPAs. For comparison with other scenarios, I used a very large annual rate of MPA establishment (82.8 km^2). Previous studies have shown that the actual rate of establishment of uncoordinated community-based MPAs in the Philippines (~1 km^2) has been insufficient to achieve regional conservation objectives (e.g. Aliño et al., 2006; Weeks et al., 2010a). Moreover, efforts of communities and local governments to establish MPAs have been constrained by institutional capacity, the costs of protecting and managing large areas, and high dependence on fisheries, which has limiting the acceptability of MPAs (Weeks et al., 2010a, Aliño et al., 2006, Christie et al., 2002). Hence, realistically, the annual rate of establishment for the uncoordinated, non-systematic scenario should have been smaller, and not all the municipalities would have had MPAs.

The results of the non-systematic coordinated scenarios were closer to reality. Coordinated establishment has demonstrated the feasibility of establishing larger MPAs than previously, through its ability to transcend governance boundaries. An example is the cluster of MPAs in the municipalities of Lubang Island. The annual rate of establishment used for all the scenarios was based on the rate when local governments in the Verde Island Passage coordinated their efforts. Hence, the coordinated scenarios are more likely to be

implemented than the uncoordinated scenario as depicted here. However, I also recognize that the likelihood of implementation of the coordinated scenarios will be limited by the necessary transaction costs (e.g. time and money) (McDonald, 2009). Transaction costs also become greater when local governments and communities find it difficult to build consensus on the implementation and distribution of MPAs. Moreover, coordinated, regionally-relevant MPAs will not be evenly spread across governance units. Coordination would require local governments and communities to understand and accept that coordinated MPAs come with immediate benefits (e.g. larval spillover) (Weeks et al., 2014) and costs (e.g. forgone fishing) that will not be equitably distributed, requiring mechanisms to redistribute costs and benefits in ways agreeable to the parties involved.

CHAPTER 4
EVALUATING MANAGEMENT PERFORMANCE OF MARINE PROTECTED AREA NETWORKS IN THE PHILIPPINES[3]

4.1 Abstract

In the Philippines, formation of MPA networks is seen as a means to improve management of existing MPAs by forging collaborative partnerships among local governments to coordinate initiatives and share information and resources. Although forging partnerships is widely advocated because of the beliefs of the benefits it brings, there is very little empirical evidence about the management performance of MPA networks, and the extent to which networks enhance the management of individual MPAs. In this chapter, I presented measures of the management performance of collaborative partnerships to coordinate management of MPA networks. To evaluate performance of MPA networks managed by multiple governance units, I used a combination of quantitative and qualitative survey tools (e.g. performance assessment tools, interviews, perception surveys), and synthesized the results using a scoring rubric and analysis of strengths, weaknesses, opportunities, and threats. I evaluated three MPA networks in the Philippines with different sizes, histories, and objectives to test our research methods. I found that our approach improved overall evaluation of the performance of MPA networks and individual MPAs. Moreover, our analysis for each MPA network showed different combinations of outcomes, highlighting the importance of using a suite of research methods and tools. I found that MPA networks furthered the development and effectiveness of spatial management in the Philippines. However, the objectives of the collaborative partnerships, their histories, and the diversity and complexity of governance (e.g. more diverse interests with increasing number of participating institutions) had a mixed effect on the management of networks and of individual MPAs. The outcomes of this research provide an approach to evaluating management performance that can facilitate the establishment and strengthening of MPA networks in areas similar to the Philippines with multiple governance units and complex social, economic, and political contexts.

[3] A version of this chapter was published as: Horigue V., Aliño P.M., and Pressey R.L. Evaluating management performance of marine protected area networks in the Philippines. *Ocean & Coastal Management*. 95:11-25.

4.2 Introduction

There is a growing advocacy to move from establishment of single marine protected areas (MPAs) to networks of MPAs (PISCO, 2007, IUCN-WCPA, 2008). Small single MPAs have been documented to be effective at improving fish biomass and adult spillover (Russ and Alcala, 2010, Stockwell et al., 2009, Abesamis et al., 2006) and preventing loss in coral cover (Selig and Bruno, 2010). However, these small MPAs are insufficient to protect larger proportions of species, habitat types and populations compared to larger MPAs. On the other hand, large MPAs can be impractical in most developing countries, because of resistance from local communities arising from greater socioeconomic costs (e.g. more displacement of fishers) (Govan, 2009). Networks of small MPAs can be good alternatives to single large MPAs, because they will be more socially acceptable while still extensive enough to protect fish and invertebrate populations from human impacts and climate change (PISCO, 2007, White et al., 2006b).

One benefit of establishing ecologically connected networks of MPAs is to promote dispersal of larvae between MPAs, thereby increasing protection and recovery of fish and invertebrate populations from large-scale disturbances (Almany et al., 2009). DNA parentage analysis of fish species in the MPA network at Kimbe Bay, Papua New Guinea (Planes et al., 2009) and the Great Barrier Reef Marine Park, Australia (Harrison et al., 2012) showed that fish from MPAs provide recruits to neighbouring MPAs and unprotected reefs. Additionally, MPA networks formed by collaborative partnerships among institutions and people can ensure effective management of the network by sharing information, resources, and responsibilities (White et al., 2006b, Eisma-Osorio et al., 2009, Lowry et al., 2009) and facilitating coordination (White et al., 2006a, WorldBank, 2006). It is also believed that MPA networks accelerate MPA establishment (Aliño et al., 2006),

Although MPA networks can be more feasible than single large MPAs in some governance settings, establishment and implementation of networks are more complex. In most developing countries, this complexity includes, but is larger than, the challenges of effectively managing single MPAs (Lowry et al., 2009, Govan, 2009). Sustaining initiatives for individual MPAs in areas with very high resource dependence has proven difficult, for reasons including: 1) lack of funds to sustain activities, particularly patrolling and monitoring (Butardo-Toribio et al., 2009, McCrea-Strub et al., 2011); 2) weak governance and lack of institutional skills and capacity (Lebel et al., 2006, Cabral et al., 2013); 3) lack of incentive systems and/or diversification of livelihoods (Toribio et al., 2013); and, 4) social complexity and conflicting interests of stakeholders (Hind et al., 2010, Fabinyi et al., 2010).

The management requirements of MPA networks add to these challenges in several ways: 1) spatial and temporal considerations; 2) science and information management; 3); social and economic considerations and, 4) institutions and governance (IUCN-WCPA, 2008). Because marine ecosystems are highly connected, MPA network planning and management must consider spatial and temporal factors that affect marine ecosystems. These can include the extent and status of different ecosystems, connectivity within and between MPAs, and the extent of human impacts. Hence, MPA network planning and monitoring require considerable scientific data and information management. Marine spatial planning, for example, requires substantial amounts of data and analytical tools for scientists, stakeholders, and decision makers to design an equitable and feasible MPA network plan (Fernandes et al., 2005, Fernandes et al., 2009). If MPA networks are to be accepted, they also require an understanding of the social and economic costs and benefits to local stakeholders of protecting marine ecosystems. Lastly, institutions and governance also influence design, implementation, and effectiveness of MPA networks. Governance is shaped by people and institutions, which determine the structures and processes for individual and collective action (Lebel et al., 2006). High governance capacity is required for effectively managing MPAs (Aliño et al., 2006, Green et al., 2011). However, this can be difficult to achieve in some contexts, because governance is non-linear, dynamic, and constantly changing due to the decisions and interactions of different stakeholder groups (Jentoft, 2007).

Most MPA networks in the Philippines are social MPA networks with varying levels of engagement and involving different types of stakeholders (White et al., 2006b). Some social MPA networks limit their engagement to just sharing of information, resources, and experiences through meetings and other activities (White et al., 2006a, Pajaro et al., 2010a). Examples of information networks include the *Pambansang Alyansa ng mga Maliliit na Mangingisda at Komunidad na Nangangalaga ng Santuwaryo at Karagatan sa Pilipinas* (known as PAMANA), a national network of fishermen and community-based MPA managers (Pajaro et al., 2010a), and the Philippine MPA Support Network (MSN), a network of MPA experts from academic institutions, non-government organizations, and government agencies (PAMS, 2008). Other social MPA networks have a more formal engagement and can also be considered as governance networks, because they share management responsibilities, establish financial systems (e.g. trust funds), and have accountability measures for compliance in their agreements. Examples of these networks are local government alliances (Horigue et al., 2012). Most of these networks began by forming alliances against illegal fishing and sharing strategies and responsibilities to enforce fisheries-related laws (Pomeroy et al., 2010, Armada et al., 2009, Eisma-Osorio et

al., 2009). However, because these networks are already meeting regularly and sharing information about enforcement, they have learned that they can also share information and resources to improve MPA management and jointly establish MPAs (Horigue et al., 2012, Junio-Meñez et al., 2007).

The corresponding difficulties encountered in managing MPA networks in the Philippines include (Lowry et al., 2009): 1) boundary delineation; 2) increased limitations on fishing; 3) lack of monitoring at the network level; and, 4) conflict resulting from difficulties in finding common goals among governance units. Currently, there is no evaluation process to determine the management effectiveness of MPA networks that can be applied for regular monitoring and evaluation. Moreover, standards of performance for MPA networks managed by multiple governance units have not yet been established.

This paper describes an approach to determining the management effectiveness of MPA networks in the Philippines. IUCN defines management effectiveness as, "the degree to which management actions are achieving the goals and objectives of a protected area" (Hockings et al., 2000). In this study, however, I use management performance as a surrogate for management effectiveness. I define management performance as the level of effort exerted to enhance and sustain management of MPAs and coordinate expansion of MPAs among multiple governance units. I assess performance, because management effort (or output) can be much more readily measured than management outcomes, even if effort is only part of the larger picture. I assume that greater management effort (performance) will provide, up to a point, greater ecological and socioeconomic outcomes (effectiveness). I also acknowledge that effectiveness has other dimensions that are not assessed here. These include biophysical changes within and surrounding the MPAs and the social and economic benefits received by communities directly affected by the MPAs. Gauging these aspects of effectiveness depends on consistent and regular biophysical monitoring and socioeconomic surveys, requiring longer engagement and more resources than were available for this study. The specific goals of this study are to: a) develop a method and tool to evaluate management performance of MPA networks; b) test the methods by evaluating MPA networks with different sizes (numbers of participating local governments and total areas protected), geographical locations, governance histories, and objectives; and c) infer how management of individual MPAs and MPA networks influence each other.

4.3 Methods

4.3.1 Study design

I applied multiple methods to gauge management performance of MPA networks (Figure 4.1). This section gives an overview of the study design, with each of the study components described in more detail in subsequent sections.

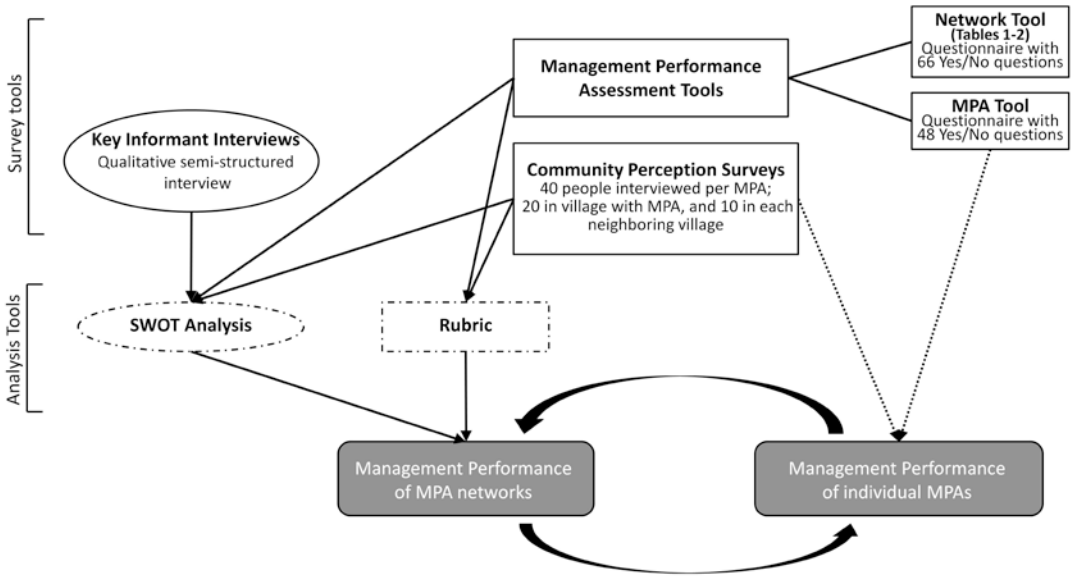


Figure 4.1 Study design. I applied quantitative methods (solid rectangles) and qualitative methods (solid oval) to evaluate the management performance of MPA networks and individual MPAs. The dotted shapes represent syntheses of the results from both quantitative and qualitative methods into a rubric and the analysis of the strengths, weaknesses, opportunities, and threats (SWOT) to determine overall management performance of networks. I then made inferences about the relationships between the management performance of individual MPAs and that of networks.

I developed a tool to assess the management performance of MPA networks (hereafter "network assessment tool"). The network assessment tool was created to complement the tool to assess the management performance of individual MPAs (hereafter "MPA assessment tool"). The MPA assessment tool[4] was developed by the Philippine National Coordinating Committee for the Coral Triangle Initiative, in partnership with the Coral Triangle Support Program and the MPA Support Network in the Philippines. The aim was to establish a benchmark for management performance of individual MPAs nationally (CI-Philippines, 2013, MSN, 2010). Both tools were used to understand how management of individual MPAs is enhanced if they are parts of networks. I implemented the tools in facilitated focus group discussions with MPA network members and MPA managers.

I also conducted community perception surveys and key informant interviews. The results of the perception surveys were used to validate management performance and to understand the communities' beliefs about the benefits of MPAs. I asked communities about their knowledge and awareness of MPAs and networks in their area. I conducted key informant interviews individually with the main members of each network to have a more open discussion on the network's history, the challenges experienced, and potential sources of conflict, and other factors that improved and/or impeded management.

I created a scoring rubric to establish the standard of management performance for MPA networks. A scoring rubric is a method developed by teachers to set standards to measure students' performance through learning. It is a matrix with two-dimensions, indicating performance in relation to a given set of criteria (Goodrich, 1996). Scoring rubrics are adaptable for use in other fields of study. They are now used to integrate social, ecological, and governance metrics and are used, for example, in assessment of governance (Fung, 2006) and vulnerability of fisheries to climate change (Mamauag et al., 2013). I tallied the results of the management assessment tools and perception surveys in the rubric to determine the overall management performance of networks.

I synthesized the results of the management assessment tools, perception surveys, and key informant interviews in a strengths, weaknesses, opportunities and threats (SWOT)

[4] The members of the Philippine National Coordinating Committee for the Coral Triangle Initiative and the MPA Support Network call the MPA management performance tool as MPA Management Effectiveness Assessment Tool or MPA MEAT. The network tool being the developed by the authors is called the MPA Network Effectiveness Assessment Tool or MPA NEAT. We simplified the name of the tools in this paper to avoid the use of too much acronyms.

analysis. The results of the SWOT analysis were used to understand the networks' advantages and bottlenecks in management, and identify potential problems and solutions.

Lastly, I inferred whether there was a strong relationship between management performance of individual MPAs and that of network management. I assumed that network management has the ability to enhance management of individual MPAs and vice versa. The reasons include increased efficiency of enforcement, measures taken for transparency and accountability such as ensuring monitoring and evaluation for each MPA, incentive systems, and improved communication across multiple governance units.

4.3.2 Management performance assessment tools

I created the network assessment tool to set standards for achieving management performance of networks within specified time frames of two years per management level (Table 4.1). The standards set were based on the lessons learned from Chapter 2, and consultations with various stakeholders. I aimed to develop a simple yet extensively applicable tool that establishes the minimum requirements for MPA networks and evaluates different types of collaborative partnerships that are implementing and co-managing MPA networks. These partnerships included fishing villages that have formed fishers' federations and local government alliances that coordinate coastal management, coastal development, and other activities.

The network assessment tool questionnaire was designed to complement the already-established MPA assessment tool. The new tool I developed measures management performance by checking how many activities are achieved and sustained for a given period. There were a total of 66 questions that can be answered by a 'yes' or 'no' in the questionnaire. If a question was answered with a 'yes', evidence in the form of documents (e.g. copies of laws, minutes of meetings, reports) and photos (e.g. of activities or signboards) were checked for verification. Points were given for each question with a positive answer. The accumulated points were interpreted in three ways: 1) overall score; 2) management level; and, 3) management focus. The overall score indicated level of effort exerted to sustain management. The higher the score, the greater the effort directed at coordinated management. The highest possible score in the tool was 142 points.

There were four management levels (Table 4.1), each reflecting the overall strength of performance for a certain period. To attain a management level, the following criteria should be achieved: a) all threshold questions (Table 4.1) in each level and those below it were answered positively; b) the minimum number of years since establishment of the network should be reached; and c) a minimum overall score should be attained.

Table 4.1 Description of each management level in the network assessment tool

Network management levels	Threshold questions unique to each level
Level 1 – Network is established – At least one year from establishment; all thresholds achieved, minimum score of 40	Formed management committee Signed and implemented legal bases (e.g. memorandum of understanding) Implemented work plan Undertook joint enforcement strategies for (shared) municipal waters Organized financial systems Initiated joint activities (apart from enforcement) Reviewed management performance of all MPAs
Level 2 – Network is strengthened – At least three years from establishment, all thresholds in this level and from the previous level achieved, minimum score of 60	Initiated discussions with provincial government and/ or neighbouring local governments to participate in the network Conducted regular patrols and adjudicated documented violations Established incentive systems and subsidies for MPA managers and their committee members Performed fisheries and socioeconomic impacts monitoring Feedback system in place allowing members to make informed suggestions (e.g. forum about results of monitoring and evaluation activities, suggestion boxes)
Level 3 – Network is sustained – At least five years from establishment, all thresholds in this level and from the previous level achieved, minimum score of 90	Gained support from the provincial government Accessed, generated and/or outsourced funds Initiated integration of MPA network management into integrated coastal management and ridge-to-reef management
Level 4 – Network is institutionalized – At least seven years from establishment, all thresholds in this level and from the previous level achieved, minimum score of 120	Full involved provincial government Incorporated MPA network management into integrated coastal management and ridge-to-reef management

Of the 66 total questions, 37 were threshold questions used to determine management level. Each threshold question contributed three points, whereas the other questions were each worth one point. Threshold questions conferred more points since these are management requirements, whereas the standard questions correspond to extra activities that also contributed to enhanced management. Each management level had unique threshold questions (Table 4.1). However, there were also thresholds repeated in each level that were fundamental to sustaining accountability and transparency among members of the network. These repeating threshold questions related to: 1) attendance and participation in regular meetings; 2) monitoring and evaluation of individual MPAs, especially measuring management performance; 3) fully operational enforcement systems; 4) secure finances with accurate and timely financial reporting systems; and, 5) feedback mechanisms (e.g. public forums, state of the province address) to increase awareness and elicit responses from communities.

The last way to interpret the results of the network assessment tool was to determine the network's management focus. The questions in the tool refer to eight categories of management (Table 4.2). Determining the scores per management category helps to identify the specific strengths and weaknesses of the network's management. All the management categories were related. For example, legal bases such as ordinances (category 2) were also necessary for enforcement (category 4), because they ensured legality of the network's initiatives. Work plans and financing (category 3) were important to conduct organized and timely joint activities (category 5) such as meetings, monitoring, and feedback.

Table 4.2 Description of each management category evaluated using the network assessment tool

Network management categories	Description
Management committee	Presents the structure and position of each member with clear roles and responsibilities
Legal bases and by-laws	Provides legality of the network and the activities (e.g. enforcement); includes but is not limited to: memorandum of agreement, ordinances, by-laws
Work plan and financing	Details annual activities for a given period, and how activities are funded
Enforcement plan	A separate plan from the work plan, focused on strategic enforcement measures developed and tailored by each network to suit its needs
Joint activities	Includes meetings, general assemblies, awareness campaigns, training sessions, planning workshops and other activities that maintain the MPAs and strengthen partnerships
Monitoring and evaluation	Biophysical (e.g. coral reef, seagrass assessments), socio-economic (e.g. well-being, catch monitoring), and management performance of all MPAs. Results of the monitoring allow management initiatives to be reviewed and adjusted if necessary
Feedback mechanisms	Information (e.g. results of monitoring) should be shared at all levels to increase awareness and understanding, and potentially improve compliance
Expansion activities	Expansion of the network by expanding existing MPAs or establishing new ones within jurisdictions and/ or inviting other local governments to get involved

Complementary to the network assessment tool , the MPA assessment tool (MSN, 2010, Aliño et al.) was developed previously to establish a benchmark for the management performance of locally-managed MPAs in the Philippines. The MPA assessment tool addressed management activities that individual MPAs should accomplish, thereby providing unique information about individual MPAs within networks. The MPA assessment tool only partly considers aspects of MPA networks: it scales up to network

management by including indicators that facilitate coordination and collaboration with neighbouring villages or municipalities, and eventually provincial governments. The network assessment tool substantially added to evaluation of networks by establishing enhanced and stricter criteria to help increase scale and efficiency in enforcement, monitoring and other activities, and increased accountability measures.

The MPA assessment tool was the product of the review of management effectiveness tools used in the Philippines. The tool resulted from the integration of the MPA Report Guide of the Coastal Conservation and Education Foundation, Inc. (Maypa et al., 2012, White et al., 2004) and the Management Effectiveness Tool of the Philippine Environmental Governance Project (Toribio et al., 2013).The MPA assessment tool was pilot-tested through the 2011 Philippine MPA Awards and Recognition contest conducted by the Philippine MPA Support Network and government partners. The biennial contest was a culmination of a national-level assessment of MPAs in the country. The contest was a means to consistently update the national MPA database, document good practices on MPA management (e.g. consistent monitoring, strict enforcement), and provide incentives to assist in MPA management (PAMS, 2008). The MPA assessment tool was now the standard tool to measure management performance of locally-managed MPAs in the Philippines (Maypa et al., 2012, CI-Philippines, 2013). Interpretation of the scores of the MPA assessment tool was the same as that for the network assessment tool. The MPA assessment tool had 48 questions, of which 18 relate to thresholds and 30 were standard questions and that were assigned to nine management categories.

I implemented the network and MPA assessment tools in facilitated focus group discussions in provincial, municipal, or village government offices or MPA sites (e.g. guardhouses, beach fronts). I used group discussions since there was no one person that will have complete familiarity and understanding of all the activities and challenges encountered in management. Since the organizational structures and membership representation for networks varied, I invited people who were directly involved in each network to participate in the questions for the network assessment tool. These participants included provincial government employees (e.g. environment and planning), local chief executives, local government employees (e.g. agriculturists, environmental officers, engineers), and/or chiefs of fishers' organizations. For the MPA assessment tool, I invited MPA committee members. The roles of these people varied between municipalities, but included local government employees, village captains, and/or main representatives of fishers' organizations. When the participants were invited, they were asked to provide

evidence of their management activities, these included copies of reports, ordinances, patrolling logbooks, and accounting ledgers.

4.3.3 Key informant interviews and community perception surveys

To complement the assessment tools, I conducted community perception surveys in villages with MPAs and adjacent villages without MPAs to validate functionality of and ascertain outcomes of management. MPA management was deemed functional when the management body was carrying out and capable of carrying out key activities. I interviewed community members who were directly affected (fishers) and indirectly affected (non-fishers) by the MPAs. The sampling design was to interview 40 people per MPA, 20 residing in the village with the MPA, and 10 residing in each of two neighbouring villages. I aimed to split the interviews evenly between fishers and non-fishers. The survey consisted of 20 questions which took 15 to 30 minutes per person. I asked the communities about their awareness and understanding of MPAs, if they had seen or received benefits from the MPAs, their perceptions of the level of effort expended by the management committee to maintain the MPAs, and their awareness of MPA networks.

The key informant interviews involved participants of the network individually for more candid discussions. Since the assessment tools were a yes-no questionnaire type, I needed to understand why some of the management indicators were not satisfied and to determine potential ways to overcome management impediments through reflection. I asked them individually about their understanding of the nature of MPA networks, beliefs about the benefits of MPAs and MPA networks, how much they were achieving as a group, challenges experienced that were caused by internal and/or external pressures, unresolved problems, and other matters. The results of the key informant interviews were also used to complement the results of the network and MPA assessment tools in the SWOT analysis (below).

4.3.4 Scoring rubric and SWOT analysis

I created a scoring rubric to summarize and compile data to rate the management performance of MPA networks against seven criteria, each criterion had five levels of achievement (Table 4.3). The criteria included in the scoring rubric were management levels achieved in the network and MPA assessment tools, overall scores from the network and MPA assessment tools, increase in total area protected since formalization of the network and, percentage of community members supporting the MPAs and MPA network. Each criterion had categorical or continuous levels that related to corresponding points

(Table 4.3). The points reflecting the performance level for each criterion were then summed across criteria to give an overall assessment of management performance.

Table 4.3 Scoring Rubric: Standard of performance for the management effectiveness of MPA networks

Criteria	Points Distribution				
	4 points	**3 points**	**2 points**	**1 point**	**0 point**
1. Management level achieved in the network assessment tool	Attained Level 4	Attained Level 3	Attained Level 2	Attained Level 1	Did not attain any level
2. Overall score achieved in the network assessment tool	Achieved a score of 121 to 142	Achieved a score of 107 to 120	Achieved a score of 92 to 106	Achieved a score of 78 to 91	Achieved a score <78
3. Management level achieved in the MPA assessment tool	All MPAs attained Level 1 or higher	At least 85% of all the MPAs attained Level 1 or higher	At least 70% of all MPAs attained Level 1 or higher	At least 60% of all MPAs attained Level 1 or higher	Less than 60% of all the MPAs attained Level 1 or higher
4. Overall score achieved in the MPA assessment tool	All MPAs achieved a score of 40 and above	At least 85% of all MPAs achieved a score of 40 and above	At least 70% of all MPAs achieved a score of 40 and above	At least 60% of all MPAS achieved a score of 40 and above	Less than 60% of all MPAs achieved a score of 40 and above
5. Increase in total area protected since formalization of the MPA network	The total area of MPAs increased five-fold since the formalization of the network.	The total area of MPAs increased four-fold since the formalization of the network.	The total area of MPAs increased three-fold since the formalization of the network.	The total area of MPAs doubled since the formalization of the network.	The total area of MPAs less than doubled since the formalization of the network.
6. Percentage of community members who support the MPAs	All fisher respondents and more than 50% of the non-fisher respondents support the MPAs in their area.	At least 75% of the fisher respondents and more than 50% of non-fisher respondents support the MPAs in their area.	At least 75% of the fisher respondents and less than 50% of non-fisher respondents support the MPAs in their area.	At least 50% of the fisher respondents and less than 50% of non-fisher respondents support the MPAs in their area.	Less than 50% of the fisher respondents and less than 50% of non-fisher respondents support the MPAs in their area.
7. Percentage of community members who support the MPA network	All fisher respondents and >50% of the non-fisher respondents support the network.	At least 75% of the fisher respondents and more than 50% of non-fisher respondents support the network.	At least 75% of the fisher respondents and less than 50% of non-fisher respondents support the network.	At least 50% of the fisher respondents and less than 50% of non-fisher respondents support the network.	Less than 50% of the fisher respondents and less than 50% of non-fisher respondents support the network.

The scoring rubric did not include information on the length of time performance levels had been maintained. This was, because data on management performance of individual MPAs were lacking for most MPAs and patchy in some. As these data improve, however, it should be possible to determine chronological trends in management performance of networks.

I used a SWOT analysis to complement the results of the rubric to explain strengths and weaknesses in management. The SWOT was used to combine and analyse the results of the MPA and network assessment tools, community perception surveys, and key informant interviews. I used the SWOT analysis to identify internal and external factors that contribute to improvement or form bottlenecks in management performance. By using the SWOT analysis to evaluate the governance capacities of the network, I was able to infer how network management contributes to improved management of individual MPAs.

To summarize visually the results of the SWOT analysis, I located the evaluated networks in a two-way plot, with axes reflecting governance capacity and urgency to mitigate threats. Governance capacity for each network was derived from the total of number of strengths and opportunities from the SWOT analysis. The urgency to mitigate threats for each network was derived from the total number of threats identified in the SWOT analysis.

4.3.5 Case study areas

I selected three networks from the 40 networks identified in Chapter 2. I chose three to balance, on one hand, the need to represent different types of networks in the Philippines and, on the other hand, the constraints on funding and time to collect the required data. The networks I selected were the provincial MPA and enforcement network of Batangas, the Camotes Sea Coastal Resource Management Council, and the Lanuza Bay Development Alliance (Figure 4.2). These networks varied in terms of geopolitical scales (number of local governments involved and extent of jurisdiction), network type, history, governance structure, and the social, cultural, and economic attributes of communities (Table 4.4).

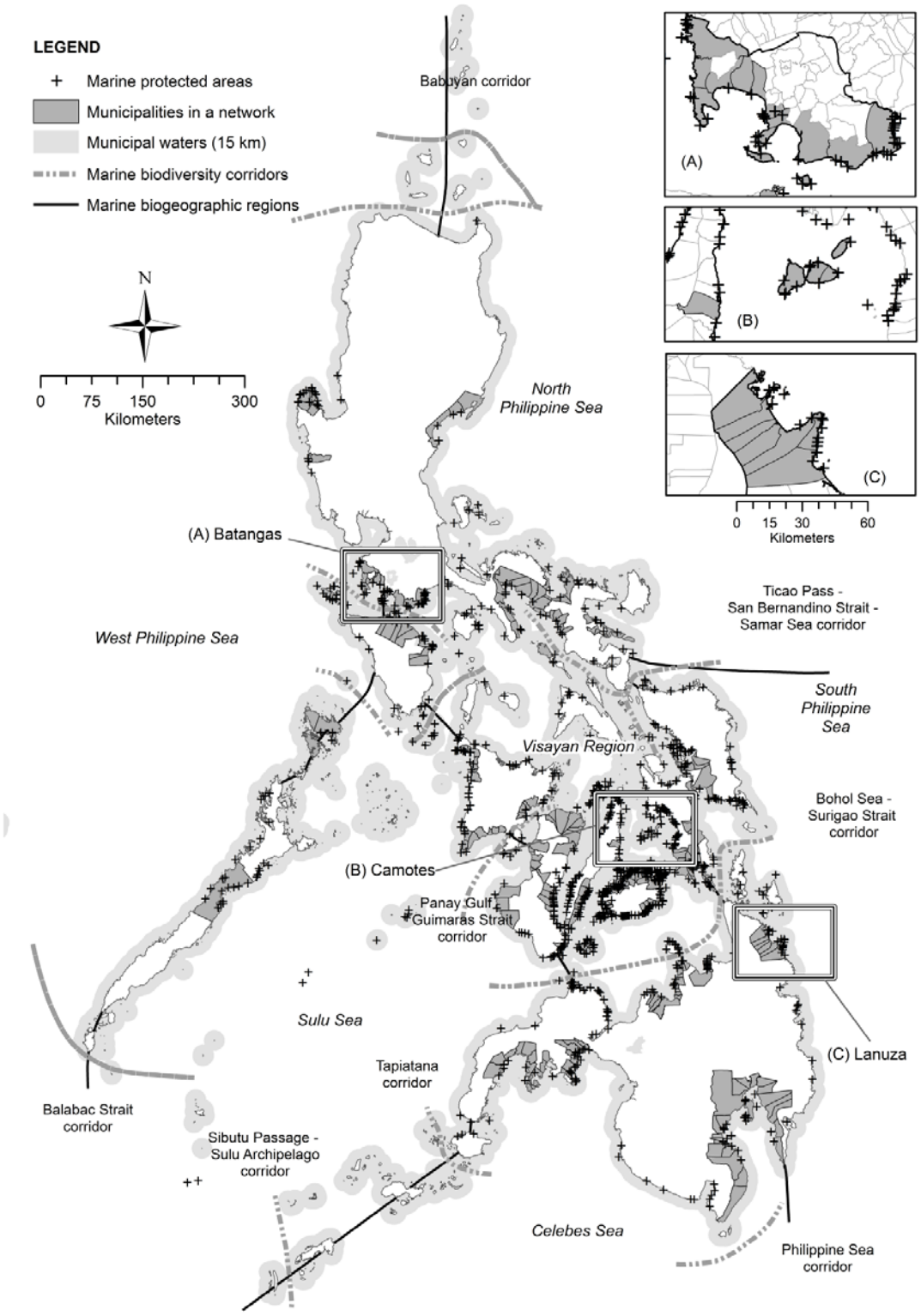


Figure 4.2 The three case study areas selected in the inset. The Philippines, showing marine protected areas and networks of MPAs now being initiated by local governments in collaborative partnerships. Darker shading indicates administrative units where local governments have formed alliances for the purposes of coastal resource management and enforcement.

Table 4.4 Summary characteristics of the three MPA networks evaluated in this study

	Batangas MPA and Enforcement Network	**Camotes Sea CRM Council**	**Lanuza Bay Development Alliance**
Short name	Batangas	Camotes	Lanuza
Biogeographic region and location	West Philippine Sea; Verde Island Passage	Visayan Region; Camotes Sea	South Philippine Sea; Lanuza Bay
Province	Batangas	Cebu	Surigao del Sur
Year legally established	2007 (MPA); 2009 (Enforcement)[1]	2006[2]	1999[3]
Number of members	13	5	7
Land area[4] (km^2)	1,736	383	1,531
Coastline length (km)	492	152	145
Municipal waters (km^2)	7,000	2,050	1,450
MPA management	Mixed – municipal government, *Barangay*[5] government, people's organizations, private (e.g. resorts, NGO)	*Barangay* government	People's organizations
Major supporting institutions[6]	CI – Philippines (2007-11)	USAID funded - EcoGov Project (2002-11)	USAID funded – FISH Project (2003-10)
Other previous supporting institutions (selected municipalities)	PEMSEA, WWF, PLMMA, Hayuma Foundation, Haribon Foundation	Plan International, CCEF	Haribon Foundation, Green Mindanao, CERD, Tambuyog
Supporting institutions as of 2012 (selected municipalities)	CAP Oceans, CI – Philippines[7]	Rare Conservation – Philippines	Rare Conservation – Philippines

[1] The network in Batangas is composed of 11 municipalities that have MPAs in their respective municipal waters. The municipalities of Calaca and San Luis do not have MPAs and are members only of the enforcement network.

[2] The memorandum of agreement formalizing the network in Camotes was amended in 2007 to include more explicit terms of their partnerships.

[3] The memorandum of agreement among the municipalities in Lanuza was amended in 2008 to change some terms and definitions in their by-laws and manual of operations.

[4] Total land area for participating municipalities

[5] A *barangay* is equivalent to a village. It is the smallest political unit in the Philippines. *Barangays* are led by captains and also have their legislative officials to institute ordinances suited to the needs of their communities. However, *barangay* leaders also depend on

municipal governments for basic services (e.g. funding) and implementation of local development plans (Rodriguez, 2009).

[6] Some municipalities within all these networks have received support from various local and international non-government organizations and academic institutions.

[7] CI retains a strong tie with the provincial government of Batangas' Environment and Natural Resources Planning Division.

Abbreviations: CI – Conservation International; USAID – The United States Agency for International Development; EcoGov – Philippine Environmental Governance Project; FISH – Fisheries for Improved Sustainable Harvest Project; PEMSEA – Partnerships in Environmental Management of the Seas of East Asia; WWF – Worldwide Fund for Nature; PLMMA – Philippine Locally Managed Marine Area Network; CAP Oceans – Conserve and Protect the Oceans Foundation; CCEF – Coastal Conservation and Education Foundation; CERD – Centre for Empowerment and Resource Development.

References: Documents provided by the networks (e.g. memorandum of agreement, constitutions, minutes of meetings); State of the Coasts of Batangas, 2008; www.oneocean.org; www.dai.com)

I applied the network assessment tool to 16 representatives across the three networks and applied the MPA assessment tool to 93 representatives across 62 MPAs. I conducted a total of 61 key informant interviews and completed 1,575 perception surveys with full responses. I intended to interview more representatives, but I was constrained by people's schedules and some refusals to be interviewed. Some key informants that were not available to be interviewed referred us to their colleagues while others did not participate in any way.

4.4 Results

4.4.1 Network management performance

None of the networks I evaluated achieved Level 1 (Established). However, Batangas scored the highest with an overall score of 128 out of a possible 142 points (90%). Camotes and Lanuza attained overall scores of 115 (81%) and 92 (65%), respectively (Figure 4.3). I found that the thresholds that I had set in the network assessment tool were not applicable to all the networks I evaluated. Unlike the experience with individual MPA management, I realized that I needed more knowledge of different network types, objectives, and histories in order to establish thresholds for network management.

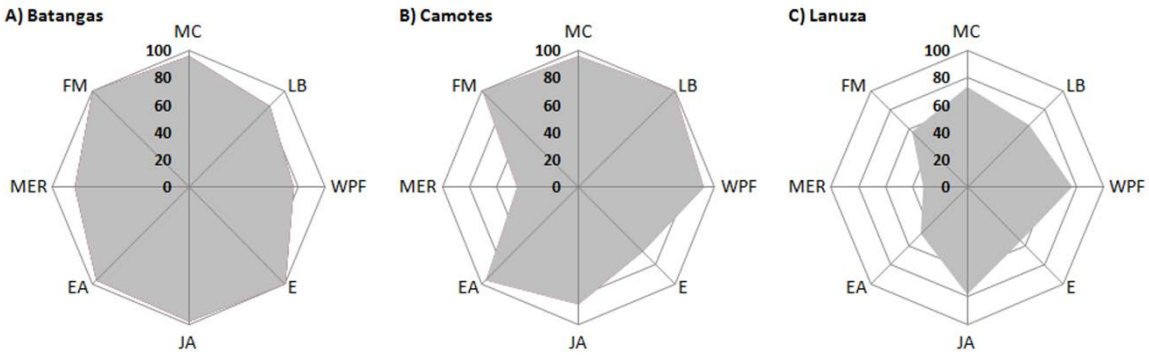


Figure 4.3 Scores for management categories (from Table 4.2) achieved by each network. Abbreviations (from the top, clockwise): MC – Management committee; LB – Legal bases; WPF – Workplan and financing; E – Enforcement; JA – Joint Activities; EA – Expansion activities; MER – Monitoring, evaluation and review; FM – Feedback mechanisms.

The Batangas network implemented activities that gave high scores for all management categories (Figure 4.3A). Batangas' particular strengths were in enforcement, joint activities, and expansion activities. The network included a network of enforcers (volunteer patrollers called *Bantay Dagat*) and was supported by another enforcement team which included the Philippine National Police and Coast Guard. The municipalities involved continue to expand their MPAs to comply with the network's requirements of a minimum protected area of 40 ha. The network also has a best-MPA awards competition as an incentive to complement their monitoring and evaluation efforts.

The Camotes network had strong legal bases, work plans, and sustained financing (Figure 4.3B). Their legal bases and workplans (e.g. strategic action plan and CRM plan) carefully detailed the objectives of their network and the activities that they initiated and endeavoured to achieve by 2015. They also sustained their joint finances and gained financial assistance from external sources. However, they had not yet allocated the funds for any activity since the end of the USAID-funded Philippine Environmental Governance Project. They were not able to sustain their joint enforcement activities and monitoring and evaluation activities due to the lack of manpower, boats and gear. The network initiated establishment of a 100-hectare MPA to be jointly managed by three municipalities in 2009. However, due to opposition from fishermen in one municipality, they reduced the MPA to 50 hectares which straddled along two municipalities, in 2012.

Lanuza was one of the oldest networks in the Philippines that are still active. The network encountered numerous problems concerning enforcement, particularly problems with commercial fishermen. The legitimacy of the network's unified ordinance was challenged in court when it sued commercial fishermen that encroached municipal waters. Due to their loss in this case, the governance structure and management focus was shifted. The network devolved much of its responsibilities to the local governments and expanded its objectives to include forest, agriculture, and eco-tourism in addition to coastal resource management. Since this shift in focus, MPA network activities became less important, and eventually deteriorated (Figure 4.3C). Financing was one of the main problems of the network,, because not all local government members were able to contribute to management funds. However, despite these problems, the members of the network are still committed to strengthening their ties and improving their management and have started to develop a communication system to support enforcement.

Establishment of MPAs in each network had at least doubled since the formalization of the networks (Table 4.5, Figure 4.4). Most of these MPAs established were facilitated by partner non-government organizations, but in Batangas and Camotes some municipalities

continued to establish and/or expand the MPAs in their waters. In Batangas, one municipality established one MPA and was in the process of establishing another during the period of assessment. Similarly, in Camotes, one of the municipalities was able to get funding from the Global Environment Facility's Small Grants Program to establish another mangrove and coral reef MPA and mangrove rehabilitation project. Another municipality in Camotes was in the process of establishing a new mangrove MPA, and the local government officials were using the MPA assessment tool as a guide.

Table 4.5 Summary of MPAs established before and after formalization of each network

	Batangas	**Camotes**	**Lanuza**
Before formalization of the network			
Number of MPAs	24	5	4
Total area protected (km^2)	7.93	2.22	2.10
Number of municipalities with MPAs	8	3	1
After formalization of the network			
Number of MPAs in 2012	42	12	17
Total area protected in 2012 (km^2)	17.55	5.72	7.93
Number of municipalities with MPAs in 2012	11	5	5
MPAs established with minimal support from NGOs	2	2	0
Number of municipalities that established MPAs with minimal support from NGOs	1	2	0
MPAs with effectiveness ratings in 2012*	37	10	15
Rate of MPA expansion since network establishment (MPA/ year)	3.6	1.2	0.9
Rate of MPA expansion since network establishment (km^2/ year)	1.9	0.6	0.4

*See Figures 4.4 and 4.5 for more detailed information on effectiveness ratings of MPAs within the networks.

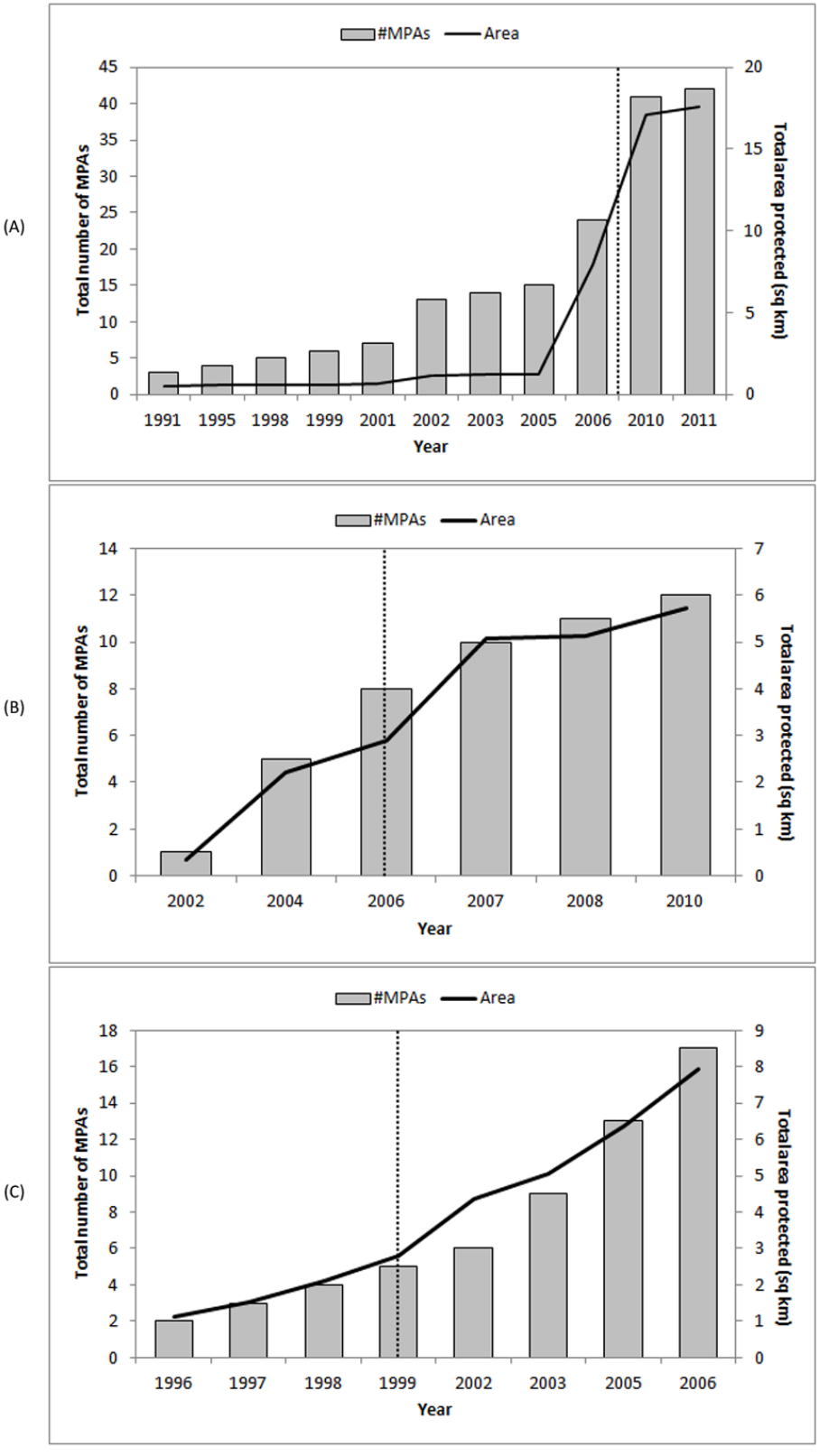


Figure 4.4 Cumulative number and total area protected in the networks of (A) Batangas, (B) Camotes, and (C) Lanuza. Vertical dotted lines indicate years in which networks were established. Note that scales on both *x*- and *y*-axes vary.

4.4.2 MPA management performance

Management performance scores of 48 out of the 62 MPAs assessed attained Level 1 or higher (Figure 4.5). MPAs at Level 0 did not satisfy all threshold questions for Level 1 (e.g. they had outdated management plans or were currently reorganizing their management bodies). Nonetheless, some Level-0 MPAs had high overall scores. Variation in management performance scores across the three networks was mostly attributable to the different ages of MPAs (See Table 4.5 and Figure 4.5). Older MPAs performed better compared to younger MPAs and recently established MPAs. For example, some of the older MPAs in each network have been recognized in previous national MPA awards and recognition competitions, because of their notable management performance. These included Twin Rocks Marine Sanctuary in Batangas (established in 1991), Pilar Municipal Marine Park in Camotes (established in 2005), and General Island MPA in Lanuza (established in 2006).

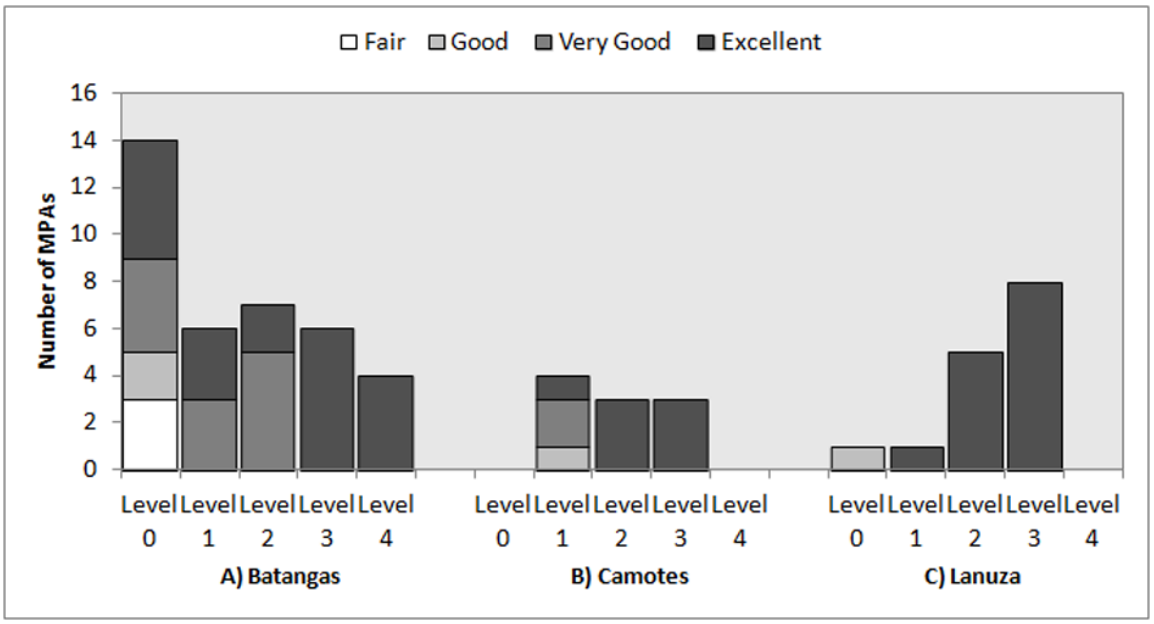


Figure 4.5 Management levels and overall scores of the MPAs assessed in each network. Level 1 – MPA is established; Level 2 – MPA is strengthened; Level 3 – MPA is sustained; Level 4 – MPA is institutionalized. Legend above graph indicates categories of scores: Fair = <24 points; Good = 25 to 39 points; Very Good = 40 to 61 points; Excellent = 62 to 84 points.

In terms of management focus, nearly all MPAs across all three networks satisfied the categories for legal bases and community participation (Figure 4.6). This indicated that local governments and MPA management bodies considered community participation and legal bases as key elements in MPA management, and usually addressed these two focus areas first to establish buy-in and legal validity of enforcement. The other management categories were highly variable within and between networks, with relatively poor results for financing, information-education campaigns, monitoring and evaluation, and site development.

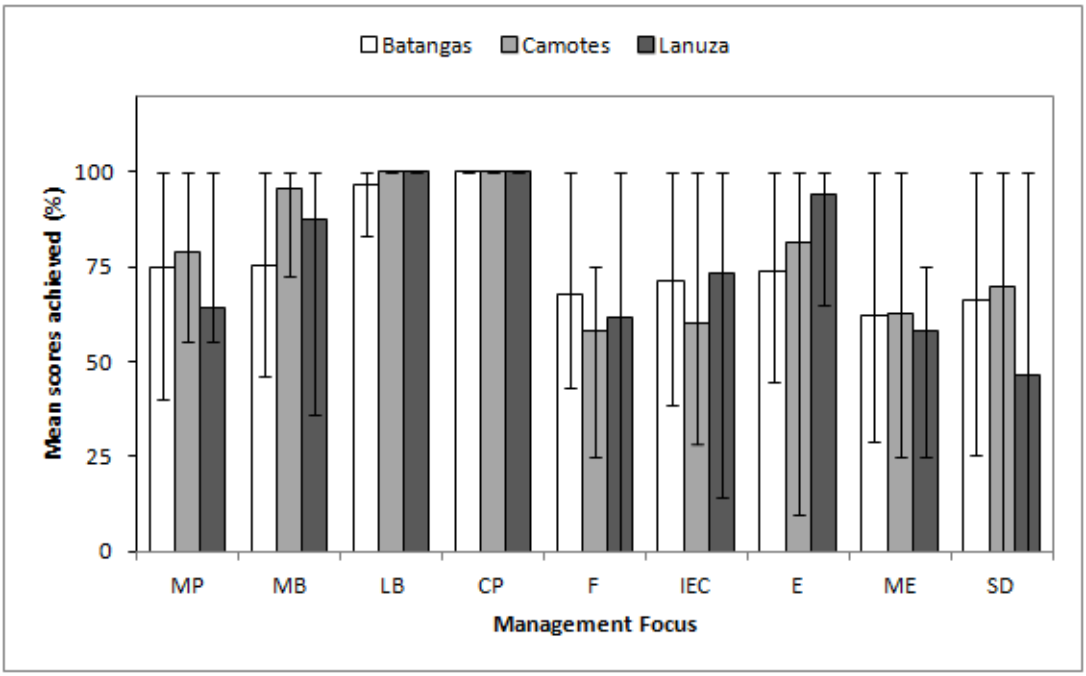


Figure 4.6 Mean scores achieved for each management focus across all assessed MPAs. Error bars show standard deviations. Abbreviations: MP – Management plan; MB – Management body; LB – Legal bases; CP – Community participation; F – Financing; IEC – Information, education and communication; E – Enforcement; ME – Monitoring and evaluation; SD – Site development

I found that the causes of variability in management performance across the three networks, apart from age of MPAs, were: 1) different profiles and varying priorities and/or strengths of management committees; 2) lack of funds allocated for management due to insufficient internal revenue allotments of local governments; 3) lack of focus on some activities, because MPA managers believed that community awareness was high and that other activities need to be prioritized; and/or 4) lack of technical capacity and/or gear (e.g. SCUBA, snorkelling) to conduct monitoring and evaluation.

A variety of stakeholders managed MPAs across the three networks. Some MPAs co-managed by private institutions had well-financed MPAs and stronger enforcement. In contrast, MPAs managed by people's organizations had inconsistent and usually insufficient financing, because they were highly dependent on local governments to support their activities. Local governments stated that they had insufficient funds for MPA management, because their internal revenue allotments from the national government were also scarce. Most local governments stated that the allotments from the national government were not divided fairly across the country. These allotments were divided based on land area, population and equal sharing, and did not consider the total area of jurisdiction including municipal waters. Management activities such as information-education campaigns and site development were not conducted, because some MPA managers believed that the MPAs were well-known and that communities accept the MPAs. They also believed that enforcement was much more important than other activities. Lastly, monitoring and evaluation was poor for most MPAs, because management committees either lacked trained volunteers or gear.

4.4.3 Key informant interviews

All of the informants defined their networks as governance and/ or social. When asked to define what an MPA network was, informants said that it was a group of local governments … "… working together to strengthen MPA management and other coastal management initiatives", "… who meet regularly to share lessons and experiences on MPA management", and "… that helps to solve problems that cannot be addressed by one local government". Fisher informants in Lanuza mentioned that an MPA network was a group of local (fisher) MPA managers. There was a separate network of local MPA managers (local chapter of PAMANA Ka) in Lanuza that was also supported by the alliance. A few (6%) informants across the three networks attempted to define their network as ecological. These informants said that there were larval dispersal studies done in their area, so their MPAs were ecologically connected as well.

Most (97%) of the informants valued their participation and/or that of their local governments in the network. They believed that joint meetings and other activities (e.g. MPA forum, trainings) allowed them to learn from the experiences of other members and gain more skills for management, monitoring, and enforcement. Meetings were also seen as a way for them to discuss common problems and address current issues. The informants believed that holding and participating in meetings were important for a network to remain active and for accountability and transparency, because they used meetings as a venue to report on their activities and to facilitate conflict resolution. The informants also noted that

it was important for all the representatives to attend meetings, because poor attendance impeded decision-making and conflict resolution.

4.4.4 Community perception surveys

Despite having feedback mechanisms in place, less than 50% of all respondents across all the three networks said that they were familiar with the concept of an MPA network and knew that there was an MPA network in the area (Table 4.6). Few respondents mentioned or attempted to define an ecological MPA network and said that it was "a group of connected MPAs" or "a group of MPAs that are able to protect eggs that travel to and from MPAs and other habitats". The respondents had also heard these definitions from local government officials, MPA managers, *Bantay Dagat* members, media (e.g. radio, newspaper/ newsletter), NGO partners, and other community members. Despite these low awareness ratings, more than 50% of respondents said that they would support the MPA network. These respondents are supporters of MPAs and assume that MPA networks will have greater benefit compared to single MPAs. Those not supporting it said they might offer support if they knew what an MPA network was.

Table 4.6 Summary of community perception survey results (%) on MPA networks and MPAs across the three networks.

	Batangas		**Camotes**		**Lanuza**	
	F	***NF***	***F***	***NF***	***F***	***NF***
Total number of respondents (n)	***332***	***311***	**159**	**163**	**315**	**295**
MPA networks						
Aware of the MPA network concept	34	21	41	34	25	22
Aware of the MPA network in their area	30	20	36	22	17	22
Support the MPA network in their area	61	50	91	90	63	67
Individual MPAs						
Aware of MPAs in their area	72	38	100	98	98	95
Positive perception of MPA benefits	45	25	53	47	60	74
Positive perception of MPA management performance						
Functionality	66	47	78	83	83	81
Sustainability	64	48	75	73	59	63
Decrease in illegal fishing	68	54	92	91	90	86
Support the MPAs in their municipalities	76	61	93	88	89	90

Abbreviations: F – fisher; NF – non-fisher

Awareness of individual MPAs was higher than that of the MPA networks. Most respondents in Camotes and Lanuza knew what MPAs were and where they were (Table 4.6). This was attributed to the age of the MPAs, and the activities implemented by the MPA managers and local governments, particularly enforcement. However, in Batangas, the awareness of MPAs was lower. This was attributed to either or both of the following reasons: 1) some of the MPAs were relatively new and therefore not yet well-known; and, 2) a higher proportion of people in Batangas were migrants from other areas. Non-fisher respondents in Batangas also had no involvement in fisheries and/or not concerned with fisheries. There were a lot of livelihood options in Batangas apart from those related to fisheries, so non-fisher respondents may have had little knowledge of MPAs.

Most respondents, except for the non-fishers in Batangas, said that MPA management performance was good. The responses of the communities included: 1) the *Bantay Dagat* actively enforced MPAs and other fisheries-related laws; 2) illegal fishing practices (e.g. dynamite and cyanide fishing, fine mesh nets) in their areas were reduced, 3) meetings and public hearings discussing the MPAs and fisheries laws were consistently held; 4) markers, buoys and billboards were visible and replaced regularly.

4.4.5 Overall performance ratings and evaluation

Based on the scoring rubric, Batangas scored "fair", whereas Camotes and Lanuza had "good" overall performance rating (Table 4.7). Batangas had a lower overall performance rating, because of the lower overall MPA management performance scores and community perception surveys. The MPAs in Batangas were established recently and have still yet to accomplish all the management initiatives indicated in the performance tools and require more time to increase their community awareness ratings. The higher overall performance ratings in Camotes and Lanuza were attributed to the higher overall MPA management performance scores and community perception surveys (Table 4.7). The higher rating for Camotes was attributed to its small, isolated geographic area and high dependence on fisheries. News such as establishment of MPAs spread faster, because the area was smaller. Moreover, most families in Camotes were involved in fisheries and were concerned about their resources and/or fishing activities. Lanuza had a high rating, because the people's organizations comprised of fishermen were working hard to manage their MPAs and keep other fishermen well-informed.

Table 4.7. Summary of results and overall management performance rating in the scoring rubric

	Batangas		Camotes		Lanuza	
	Rating	**Points**	**Rating**	**Points**	**Rating**	**Points**
1. Management level achieved in the network assessment tool	Level 0	0	Level 0	0	Level 0	0
2. Overall score achieved in the network assessment tool	128 (Excellent)	4	115 (Very Good)	3	92 (Fair)	2
3. Management level achieved in the MPA assessment tool	63% of MPAs achieved Level 1 or higher	1	100% of MPAs achieved Level 1 or higher	4	93% of MPAs achieved Level 1 or higher	3
4. Overall score achieved in the MPA assessment tool	86% of MPAs achieved a score of 40 or higher	3	90% of MPAs achieved a score of 40 or higher	4	93% of MPAs achieved a score of 40 or higher	4
5. Increase in total area protected since formalization of the MPA network	2x increase in total area protected	1	2x increase in total area protected	1	3x increase in total area protected	2
6. Percentage of community members that support the MPAs	F -76% NF - 61%	1	F - 93% NF - 88%	3	F - 89% NF - 90%	3
7. Percentage of community members that support the MPA network	F - 61% NF - 50%	1	F - 91% NF - 90%	3	F - 63% NF - 67%	1
TOTAL		**11 (Fair)**		**18 (Good)**		**15 (Good)**

Categories of scores: Poor = 0 to 7 points; Fair = 8 to 14 points; Good = 15 to 21 points; Very Good = 22 to 28 points.

The results of the SWOT analysis and the governance capacity vs. urgency plot did not coincide with the results of the scoring rubric. Batangas scored "fair" in the overall management performance rating. However, the SWOT analysis showed that Batangas had high governance capacity and low urgency to mitigate threats (Table 4.8, Figure 4.7). The high governance capacity in Batangas was attributed to a high level of coordination, because the members adhere to the established transparency and accountability measures and heed the leadership of the provincial government. The participation of the provincial government and accountability measures in Batangas ensured good coordination among the local governments. Threats in Batangas were relatively low compared to the other case studies. Moreover, Batangas initiated measures to mitigate these threats.

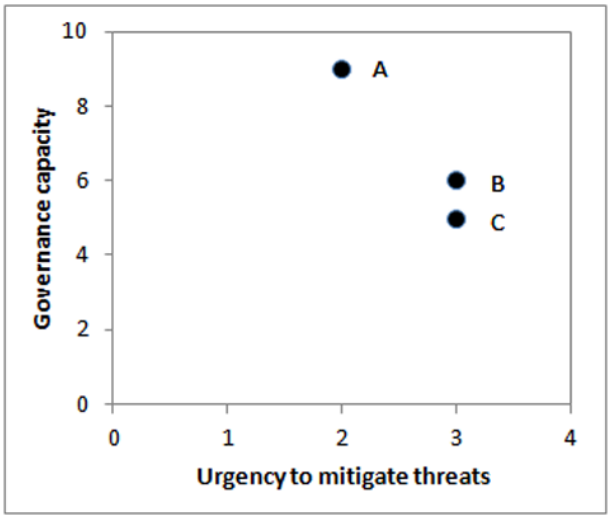


Figure 4.7 Governance capacity vs. urgency to mitigate threats. The points on the plot represent the three networks: A) Batangas, B) Camotes, C) Lanuza.

Table 4.8 Strengths-weaknesses-opportunities-threats (SWOT) analysis for the three networks

	Strengths	Weaknesses	Opportunities	Threats
Batangas	Supportive provincial government with demonstrated capacity to motivate the local governments Active and motivated local governments, some of which are experienced (e.g. MPA management, mangrove and reef restoration, ecotourism) and always willing to help those who are less experienced Had a separate network of volunteer enforcers which complements the MPA network, and is also supported by an enforcement response team composed of the Philippine National Police and Coastguard Sustained joint activities and meetings despite termination of project funds from bridging organizations Members and local volunteers participated in a variety of capacity building activities that are useful for	Strong local autonomy of local governments can impede performance by limiting consensus and participation in the management of the network Some local governments had variable feedback mechanisms within their municipalities which made some communities less aware and involved Elected local government officials such as the local chief executives and legislative bodies were encouraged but not required to participate in general meetings and other network activities	Increased priority for protection and research in the Verde Island Passage due to an Executive Order promoting biodiversity conservation in this area Influx of donor-assisted projects and research that the network can tap for technical and financial assistance and capacity building Coordination with other MPA networks in the region (e.g. neighbouring Oriental Mindoro provincial MPA network) and learning exchanges in other Coral Triangle countries	Less exploited fisheries and higher diversity of livelihood opportunities attract migration, which can reduce employment opportunities for residents and make enforcement and other management initiatives more difficult Industries in the capital city can cause pollution and reduce water quality

	Strengths	Weaknesses	Opportunities	Threats
	management, monitoring and evaluation, enforcement and other assessments (e.g. vulnerability assessments of fisheries to climate change) Core members of the network were composed of provincial and local government employees (e.g. agriculturist, fisheries technicians and environment & resources officer) that allow for continuity of membership			
Camotes	Supportive and experienced local governments that belong to the same political party and have aligned objectives Core members were composed of the local chief executive, municipal agriculturist, and municipal planning and development coordinator from each municipality, which allowed each representative to be well-informed, thereby supporting decision-making	Strong local autonomy and lack of accountability measures Leading municipality not strongly motivated to facilitate joint activities Meetings became irregular and frequent due to the lack of interest and weakening leadership Some livelihood programs promoted increased fishing activities (e.g. use of fish	Provincial government and congressional district support allowed them to leverage more funds and assist in enforcement A focal area of a few donor-assisted projects Local governments understood that conservation and rehabilitation of their coastal and marine resources should	Geographically isolated small island group, making access to and from the mainland difficult and reducing available support Lack of diversity of livelihood opportunities reduced communities options to exit fisheries Heavily exploited fisheries resources and long history

	Strengths	Weaknesses	Opportunities	Threats
	Local government officials and employees were resourceful and have successfully obtained support (e.g. funding) from external sources	aggregating devices)	have high priority because their constituents depend on these resources	of illegal and destructive fishing practices
Lanuza	Had a long history of partnership with experience in terms of asserting the network's legal bases Inherent for some of the members to build on the partnership, because of kinship, relations (blood and marriage) and history (some of the municipalities originally formed one municipality) Structure of the network involved employing external people with expertise to support the network's needs Core members included an externally hired executive director who convenes the council which includes local chief executives and fisheries technicians from each municipality	Strong local autonomy and lack of accountability measures Lack of feedback mechanisms and interaction of local chief executives with government employees and MPA managers (e.g. the MPA managers and coastal management coordinators do not participate in council meetings) Regular absence of some local chief executives due to lack of interest Unresolved conflict resulted from inconsistent contributions of local governments to their mutual fund system and members' perceptions of inappropriate fund allocation	A focal area of a few donor-assisted projects	Provincial government had development and economic goals in opposition to the goals of the network Mining activities were threatening the MPAs and the participation of a few local governments in the network, because the priority of some local governments shifted from conservation to development Exploited fisheries resources, especially from commercial fishers

The SWOT analysis also showed that both Camotes and Lanuza had moderate governance capacity due to their lower levels of coordination (Table 4.7, Figure 4.7). The local governments in both case study areas strongly exercised their political independence from the network, which affected their coordination and governance capacity to sustain management efforts.

Both Camotes and Lanuza had the same level of threats, but varied in terms of history, types and sources of threats. Fisheries in Camotes had been exploited for a long period which degraded their resources severely. It is notable that illegal fishing practices in Camotes have decreased in the past decade, but better enforcement of fisheries laws is still important to sustain fishing activities and allow resources to recover. Lanuza's fisheries were not as problematic as Camotes, but the shift from conservation and sustainable use to development increased land-based threats which can reduce water quality and increase sedimentation along the coast and affect the MPAs. It is notable that most of the MPAs in both these networks were managed well and accepted by the communities. However, the lack of interest and differences in priorities related to development and conservation of the local chief executives endanger the MPAs.

4.5 Discussion

This study aimed to determine the management effectiveness of MPA networks by measuring management performance. I evaluated the management performance of three MPA networks in the Philippines with assessment tools, key informant interviews, and community perception surveys. The data gathered in this study were synthesized and analysed using a scoring rubric and SWOT analysis. By using these methods in combination I was able to test the applicability of the management performance tools and other approaches to obtaining and integrating data. I learned about the value-added benefits of MPA networks, the factors that affect network management performance, and how management of MPA networks and individual MPAs influence each other.

4.5.1 Applicability of the methods used

The process of determining management performance of networks was difficult, because management of networks is more complex compared to that of individual MPAs. Networks were larger, involved a lot more people and institutions, and were required to have different characteristics than individual MPAs. These differences made rigorous evaluation more time-consuming, because of the amount of data to be gathered. There

were numerous management performance assessment tools that have been developed and implemented for single MPAs (e.g. Pomeroy et al., 2005, White et al., 2006c). However, these tools were more difficult apply to networks managed by multiple governance units and with MPAs managed by different sectors. Moreover, the standards of performance of networks have not been published in the literature. The network assessment tool that I developed was the first management performance tool to explore aspects of management, financing, and governance of whole MPA networks across multiple, disparate governance units. Moreover, the combined quantitative and qualitative methods I used enabled us to understand network management performance more thoroughly than would have been possible with a single assessment tool.

The network assessment tool I developed was timely, because there is increasing advocacy, in the Philippines and throughout the Coral Triangle, for the establishment of MPA networks and for communities and local governments to work together (White et al., 2014, Walton et al., 2014). The network tool can serve as a guide for improved management of established networks and for the development of new MPA networks. However, I also recognized that the tool needs to be improved further, particularly to consider the nuances of different kinds of networks. For example, I found that the thresholds in the tool were too strict and variably applicable to the three networks. That was why none of the networks attained Level 1 - Established. I learned through the use of qualitative methods such as interviews and surveys that the tool needs to account more thoroughly for the diversity of objectives, histories, and structure of networks.

The results of the rubric and the SWOT seemed to contradict each other, but both analyses described different aspects of performance. The rubric was the quantitative description of network performance relative to a variety of criteria. However, the rubric did not account for qualitative information such as objectives, history (e.g. age of network and age of individual MPAs), and the internal and external factors that affect management performance. The qualitative information described in the SWOT complemented the rubric and explained why some of the criteria were not achieved for the networks. The SWOT also outlined the factors that will help the networks improve, because of the internal and external characteristics that promote growth of the network. Moreover, the SWOT also identified the constraints and the impediments to improving performance and the threats that the networks are experiencing.

Batangas scored low in the rubric, because their MPAs were younger and the towns were more developed which made their communities less involved in fisheries. However, Batangas scored high in the SWOT, because the network had higher capacity to improve

management and address the threats they were experiencing. Camotes and Lanuza were the opposite of Batangas. These networks scored well in the rubric. Their MPAs were well managed, because they were older and the managers were more experienced. Communities were aware and supportive, because they were involved in fisheries and/ or their geographical areas are small which made communication much easier. However, both networks scored less well than Batangas in the SWOT. They had lower governance capacity, because they were becoming less active due to various problems that had not been resolved (e.g. meetings less often, unresolved financial issues). Moreover, both networks were experiencing more threats (e.g. fisheries related, mining). Their combination of lower governance capacity and higher threat levels can potentially negate the effects of the high management performance (reflected in the rubric scores) of these networks.

The results of both the rubric and SWOT can be used for strategic planning. The rubric summarized present management performance. The SWOT explained many of the main factors shaping the results in the rubric, provided insights into likely trajectories of performance, and identified potential ways to improve performance by building on networks' strengths and opportunities and reducing constraints.

4.5.2 Interdependence between MPAs and MPA networks, and between local government units and governance networks

I strongly suggest that evaluation of management performance of networks should involve evaluation of individual MPAs. The methods I used showed that individual MPAs and networks are interdependent and that there are value-added benefits to having a well-coordinated network. Networks depended on the functions of individual MPAs to a certain degree. Well-managed individual MPAs had experienced managers and local governments that shared lessons learned with other members of a network. Individual MPAs and local governments benefitted from networks as well, because well-coordinated networks served as a platform to convene MPA managers and local governments for learning exchanges and to make decisions that will benefit everyone involved in the networks. Moreover, MPAs in a well-coordinated and well-managed network became more sustainable, because the local government members were motivated to perform their functions well due to the accountability measures and incentive systems that they have established.

Well-managed MPAs can be affected by the differences in priorities of the local governments in a network. Governance networks such as Batangas, Camotes and Lanuza have different structures and arrangements and were composed of interdependent local

governments that work cooperatively, but also operate autonomously. Hence, the local governments can have different priorities and strategies. For example, local governments with priorities different from the network will be less likely to participate, because they would prefer to achieve their own goals rather than those of the networks. Hence, it is important that a strong network leader is present, because they remind and motivate local governments to participate and to perform their duties to the network. Moreover, transparency and accountability measures and incentive systems can ensure compliance with network goals, regardless of the differences in the priorities and attributes of the local governments and their municipalities. This is because these measures will require local governments to participate in activities, report their progress and reward the local governments and MPA managers for their hard work.

4.5.3 Value-added benefits of MPA networks and future directions

The value-added benefits of MPA networks were: 1) accelerated establishment of MPAs; 2) acceleration in improvement of management of individual MPAs; 3) reduction of threats to MPAs; and 4) increased ecological and socioeconomic benefits. For the networks I studied, the rate of establishment of MPAs increased after network formation, because local governments were motivated to increase the number and/or sizes of their MPAs to comply with the network goals. Establishment rates can be higher in networks with fewer MPAs, more available area to protect (e.g. larger shared municipal waters), and less fishing pressure. Management performance of individual MPAs in networks was also high for almost all of the MPAs in the networks I studied, because local governments and their MPA managers were empowered and learned from other members in the network.

Monitoring and evaluation of networks is more difficult and rigorous than monitoring individual MPAs. However, it is important to know whether networks can achieve larger ecological and socioeconomic benefits than MPAs managed by individual governance authorities (Roff, 2014). Estimating these benefits goes beyond evaluation of management performance. In theory, networks improve MPA enforcement and reduce illegal and destructive fishing practices within municipal waters, because of the more extensive patrols conducted jointly by the members. More extensive and stricter enforcement improves habitat quality and reduces fishing mortality, because human disturbances are reduced (EcoGov, 2011). In principle, these changes lead to higher socioeconomic benefits. I am stating that these benefits of networks are still theoretical, because I do not have supporting information (e.g. enforcement, ecological and socioeconomic data). Hence, the focus of this paper was to measure management performance (outputs) to serve as a surrogate for management effectiveness (outcomes). However, I support the suggestion by various

authors (e.g. Green et al., 2011; Roff, 2014) that evaluation of the management effectiveness of MPA networks should be conducted in the future to more fully explore their benefits.

CHAPTER 5
INFLUENCE OF GOVERNANCE CONTEXT ON PARTICIPATION AND GOVERNANCE CAPACITY OF MARINE PROTECTED AREA NETWORKS IN THE PHILIPPINES

5.1 Abstract

Networks of marine protected areas (MPAs) are more complex than individual MPAs, primarily due to the involvement of multiple governance units. Hence, there is a need to understand the governance context of networks to determine the factors that influence their performance. I analysed three MPA networks in the Philippines with varying sizes, histories, and compositions of local governments and constituencies. One of my initial assumptions was that larger networks with more diverse actors and diverging interests have higher governance complexity, which lowers participation of members and governance capacity. I predicted further that higher levels of participation and governance capacity are necessary for high management performance. My results showed that the sizes of the MPA networks did not appear to affect levels of participation and governance capacity. Instead, participation and capacity were influenced by institutional arrangements and the socioeconomic and political contexts of the local governments involved. I found that participation and governance capacity were higher with less complicated network objectives and systems for engagement, more inclusive membership, and better communication. Moreover, participation and governance capacity were enhanced by incentive systems and strong and eager network leaders who enforced measures of transparency and accountability.

5.2 Introduction

Implementation of networks of marine protected areas (MPAs) is more complex than establishment of individual MPAs because it involves expansion across larger spatial scales (PISCO, 2007, IUCN-WCPA, 2008, WorldBank, 2006). Designing MPA networks with consideration of ecosystem function can be challenging, because ecological and governance scales are rarely congruent (Mills et al., 2010, Pressey et al., 2013, Foale and Manele, 2004). Moreover, implementation of MPAs has proven difficult in countries with high dependence on natural resources and small and numerous governance units (Govan, 2009, Horigue et al., 2012), attributes that characterise countries in the Coral Triangle and other parts of the world. Hence, in these circumstances, governance of MPA networks must accommodate diverse social, economic, and political contexts to contribute to effective management decisions and implementation (IUCN-WCPA, 2008, White et al., 2006b, Lowry et al., 2009).

It is well understood that acceptance and success of individual MPAs require consideration of social contexts and dynamics (Christie and White, 2007, Fabinyi et al., 2010, White et al., 2002). Hence, a greater emphasis on understanding and accommodating these local-scale social interactions were recommended when implementing MPA networks (Green et al., 2011, Christie et al., 2009b). Formation of MPA networks is seen as a means to reconcile various stakeholder differences, and establish collaborations and concerted management efforts (White et al., 2006b, Aliño et al., 2006). MPA networks require administrative linkages, facilitate shared learning and conflict resolution, and motivate other collective efforts (Horigue et al., 2012, Eisma-Osorio et al., 2009, Armada et al., 2009). However, the challenges of establishing and sustaining MPA networks are still poorly understood, particularly in areas, such as the six countries in the Coral Triangle, that have small, numerous and disparate governance units.

Several studies have documented the effectiveness of MPA networks in the Coral Triangle and the social and institutional factors that affect their success. Green et al. (2011) suggested that a focus on institutional arrangements and sustainable financing is necessary to increase the effectiveness of networks and ensure implementation of ecologically-adequate designs in the Philippines, Indonesia, and Papua New Guinea. Lowry et al. (2009) identified several institutional requirements for effective MPA networks in the Philippines, including shared visions and common goals among various stakeholders, and conflict resolution. Another study in the Philippines (Christie et al., 2009b) emphasised the

importance of understanding the influence of local-scale social, economic, and political dynamics on the effectiveness of MPA networks. All these studies highlighted the necessity of understanding and overcoming institutional constraints on sustaining collaborations for MPA networks. Missing from this literature, however, are insights into the ways in which institutional constraints influence management performance of MPA networks. Moreover, although previous studies correctly emphasised the need to improve governance capacity to sustain MPA networks, they did not propose measures of governance capacity, identify factors that influence it, or describe the link between governance capacity and management performance.

Using the Philippines as a case study, this chapter deals with the influence of institutional constraints on management performance and sustainability of MPA networks. Understanding the influence of institutional constraints on the performance of MPA networks requires first defining and understanding the relationships and links between performance, governance capacity, and governance context. Management performance of MPA networks in the context of the Philippines is defined as, "the level exerted to enhance and sustain management of MPAs, and coordinate expansion of MPAs among multiple governance units" (Horigue et al., 2014). Studies have suggested that high governance capacity is necessary to effectively manage MPAs (Lockwood, 2010), moreso in networks, because of the large spatial extents and diverse ecosystems and governance areas encompassed (Aliño et al., 2006, Green et al., 2011). However, currently there is no clear definition of governance capacity in relation to MPA networks.

Drawing on interactive governance theory (Kooiman and Bavinck, 2013, Kooiman, 2003) and how it relates to MPA governance (Jentoft et al., 2007, Jentoft, 2007) as a broad theoretical framework, governance capacity is defined here as the ability to govern interactions of social, economic, and political processes and dynamics within a given political unit. In the Philippines, political units relevant to MPA networks include individual municipalities as alliances or cross-province groups of municipalities. Based on this definition, governance capacity relates to factors such as participation, organizational structure, leadership, enabling legislations, and conflict resolution. However, governance capacity of MPA networks can be enhanced or limited by varying levels of what Jentoft *et al.* (2007) term governance diversity, complexity, dynamics, and vulnerability. Their descriptions of these concepts all relate to governance context. Governance context influences governance capacity, because context is characterized by the knowledge, skills and interests of people who participate. In turn, these attributes shape enabling legislations and institutional arrangements necessary to implement and coordinate initiatives.

Governance theory suggests that the "one-size-fits-all" model of governance thinking should be abandoned, and we should recognize and appreciate the contributions and limitations of contextual factors (Jentoft, 2007, Andrew et al., 2007).

Based on governance theory, participation of disparate governance units in network initiatives is assumed to be influenced by a variety of contextual factors. Participation, defined here as involvement of governance units and other stakeholders in management decisions, requires trust and social cohesion (Lockwood, 2010, Lockwood et al., 2010). In any society, trust and social cohesion are influenced by various contextual factors. For example, Wilkinson and Pickett (2009) argued that income inequality among people reduced trust and increased insecurity. Low levels of trust and social cohesion influence acceptance of management initiatives, and participation in concerted efforts. Moreover, diverging interests of governance units can limit participation, because of the difficulty of finding shared goals (Lowry et al., 2009, Christie et al., 2009b). Hence, participation enhances or limits governance capacity, because cooperation is necessary when pursuing concerted management efforts.

These concepts and relationships drawn from governance theory have been observed initially in the previous study of Horigue et al. (2014). They found that management performance of networks was influenced by factors such as objectives of networks, histories, and diversity and complexity of governance (e.g. differences in priorities and interests of governance units). Moreover, that previous study defined and described governance capacity of the networks, and inferred its influence on management performance. However, it did not identify the factors that influenced participation in network initiatives and governance capacity.

In this study, I aim to understand the influence of governance context of MPA networks on governance capacity and participation and, ultimately, on management performance. I address management performance indirectly by looking at the effect of different context variables on participation and governance capacity (Figure 5.1). Following governance theory (Kooiman, 2003, Jentoft et al., 2007, Jentoft, 2007), I consider governance capacity and participation to be important determinants of management performance. I selected and used the following context variables: 1) size of networks (e.g. number of participating local governments), 2) institutional arrangements (e.g. objectives, leadership), and 3) socioeconomic and political context of networks. I recognize that other variables are relevant to governance context (e.g. culture, environmental status, legal bases) and affect participation and governance capacity (Lockwood et al., 2009). However, I limited the analysis to include only our selected

variables to empirically test specific assumptions. The first assumption concerns the upper limit of manageable sizes of MPA networks. Christie et al. (2009b) stated that the largest manageable size was between 10 and 15 participating local governments overseen by an experienced and committed non-government organization. They believed that governance capacity and scaling up to involve more local governments was limited by the increasing difficulties of negotiating conflict and building consensus with increasing socioeconomic and political diversity and complexity. The second assumption I wanted to test was that contextual variables, such as good governance structures and processes embedded in institutional arrangements can offset the influence of increasing size and complexity of networks, and improve participation and capacity (Lebel et al., 2010, Lebel et al., 2006).

The specific goals of this study were to:

1. determine the effect of size of networks, particularly in relation to the number of participating institutions and the total extent of jurisdiction of the institutions, on participation and governance capacity;
2. evaluate the influence of institutional arrangements of the MPA networks on participation and governance capacity;
3. examine the effect of diversity and complexity of socioeconomic and political contexts on participation and governance capacity; and,
4. determine the contributions of governance structures and processes to mitigating negative influences of governance context on participation and governance capacity.

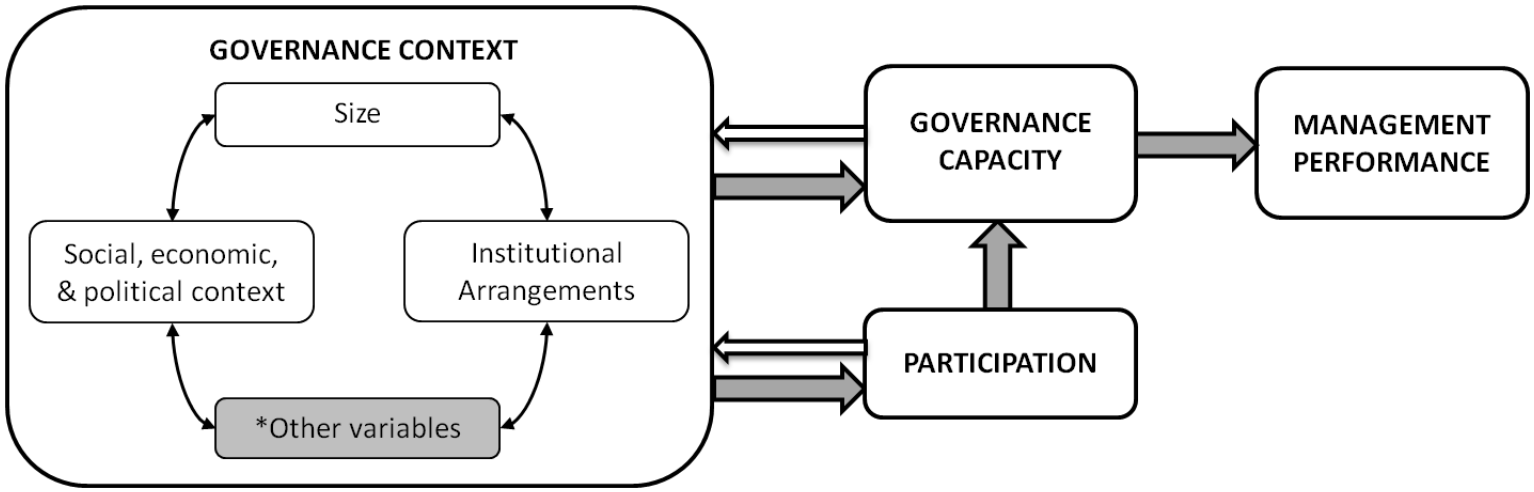


Figure 5.1 Key terms and concepts used in this study, and their relationships. The governance context explored in this paper includes the size of networks (number of participating institutions and their total jurisdictional extent), social, economic and political contexts, and institutional arrangements. These variables are interrelated and interdependent. For example, the size and composition of networks depends on their institutional arrangements, because this is subject to the preferences of participating institutions. Social, economic, and political context also limits sizes of networks, because similar attributes or common concerns are prerequisites to membership of governance networks. Governance context has bi-directional relationships with governance capacity and participation. Participation and governance capacity influence governance context through social capital, social norms, and belief systems. High levels of participation and governance capacity are requirements of high levels of management performance. Regular participation from members ensures compliance with agreed network goals and activities, increasing capacity to respond to conflict within networks and external threats. *Some examples of other variables that were not discussed in this paper include culture, history, environment, legal-bases, and demographics.

5.3 Methods

5.3.1 MPA networks and assessments from previous study

This study builds on the previous work of Horigue et al. (2014), wherein three MPA networks (Figure 5.2) with varying sizes, histories, objectives, and socioeconomic and political contexts were evaluated using multiple methods. These methods included tools to assess management performance, key-informant interviews, and community-perception surveys. The quantitative results were summarized based on a scoring rubric, whereas the qualitative data were summarized into a strength-weakness-opportunities-threats (SWOT) analysis. The scoring rubric was a quantitative description of performance relative to a set of criteria. It summarized into a single metric the results of management performance tools, the rate of establishment of MPAs, and percentage of community members supporting MPAs and networks. The metric from the scoring rubric was the overall management performance score of the networks. The SWOT analysis (see Table 5.1 for summary) was a qualitative measure of performance. It explained the factors that shaped current management and provided insights into likely trajectories of performance. The Batangas MPA and Enforcement Network (hereafter Batangas) rated "fair" in the scoring rubric, but was categorised in the SWOT analysis to have high governance capacity and low urgency to mitigate threats. In contrast, the Camotes Sea Coastal Resource Management Council (hereafter Camotes) and Lanuza Bay Development Alliance (hereafter Lanuza), scored "good" in the rubric, but were categorised in the SWOT analysis as having moderate governance capacity and high urgency to mitigate threats.

Table 5.1 Summary of location and management performance of the MPA networks evaluated

	Batangas MPA and Enforcement Network	**Camotes Sea CRM Council**	**Lanuza Bay Development Alliance**
Short name	Batangas	Camotes	Lanuza
Province	Batangas	Cebu	Surigao del Sur
Overall management performance score from the rubric	Fair	Good	Good
Capacity-Urgency from the SWOT analysis	High governance capacity; low urgency to mitigate threats	Moderate governance capacity; high urgency to mitigate threats	Moderate governance capacity; high urgency to mitigate threats

Abbreviations: CRM – coastal resource management, SWOT – strengths-weaknesses-opportunities-threats

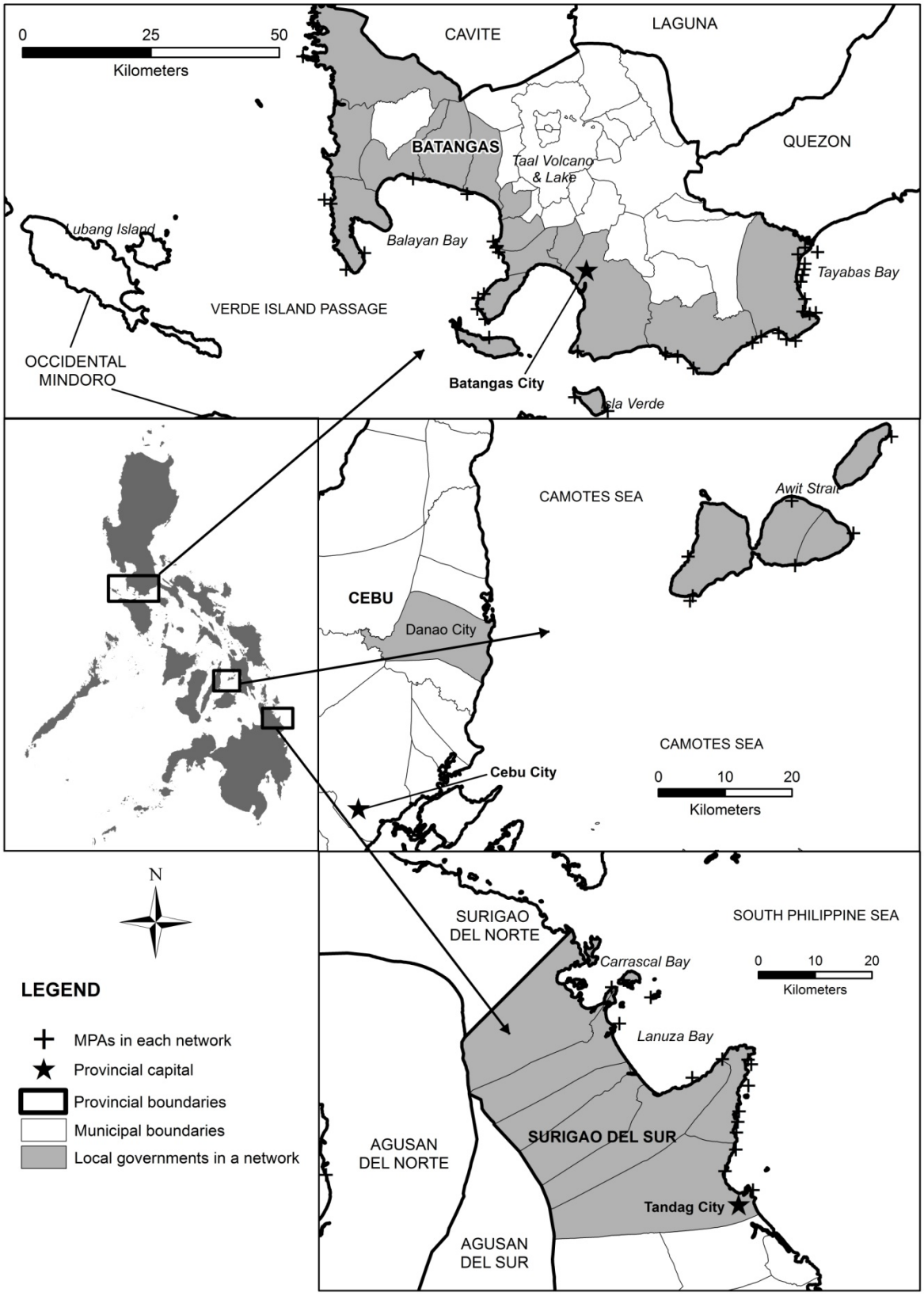


Figure 5.2 Locations of the three MPA networks evaluated in this study

5.3.2 Collection of data

To determine the influence of different aspects of governance context on participation in MPA networks and governance capacity, I used semi-structured qualitative interviews with key informants and conducted focus-group discussions with MPA network members and MPA managers. I interviewed a total of 61 informants, including provincial-government employees, and local-government officials and employees. I also conducted a total of 20 focus-group discussions with 93 MPA managers across the three networks. All these informants and participants were members of the networks and/or involved in implementation of MPAs. Each interview took an hour and a half, and included questions about the challenges experienced, conflicts resolved, knowledge about the significance, objectives, and effectiveness of the MPAs and the network, beliefs about benefits, costs, fairness and working relationships, and future prospects for activities related to MPAs and MPA networks. The interview questions were used in the focus-group discussions as well. However, discussion times ranged from two and a half to three hours because of the involvement of larger numbers of people (minimum of two participants and maximum of 18). Documents such as memoranda of agreement, by-laws, management plans, and minutes-of-meetings were also collected from each network to describe and analyse the institutional arrangements of the networks. I gathered all the data in 2012, with field work conducted from March to April in Lanuza, May in Camotes, and October to December in Batangas.

I gathered socioeconomic data from each local government in each network. I selected development as an economic and political indicator for the following reasons: 1) to determine whether varying levels of development, and therefore available funds and skills, across the networks influenced their capacity to implement initiatives; and 2) to determine whether varying levels of development of local governments influenced their development priorities, and their participation in the networks. I used income classification to reflect the level of economic development in each network because this indicator is used by the national government in determining the financial capability of local governments to fund their development projects and maintain their local offices (Appendix G). The income classification is based on the internal revenue allotments from the national government and on local-government revenues (e.g. property taxes, community taxes), and is published in six categories. Local governments are classified as cities or municipalities, depending on the average annual income and population size. Cities are more urbanized and developed than municipalities and have higher income classifications (Philippine Local Government Code of 1991).

I also selected dependence on fisheries as a socioeconomic indicator, to determine whether it influenced development priorities of local governments and interest in participating in the networks. To determine dependence, I used data on fisheries production and diversity of livelihood options. Information on fisheries production served as a direct measure of the importance of fisheries as a livelihood in each network. I assumed that high levels of production as an indicator of high fisheries dependence. I also complemented fisheries production data with information on other livelihood options, to determine whether there were opportunities to exit fisheries or complement fisheries livelihoods. Data on marine-fisheries production per province was downloaded from the Department of Agriculture Bureau of Agricultural Statistics (DA-BAS, www.bas.gov.ph). Information on livelihood options was based on the production of other agricultural products (e.g. rice, crops, and livestock) and employment rates in different sectors (e.g. agriculture, industry) at the provincial level. Data on fisheries, agricultural production, and employment rates from the DA-BAS website were given for provinces and not disaggregated to individual municipalities. I therefore verified this information for local governments during the key informant interviews by asking them about fisheries dependence and available livelihood options in their municipalities.

5.3.3 Analysis of data

Data from interviews, group discussions, and documents were organized and categorized into different themes (e.g. conflict experienced, perception of network benefits, governance processes implemented) using Nvivo software. I inferred from the patterns of responses whether two assumptions were applicable to the networks: 1. the size of MPA networks limits governance capacity because of increasing difficulties of negotiating conflict and consensus-building with increasing socioeconomic and political diversity and complexity; and, 2. good governance structures and processes in the institutional arrangements of networks can offset the influence of increasing size and complexity and improve participation and governance capacity. I also correlated the responses with socioeconomic data to complement the analysis of the influence of socioeconomic contexts.

5.4 Results

5.4.1 Effects of size and area on participation

The networks I evaluated varied in size and geographical attributes (Table 5.2). It might be expected that larger networks and those with isolated members would be more difficult and costly to organize and mobilize. However, this was not evident in the networks that I evaluated. Batangas was the largest network of the three with the highest number of representatives and participating institutions and largest geographical area. Despite its size, most of the representatives regularly attended meetings and activities. For all three networks, local-government members who came from more isolated areas still participated in activities. Hence, although I assumed that it was more difficult to organize large groups of people, there seemed to be factors operating that encouraged representatives to participate consistently in network initiatives.

Table 5.2 Size and geographical attributes of the MPA networks evaluated

	Batangas	**Camotes**	**Lanuza**
Total number of institutional members	Provincial government; 13 (+2) local governments[1]	5 local governments	7 local governments
Total number of representatives involved[2]	>50	15	10 (+7)
Land area[3] (km^2)	1,736	383	1,531
Coastline length (km)	492	152	145
Municipal waters (km^2)	7,000	2,050	1,450

[1] The network in Batangas was expanding to include two more local governments during the assessment. Although the memorandum of agreement was not yet amended to formalize this addition, the two new local governments were already actively participating in the network at the beginning of 2012.

[2] The number of people involved in the network meetings and activities can vary. However, some local-government representatives consistently participated in activities.

[3] The total land area within the jurisdiction of the local governments

I found that three strategies used by the networks increased participation in meetings and improved coordination. Firstly, mobile phones became an effective mode of communication for the three networks. Representatives who lived further away from town centres and meeting venues received information about scheduled meetings immediately. In addition, enforcement became more responsive and easier to mobilize, because volunteer patrollers were able to quickly report violations to local MPA managers and local governments. Second, for example in Lanuza, rotation in meeting venues to different municipalities was an effective means of encouraging attendance and ensuring fair access to meetings by network members. Thirdly, attendance was also better when members were provided with the means to participate in the three networks. Local MPA managers and volunteer patrollers, most of whom were fishers, were reimbursed for their transport expenses by their respective local governments or by the network to help them to participate in activities. Some also received incentives (e.g. sacks of rice, educational support for their children) for their attendance to offset the costs of not working.

5.4.2 Institutional arrangements

The three networks had different functions and levels of formality and complexity based on the institutional arrangements that the members had agreed upon. Their agreements included their objectives, organizational structures, and membership to help them facilitate and implement their initiatives. The networks implemented activities in line with their agreed goals. The organizational structures helped with decision-making and informing other local government officials, employees, and members of MPA committees in each municipality. In this section, I describe and evaluate the effects of network objectives, financial arrangements, organizational structures, and governance on participation and governance capacity (Table 5.3).

Table 5.3 Institutional arrangements of the three networks evaluated

	Batangas	**Camotes**	**Lanuza**
Year legally established	2007 (MPA); 2009 (Enforcement)	2006	1999
Network type, objectives and arrangements			
Type	Governance network	Governance network	Governance network -
Objectives	Information and enforcement	Information, enforcement, and financial	Information, enforcement, financial, and development
Financial arrangements	Counterparting – Provincial government sought and disbursed funds for joint activities, and local governments provided funds for local implementation and fares for their representatives to participate in joint activities	Mutual funds system – each local government contributed Php 50K/year Finances were handled by the elected lead local government	Mutual funds system – each local government contributed Php 100K/year Finances were handled by the local chief executive that was elected as the network treasurer. The funds were placed in a special account of the respective local government.
Organizational structure			
–Leadership	Leadership positions were accepted by local government employees and were based on elections Provincial government plays the role of the secretariat	After the lead local government was elected, leadership positions were accepted by the local chief executive and the Municipal Planning and Development Coordinator and Municipal Agriculturist	Leadership positions were accepted by various local chief executives based on elections Personnel were hired to provide technical support
Local government representation	MPA coordinator *Bantay Dagat*[1] coordinator	Local chief executive, Municipal Planning and Development	Local chief executive (representative if not able to attend)

	Batangas	Camotes	Lanuza
	- Municipal Agriculturist and/or Municipal Environment and Natural Resource Officer	Coordinator (Civil Engineer), Municipal Agriculturist	Designated Coastal Resource Management coordinator (Municipal Fisheries Technician)[2]
Other representatives - non-local government employees	*Bantay Dagat*[2] chairperson MPA managers[2] Provincial Government Philippine National Police and/or Coast Guard	MPA managers[2]	Hired personnel for liaison and administrative roles
Governance structures and processes			
Community participation	Annual general assembly including all MPA managers	Annual general assembly including all MPA managers	Hired personnel initiated separate meetings for all MPA managers
Incentive systems	Awards and recognition for provincial-level "Best MPA"; Incentives for milestones achieved by local government (e.g. new laptops)		
Accountability and transparency	Regular reporting and copies of minutes of meetings Sanctions for consecutive absences in meetings and inability to prepare progress reports	Regular reporting and copies of minutes of meetings	Regular reporting and copies of minutes of meetings

[1] Local government sea patrol usually formed by volunteer fishers

[2]Occasionally invited to participate in meetings or if there are organized activities that they would benefit from attending.

5.4.2.1 Network type, objectives, and financial arrangements

Networks can have different levels of formality, ranging from social to institutional. All the three networks I evaluated were formal governance networks because each was legally bound by a memorandum of agreement signed by all the member local governments and other partner institutions. However, each network had different levels of engagement based on its objectives (Table 5.3). Forming an information network was the simplest level of engagement, requiring members to share information and experiences in regular meetings. Another level was to form an enforcement network to help members enforce MPA and fisheries laws. Local governments in development networks cooperate and coordinate their development priorities and activities to be mutually beneficial for all the member local governments. Local governments engaged in financial networks have agreed to provide funds for MPA management and enforcement of fisheries laws in their respective municipal waters.

Camotes and Lanuza agreed to have mutual funds systems for their network activities. A mutual funds system (e.g. trust fund) required each local government to pay annual financial contributions. The financial agreements had an effect on participation of the members in Lanuza. According to 72% of the informants in Lanuza, the financial contributions discouraged participation in network activities and strained relationships of some of the members, because some thought the amount was too high and unfair, or they did not see how the funds were spent:

> *"There are delays in payments of financial contributions, because some local governments feel that they are disadvantaged, because they were required to put in the same amount of time, effort and resources even though their municipal waters [were] quite small or [and] they have less coastal barangays [villages]."*

And

> *"There are issues with finances [in terms of release of funds]. Even if the SB [Sangguniang Bayan – the legislative arm of local governments] believed that participating in LBDA has benefits, they were also doubtful of where the funds were going because they were not updated on how the funds were used."*

Camotes did not have problems with paying timely contributions, because all of the informants said that they were expected to contribute as part of their agreement, and that the amount was fair for all of them and inexpensive. It seemed that the mutual funds

systems worked when members trusted each other, and when members believed that the amount they were contributing was equitable.

Batangas used counterpart financing from the provincial government. The provincial government of Batangas allocated funds for regular meetings, equipment, and other activities to support the network and complemented the activities of the local governments. These activities included regular meetings, MPA forums, trainings (e.g. diving and monitoring, deputizing volunteer fish wardens), and province-wide enforcement to complement the *Bantay Dagat* network. This counterpart funding came from the province's income, and from grants from development organizations and private institutions. The local governments were expected to provide funds for MPA management and enforcement of fisheries laws, and to provide for expenses of their representatives when participating in network activities.

5.4.2.2 Organizational structure

Although the networks varied in terms of organizational structure (Table 5.3; Appendix H), the leaders in each network formed an executive committee (e.g. president, secretary). The members of the executive committee were elected by the network members. Executive committees facilitated activities, and managed documents, data, and finances.

The executive committee in Batangas were formed by local-government employees and supported by the provincial government of Batangas -- the secretariat of the network. The secretariat's responsibility was to support the executive committee and network by keeping and maintaining all the network documents, records of meetings, copies of local government documents (e.g. ordinances, coastal resource management plans) and other information. The provincial government also facilitated meetings, outsourced funds, and held the local governments accountable by constantly reminding them to participate and report on their progress. Most of the informants interviewed in Batangas seemed to regard the provincial government well, because of their presence and commitment. Although the provincial government was not appointed or elected to lead the network, they were believed to be very influential. According to one local-government employee in Batangas:

> *"There are instances when organizations become inactive. Every [organization] can vary, but the [Batangas] MPA network is active because of the PGENRO [Provincial Government Environment and Natural Resource Office]. They are the force that pulls. If you look at other local governments [within the network], if the PGENRO did not motivate them, they [would] not be active."*

The rest of the Batangas network (Table 5.3) was formed by the MPA and *Bantay Dagat* coordinators. These roles are typically accepted by the municipal environment and natural-resource officer and/or municipal agriculturist in each local government. The *Bantay Dagat* chairperson is the lead representative of the volunteer fish wardens who are usually fishermen. Other institutions, including the Philippine National Police and Coast Guard, supported the enforcement network by providing guidance and assistance when patrolling.

The executive committee of Camotes consisted of an elected lead local government, rather than interested individuals. The lead local government was elected based on rotation and practicality. The lead local government was in charge of the finances as well, and needed to have access to a bank. According to a local-government official in Camotes, the municipality of Pilar was supposed to be the lead after Danao City, because of their experience in MPA management and mangrove rehabilitation. However, Pilar turned down the appointment, because it was impractical for them to handle the network's finances without a bank in the municipality. The membership structure in Camotes was appropriate and strategic because the local government officials and employees worked closely together on a daily basis. This allowed them to make decisions faster, share ideas, work on problems together, and implement activities.

In Lanuza, the executive committee includes a chairperson, vice-chairperson, secretary, and treasurer who were all local chief executives of the local governments. The network was composed of local chief executives to facilitate decision-making and hired personnel to provide technical advice (e.g. grant proposal writing, legal advice) and assist in organization and coordination of network efforts. These personnel include an executive director who works directly with the executive committee and oversees organization of the network. The other personnel have administrative roles, which include documenting meetings and liaising with coordinators of coastal-resource management and MPA managers. The roles of coordinators for coastal-resource management were designated to municipal fisheries technicians of the local governments, who participated in meetings only when necessary. They work directly with the MPA managers in their respective local governments.

5.4.2.3 Governance structures and processes

For all three networks, community-participation in decision-making processes and attendance in activities was limited by institutional arrangements (Table 3.5). Each local government was responsible for disseminating information to its MPA managers and

communities. However, some MPA managers and *Bantay Dagat* members, most of whom were fishers, were invited to attend some meetings or had training activities designed for them. In Batangas and Camotes, MPA managers were included in general assemblies. In Lanuza, the structure was exclusive to local-government officials and employees, but the hired personnel have initiated and allocated funds to support an assembly of all MPA managers.

In Batangas, incentive systems (Table 3.5) complemented strong leadership by motivating local governments to participate in activities and to perform well. An example of this was a Best MPA awards competition organized by the provincial government. The provincial government aimed to conduct this provincial-level competition regularly to identify potential nominees for the biennial national-level MPA awards and recognition, and to track the progress of all the MPAs in the network.

For all the networks, accountability and transparency measures (Table 3.5) included regular reporting through meetings. Each network disseminated copies of minutes of meetings to update the representatives and local governments progress. Additionally, in Batangas, there was a clause in the network's by-laws about sanctions for consecutive absences in meetings and inability to prepare progress reports. Sanctions required writing a letter of explanation for absences, paying fees, or dismissal from the network.

5.4.3 Effects of institutional arrangements on participation and governance capacity

Institutional arrangements had varying effects on the participation and governance capacity of the three networks. In Lanuza, more complicated objectives, particularly the addition of financial agreements and exclusivity of membership, contributed to lowering participation and governance capacity. Some of the members believed that the amount requested for financial contributions was too high. Additionally, the lack of accountability measures to audit the network's expenditures reduced participation and governance capacity. An advantage of the exclusivity of membership in Lanuza was that decision-making was easier and faster, because only the local chief executives were involved. However, the disadvantages of exclusivity included reduced flow of information within the network and less cohesiveness of supporting constituencies (e.g. MPA managers, fisheries technicians). MPA managers in Lanuza reported that they did not interact with council members. One MPA manager stated that:

> "[The LBDA] *is a network at the local government unit level, because the members are officials and they rarely come to the coasts. I am not aware of what their programs are. We*

learn about their programs from [the Alliance Coordinator], [Executive Director] and the [fisheries] technicians."

Membership in Camotes was more inclusive and involved a variety of representatives with different experiences, which enhanced their capacity and performance. Moreover, as one indication of participation, all the local governments regularly paid their annual contributions to the mutual funds system. However, Camotes lacked strong leadership from the current lead government according to most informants. About 90% of the informants stated that their network was not active because of the lack of coordination. One local government official said:

"It is a shame if we do not continue what we worked on with the CSCRMC [Camotes Sea Coastal Resource Management Council]. I'm convinced of how important an alliance is. But it is so hard to maintain, because all the LGUs [local government units] are different and nobody is trying to coordinate the whole thing."

In Batangas, network objectives were simpler and less demanding, and membership was more inclusive of different types of representatives. Despite having less direct involvement by local chief executives, strong leadership and the presence of elected coordinators and the provincial government were very important in sustaining network efforts. All these institutional arrangements, combined with strong support from the provincial government in the form of incentive systems, as well as good measures for accountability and transparency, ensured participation of the local governments, and contributed to high governance capacity. Moreover, the incentive systems and approaches to accountability and transparency have motivated the local governments to perform well, thereby increasing Batangas' governance capacity.

5.4.4 Socioeconomic and political contexts

The socioeconomic and political contexts of each network are summarized in Table 5.4. Batangas was classified as having high economic development because the members included one first-class city (average annual income > Php 400 M) and eight first-class municipalities (average annual income > Php 55 M). The remaining six municipalities in Batangas belonged to the 2nd to 5th income classes (Php 15 M – 55 M)(Appendix I).

Table 5.4 Socioeconomic context of the networks

	Batangas	Camotes	Lanuza
Economic development[1]	High	Low	Low
Fisheries dependence[2]	Moderate	High	Moderate
Diversity of livelihood options[3]	High	Low	Moderate

[1] Development based on income classes from the Department of Interior and Local Government – www.dilg.gov.ph and National Statistics Coordination Board – www.ncsb.gov.ph

[2] Based on production of marine fisheries per province from the Department of Agriculture - Bureau of Agricultural Statistics – www.bas.gov.ph.

[3] Based on the production of agricultural products apart from fisheries, and employment rates in different sectors (e.g. agriculture, industry) at the provincial level from the Department of Agriculture - Bureau of Agricultural Statistics – www.bas.gov.ph.

In contrast, the networks of Camotes and Lanuza were classified as having low economic development. Camotes' members included one third-class city (average annual income Php 240 M – 320 M) and four municipalities in the 3rd to 5th income classes (Php 15 M – 45 M). Lanuza had a city that had no classification as yet, one second-class municipality (average annual income Php 45 M – 55 M), and five municipalities in the 4th to 5th income classes (Php 15 M - 35 M).

The network in Batangas had moderate fisheries dependence and high diversity of livelihood options. The entire province of Batangas has well-developed farming and livestock industries, and numerous other livelihood opportunities. The coastal villages in Batangas were not highly dependent on fisheries, with many people employed in other sectors (e.g. services, farming, and industry), and some of the fishers involved in other sectors part-time. Some fishers have also exited the fisheries in favour of tourism opportunities. Some MPAs have been open for dive tourism for more than a decade and employed some fishers and their family members to work full-time for the dive resorts.

Camotes was classified as having high fisheries dependence and low diversity of livelihood opportunities. Four of the local governments in Camotes were located in three small isolated islands that depended primarily on fisheries for food and income. Many

community members in Camotes migrate to Cebu Province to study and find employment. The local governments in Camotes were developing tourism in their areas to provide alternative livelihoods and to reduce fishing pressure and fishing-related impacts on the MPAs.

Lanuza had moderate fisheries dependence and moderate diversity of livelihood opportunities. Farming was very important in Lanuza. One local government in Lanuza allowed a mining concession to establish an open-pit mine. According to some of the informants in Lanuza, the members in the network were divided into two groups, with some members favouring mining and others not. A few of the members believed that mining would help their economy and improve the quality of life of their communities. However, others believed mining would destroy their watersheds that are important for farming communities, and potentially affect the MPAs in the network because of sedimentation and reduction of water quality in their bays.

5.4.5 Effects of socioeconomic and political contexts on participation and governance capacity

All the networks I evaluated were comprised of disparate local governments that committed to cooperate and collaborate with each other to pursue mutual goals. However, both participation and governance capacity were influenced by the socioeconomic and political contexts that shaped the development priorities of the local governments. In Batangas, support from the provincial government, as well as higher levels of development and more equal income classifications across local governments, helped increase the network's governance capacity by providing more resources for network activities. Moreover, the moderate dependence on fisheries and high diversity of available livelihood opportunities in Batangas led to local governments participating because of their interest in implementing and strengthening their MPAs.

In Camotes, the local governments had low development, high dependence on fisheries, and low diversity of livelihood opportunities, all of which lowered their governance capacity. However, according to most of the informants, the local chief executives had the same political affiliations, which played a positive role in participation and facilitated agreement on common visions and goals that shaped the network's objectives. One local government official stated that:

> *"Belonging to the same political party [helps], for example conflict. Each [local chief executive] has a political agenda, and you have to balance your political status and your actions [in line*

with the political party's agenda]. So for example if you are not an ally, you have different views, you are not comfortable working with others [local governments]. Because you know some day you are going to have disagreements.

However, some informants added that participation in Camotes still depended on the priorities of each current local chief executive, regardless of political affiliation. Some informants stated that coordinating joint activities in Camotes became challenging after the 2010 elections because of personal disagreements between some of the current local chief executives and their predecessors who were in office but in lower positions. This negated the positive influence of similar political affiliations, and reduced participation in Camotes.

Lanuza had moderate dependence on fisheries and moderate diversity of livelihood opportunities, which contributed to its capacity to implement its network. However, because the municipalities were less developed, some of the local governments had decided to engage in mining operations. This put a strain on the network, and affected participation. For example, a couple of local government officials said that:

"*We are not that united because of the mining issues. The alliance is supposed to agree on activities. In terms of personalities, we [all] get along well, but then the mining issue is putting a strain on our alliance."*

And

"Although we are an alliance, we respect the autonomy of each municipality. Each municipality [local government] can still do what they want. …if they want to do mining, so be it. But then they should present measures to lessen the impact of mining, because it has an impact on our MPAs. What if it floods too? We need to discuss this in LBDA."

Moreover, in Lanuza, the lack of transparency and the inability to utilize the meetings to build consensus on local development options and resolve conflict increased the tension among the members further:

"How do you compromise? How do you reach consensus? If you allow [prolong] these disagreements and do not settle it [immediately], it affects the rapport and trust. If there are differences between two, three or more municipalities, we have to settle it. But this has never happened before. The mayors [local chief executives] should personally attend the meetings. They need to be candid enough to bring it [issues] up during the meeting[s]."

Overall, Lanuza had lower levels of participation and governance capacity than the other networks, owing to conflicting development aspirations, combined with weaker governance structures and processes.

5.5 Discussion

In this study, I aimed to evaluate the influence of governance context on participation and governance capacity to infer the effects of different contextual variables on management performance of MPA networks. I developed and tested the applicability of a conceptual model for the influence of governance context on participation, governance capacity, and management performance. This conceptual model was based on theoretical and practical experiences published in the literature (Christie et al., 2009b, Jentoft, 2007). I used concepts described by Jentoft et al. (2007) on the interactive governance theory, governability, and MPA governance as a broad theoretical framework, and to define governance capacity and participation.

As variables for the evaluation, I selected size (the number of people and participating local governments and institutions), institutional arrangements, and socioeconomic and political context. I analysed qualitative semi-structured key-informant interviews and focus-group discussions with MPA network members, and MPA managers, and socioeconomic data from government websites to elucidate patterns in the influence of contextual factors on participation and governance capacity.

Based on the literature, governance capacity will be limited to a certain extent by the difficulties of negotiating conflict and building consensus with increasing governance diversity and complexity. Governance diversity and complexity are expected to increase with increasing sizes of networks and heterogeneity of network members (Christie et al., 2009b, Jentoft, 2007). I evaluated three networks with varying sizes and different levels of socioeconomic and political diversity and complexity. I explain below the implications of the diversity and complexity of governance contexts, the relationships of different contextual variables, and how they influenced participation in and governance capacity of networks.

5.5.1 Influence of size

Christie et al. (2009b) stated that the upper limit of the manageable size of networks in the Philippines ranges from 10 to 15 local governments, with support from a committed and experienced non-government organization. Their conclusion accorded with our results

to a certain extent, because all the networks I evaluated were within this size range. However, these networks were no longer supported by various non-government organizations and donor-assisted projects. Although activity levels of these networks slowed down when external support ceased, these networks still functioned despite having limited resources. This was because the local governments felt the need to continue their efforts and not waste the investments in establishing networks.

I did not find an effect of network size on participation and governance capacity. Despite Batangas being the largest network of the three, participation of the local governments was better compared to that of Camotes and Lanuza. While I do not disagree that there are likely to be upper size limits to networks of MPAs, my study shows that other factors can exacerbate or mitigate problems related to size. Below I discuss the influence of 1) institutional arrangements; and 2), diversity and complexity of socioeconomic and political contexts, on participation and governance capacity.

5.5.2 Influence of institutional arrangements

I found that less complicated arrangements based on simpler or fewer network objectives increased participation. Some types of financial arrangements (e.g. mutual funds systems) negatively influenced participation to a certain extent, particularly when members perceived that the costs and benefits of participating were inequitable (Fabinyi et al., 2013), and when network expenditures were not documented and reported properly. I understood that contributing to a mutual funds system was important to sustain network initiatives, particularly when external support ceases. In Lanuza, the amount of the financial contributions, lack of proper auditing, and reduced willingness of local governments to pay, reduced trust and interest in participating. This observation implied that, to ensure that financial arrangements do not negatively influence participation, the amount of contributions should be audited and reported regularly, and reviewed often and adjusted when necessary to ensure that the amounts are equitable to all the members.

I found that more inclusive and heterogeneous networks – those that included a diverse range of members such as MPA managers, local-government employees, and local-government officials for each local-government member - had higher capacity and performed better. In contrast, Christie et al. (2009b) argued that the diversity of views from increasing numbers and diversity of members were significant factors contributing to the inability of networks to function by impeding consensus-building. However, other studies on co-management and network governance (e.g. Bodin *et al.* 2006, Bodin and Norberg 2007, Carlsson and Sandstrom 2008) have recommended heterogeneity of members

because of its benefits for increasing the knowledge base and contributing experiences and shared lessons. I have seen that involving different kinds of people – with varying capabilities and experiences and from different governance levels - helps with problem-solving and coordination by improving decision-making processes and information flow from the network level down to communities. Clearly, however, there are logistical limits to involvement. Including all network members in activities that do not require everyone's participation will become more expensive because a lot more people would require financial support. However, general assemblies can be a cost-effective compromise between selective and comprehensive inclusion in activities. Assemblies can include different members of each local government (e.g. MPA managers, local government employees) in annual or biennial meetings to improve information flow and increase cohesiveness within networks and even within individual local governments.

Strong leadership was also very important to ensure participation and governance capacity. The provincial government of Batangas seemed to fill the role of a committed non-government organization. However, this was not entirely the case. Non-government organizations are seen as external to the network and providing advice as well as technical and financial support. The provincial government was a member of the network, while also having an authoritative role, and its involvement illustrated an interesting type of leadership. Although the provincial government was not elected as the leader of the network, it was steering and motivating local governments to adhere to their agreed goals. The provincial government enforced the accountability measures that the network agreed on, and provided incentive systems to motivate the local governments. The involvement of a higher-level government seemed to increase participation of the local governments. This model of leadership should be tested in other provincial networks (e.g. Oriental Mindoro and Siquijor) in the Philippines to determine if its success was unique to Batangas. Batangas could be a distinctive case because of the individual personalities of the provincial-government employees. If Batangas is not idiosyncratic, then the presence of an effective hierarchy of network governance could be more generally successful.

5.5.3 Influence of socioeconomic and political contexts

Based on the definitions of modes of governance by Kooiman (2003), the three networks I evaluated were comprised of several local governments that agreed to work cooperatively, but each also functioned autonomously. All these self-governing local governments had different governance contexts, which affect participation and cooperation. According to Jentoft (2007), governing systems comprised of heterogeneous networks require constant consensus-building, negotiations, and compromises. This is because conflict is a permanent

feature of networks, and conflict is greater in networks that are very diverse and complex. I have seen in the three networks indications of conflict, which have arisen from the diversity and complexity of the socioeconomic and political contexts of the local governments.

I found that networks associated with higher and more equal income classifications had higher governance capacity because they had more available resources for network initiatives. On the other hand, governance capacity was limited by high dependence on fisheries, and low diversity and availability of livelihoods, because of potential problems associated with acceptability of MPAs. For example, the lack of options for communities to exit fisheries discourages the establishment of new MPAs and makes enforcement of existing MPAs and other fisheries regulations more difficult.

The political factors that influenced participation in networks were political affiliations and development priorities. Local governments with the same political affiliations pursue common goals, which contribute to their participation in networks. However, local chief executives can still pursue their own development priorities, regardless of political affiliations and membership in networks. I have seen that very different or contrasting development priorities reduce participation, thereby decreasing governance capacity.

5.5.4 Inter-relatedness of the contextual variables

I found that it was quite difficult to analyse the contextual factors I selected in isolation, because all were inter-related. However, I identified features that influenced participation and governance capacity. The governance context explained the motivations and levels of interest of individuals and local governments when participating in network initiatives, and the factors that contributed to governance capacity. I found that higher levels of participation and governance capacity depended on less complicated and less demanding network objectives, more inclusive and diverse membership of representatives, more similar development objectives, and well-developed communication from network to community levels.

Moreover, elements such as leadership, participatory measures, and incentive systems, transparency and accountability, were very important to participation and governance capacity. These findings reaffirm those of Lockwood et al. (2009) regarding the importance of transparency and accountability in governance. Transparency is a good governance principle that promotes increased visibility of decision-making processes, and availability of relevant information to members of networks and other stakeholders. Accountability demonstrates how responsibilities have been met by leaders and even members. These governance principles together with good leadership and effective processes ensure regular

and timely reporting of progress and instil a sense of responsibility, commitment, and inclusiveness in the local governments (Borrini-Feyeraband et al., 2013). Incentive systems contributed to motivations for members to perform their duties well. Providing MPA managers and local governments with supplies and material incentives instead of monetary incentives helped them to maintain their initiatives while preventing misuse of funds.

I believe that it is important to analyse governance context to diagnose potential problems with governance prior to designing and facilitating the establishment and management of MPA networks. Understanding how governance contexts constrain or improve success of initiatives can guide the development of networks and determine their likely trajectories. I recommend analysing other governance factors, in addition to the ones considered here, because contextual variables are inter-related and inter-dependent. Other governance factors, such as culture and demographics should be examined, because these factors also influence management decisions.

CHAPTER 6
GENERAL DISCUSSION

6.1 Introduction

The realization that local-scale initiatives were insufficient to halt the continuous decline of coastal and marine resources has led to the move towards more integrated and ecosystem-based management approaches (FAO, 2003, IUCN-WCPA, 2008). One of the recommended solutions was the establishment of networks of MPAs. Well-planned and well-managed networks of MPAs were believed to provide higher ecological, social, and economic benefits (IUCN-WCPA, 2008, PISCO, 2007). In some countries they have been proven to improve recruitment of fish and corals in coral reefs (Harrison et al., 2012, Saenz-Agudelo et al., 2011, Planes et al., 2009) and to enhance cost-effectiveness of management efforts (Toribio et al., 2013, Aliño et al., 2006). However, there are still numerous gaps in knowledge about MPA networks (Roff, 2014, Cvitanovic et al., 2013). One important knowledge gap is how to plan and implement MPA networks in countries with small, numerous, and disparate governance units (Wilkinson and Salvat, 2012, White et al., 2014). Moreover, implementing networks in many regions, such as the Coral Triangle, can be quite challenging, because of fine scales of governance, high dependence on natural resources, and the variety of social, economic, and political characteristics that can impede initiatives for conservation and management (Green et al., 2014, White et al., 2014, Walton et al., 2014).

In the Coral Triangle, scaling up initiatives has been seen as a means to improve MPA management and planning to form functional MPA networks (White et al., 2014, CTI-CFF, 2009). Scaling up entails integrated and coordinated approaches with a regional perspective (Chua, 2006, Junio-Meñez et al., 2007). Simply, scaling up involves engaging numerous and various stakeholders over increasing spatial extents (Junio-Meñez et al., 2007). Although, "working together" makes sense, conservation biologists and coastal resource management experts should be mindful when prescribing these approaches, because there comes a point at which scaling up and institutional capacity for coordination will reach limits (Christie et al., 2009b).

The aim of this thesis was to advance the body of knowledge on MPA networks by understanding how scaled-up approaches enhance and limit their design and implementation, particularly in countries with numerous social, economic, and governance constraints on implementation of networks. Using the Philippines as a case study, the goals of this study included: 1) understanding how scaling up operates to form MPA networks; 2) examining the benefits and challenges of scaling up; and, 3) documenting lessons on how effectively scaled-up MPA networks can be governed. These goals were inter-related, and were achieved in each of the thesis chapters. Specifically, I addressed these goals in Chapters 2-5, by exploring how collaborations of local governments coordinated design and management of MPAs, and the likely trajectories of these collaborations. I describe below how the thesis chapters contributed to addressing the thesis goals.

6.2 Summary of thesis and key findings

Jentoft (2007) emphasized the need for institutional experimentation and "learning by doing" as means to document lessons and determine governance standards, processes, and conditions conducive to effective coastal governance. The Philippines provided a good case study, because coastal governance there has consistently evolved as a result of institutional experimentation. Hence, have come to recommendations to scale up efforts from community-based practices which have a proven track record, to collaborations of local governments for coastal and marine resource management.

Roff (2014) stated that the process of establishing MPA networks, and its benefits over individual MPAs, are well-known theoretically, but not empirically. This was because implementation of MPA networks was perceived as more complex than that of individual MPAs, and that elucidating these benefits of networks over individual or unconnected MPAs was difficult. This thesis contributed to the growing body of knowledge on MPA network initiatives, particularly to understanding of the development of MPA networks, and their value-added benefits compared to individual MPAs. The thesis chapters provided examples of successful interventions to scale up design and management of MPA networks in the Philippines. I used novel approaches and applied theories and methods from different disciplines to present the benefits of MPA networks over individual MPAs, and to identify the challenges experienced in approaches to scaling up.

6.2.1 *Scaling up to form MPA networks in the Philippines*

In Chapter 2, I described the history of MPAs and coastal management that led to the development of networks and I conducted a gap analysis of MPAs and MPA networks in the Philippines. I also complemented the literature review with interviews of MPA experts to identify and organise data on networks. The interview data were used to document scaling up approaches and identify the fundamental elements of successful collaborative partnerships. In this chapter, I used and updated the database of individual MPAs organised by the Philippine MPA Support Network (MSN) by developing the database on MPA networks. I found that most MPA networks had social and political objectives, and that scaling up involved collaboration, cooperation, and coordination between local governments. Initially, networks were formed by alliances of local governments to address common issues and threats (e.g. difficulties with enforcement, illegal fishers). As the members of networks gained more experience and trust, they coordinated expansion and management of MPAs. There were 40 networks in the country, varying in histories and objectives. I also found that the most conservationists and researchers believed in and promoted scaling up because of the following perceived advantages: 1) enhanced enforcement; 2) cost-effective management; 3) improved MPA design and coordination of responses to threats; and 4) facilitated resolution of conflict among neighbouring communities and local governments. However, these MPA experts also recognized the potential challenges to scaling up: 1) low technical capacity and high dependence on bridging organizations to help with MPA design; 2) lack of funding to sustain joint efforts; and 3) conflict arising from the lack of shared visions. The benefits and challenges identified in the literature and by the MPA experts as presented in this chapter were further examined in the succeeding chapters.

6.2.2 *Benefits and challenges of scaling up MPA network designs and coordinating expansion*

After conducting the national review of MPA networks, I then selected the Verde Island Passage as a case study to examine the benefits and challenges of scaling up in terms of the design and expansion of MPA networks. In Chapter 3, I defined scaling up as the coordinated expansion of locally-motivated MPA initiatives facilitated by collaborations of local governments and their communities. I simulated future scenarios of MPA expansion and compared these scenarios in terms of achievement of objectives for habitat representation. The scenarios included: uncoordinated community-based establishment of MPAs, two scenarios reflecting different levels of coordination of MPA expansion, and four scenarios guided by systematic conservation planning in different spatial contexts of

governance. I found that the current MPA network in the Verde Island Passage achieved more than 20% of the representation objectives for some of the habitats. Each of the scenarios protected different locations in the Passage, resulting in variations in the extent of protection of habitat types. As expected, the systematic scenarios were better than the non-systematic scenarios in terms of achieving habitat targets. Contrary to our expectations, the uncoordinated scenario was better than the coordinated scenarios. However, the results of the uncoordinated scenario did not reflect significant real-world constraints on community-based establishment of MPAs, because I used a very large annual rate of MPA establishment to allow for comparison with other scenarios. Hence, realistically uncoordinated community-based MPA establishment should have been smaller, and not all the municipalities would have had MPAs. On the other hand, the results of the coordinated scenario were closer to reality. Coordination improved planning through its broader perspective, inclusion of more ecological and social information, and ability to transcend boundaries of smaller governance areas by sharing municipal waters. However, I recognized from these scenarios that scaling up also has high transaction costs and requires considerable technical input that is beyond the capacity of most local governments. Moreover, regionally-relevant MPAs will not be evenly spread across governance units because the best places to achieve regional-scale objectives are not evenly distributed with respect to governance boundaries. Scaling up would require local governments and communities to understand and accept that the immediate benefits and costs of MPAs will not be equitably distributed, and to arrange for these spatially-uneven costs and benefits to be redistributed in some way agreeable to the parties involved.

6.2.3 Benefits and challenges of scaling up management of MPAs, and coordinating and conducting joint initiatives

For Chapter 4, I examined the benefits and challenges of scaling up in terms of improving MPA management. It is believed that scaling up improves MPA management because local governments and their constituencies share information, resources, and responsibilities. I evaluated the management performance of networks and the extent to which networks enhance the management of individual MPAs. To do this, I used multiple methods including management performance tools, key informant interviews, and community perception surveys to evaluate the management performance of three MPA networks. Because there were no management performance assessment tools developed for MPA networks, I developed a network tool that complemented the assessment tool for management performance of individual MPAs, already widely used in the Philippines. This allowed me to study the different levels of management performance at the different

hierarchical levels of governance (e.g. village to municipality to province). The performance tools provided quantitative descriptions of management performance relative to a variety of criteria. However, they did not explain why the criteria were achieved or not. Hence, I used the interviews and surveys to complement the performance tools to consider information on aspects of management environments, such as objectives and history that potentially affect performance. This additional information allowed me to explain successes and bottlenecks in management.

I found that performance varied between the three networks I evaluated. The performance of the networks was influenced by their objectives, histories, and structures and the diversity and complexity of governance. Governance diversity and complexity refer to the variability of social, economic, and political interests of interacting and interdependent local governments. I also found that the performance of networks and individual MPAs were interdependent. Networks depend on the individual functions of the MPAs, and MPAs are enhanced by being parts of networks. Well-managed MPAs are overseen by experienced local governments and MPA managers that share lessons and experiences with other members within the network. Well-coordinated networks serve as platforms to convene these local governments and MPA managers to make decisions and share resources to help improve the MPAs. The interdependencies between MPAs and networks, and between individual MPA managers and local governments and their collaborations, require participation and cooperation of everyone involved. Otherwise, the lack of participation will lead to distrust and eventually the demise of the networks.

6.2.4 Influence of governance context on participation, governance capacity and management performance of scaled up MPA networks

Networks of MPAs are not just systems of individual MPAs that interact ecologically. Networks rely on the characteristics and interactions of people and social institutions as well. These social and political characteristics and interactions, as observed in the two previous chapters, influence the coordinated management of MPA networks. In Chapter 5, I evaluated the influence of governance context on the management performance of networks. Management performance is affected by participation of network members and their capacity to coordinate initiatives. Presumably, institutional capacity and scaling up are limited to a certain extent by the difficulties of negotiating conflict and building consensus with increasing diversity and complexity of governance. Governance diversity and complexity increase with increasing sizes of networks and social and economic heterogeneity of network members. Using the same case studies and interviews as those for Chapter 4, I examined the influences on participation and coordination of network sizes

(e.g. number of participating local governments), institutional arrangements (e.g. structure, objectives), and socioeconomic and political contexts. I found that the sizes of the MPA networks had no effect on participation and coordination of initiatives. Instead, participation and coordination were influenced by institutional arrangements and the socioeconomic and political diversity of the local governments involved. I recognized that these networks were very different from each other, which made it difficult to identify overarching generalizations about network governance. Although governance was mostly dependent on contextual factors, certain institutional arrangements of these networks stood out as positively influencing participation and coordination. These arrangements included less complicated objectives, less demanding structures and interactions, more inclusive membership of representatives (e.g. local government officials, employees, and MPA managers), and increased communication from network to community levels. Leadership was also important and it appeared that hierarchical governance contributed to better participation. Leadership roles taken by a higher-level government entity increased participation of local government members. Moreover, strong leadership, combined with transparency, accountability, incentive systems, and participatory measures, contributed to increased participation, better coordination, and higher management performance.

6.3 Cross-cutting themes and contributions to conservation and management initiatives

This thesis contributed to broadening the understanding of the theory and application of MPA networks and scaled-up approaches to management of marine ecosystems. The results of this thesis provided lessons that could help sustain and improve management efforts in the Philippines, and aid development of MPA networks in countries with similar governance contexts. Because scaling up has been widely advocated in the Coral Triangle, other CT6 countries would benefit from the experiences in the Philippines as documented in this research. Below, I outline the contributions of this thesis to the overall theory and application of MPA networks.

6.3.1 Contributions of this research to improving and sustaining MPA network initiatives in the Philippines

This thesis contributed to understanding the motivations and evolution of MPA network initiatives in the Philippines. Because the field of MPAs and ICM in the Philippines is consistently evolving, it is imperative to document and update the history of MPAs and ICM, and the MPA database of the Philippine MPA Support Network. The

updated database and history from Chapter 2 increased accessibility of information, and provided lessons that various MPA experts, local MPA practitioners (e.g. local governments and community members), and upcoming researchers can use for research and implementation on MPAs.

In Chapter 3, the future MPA expansion scenarios I developed for the Verde Island Passage could serve as an example of the benefits of scaling up MPA designs. Scenario planning and systematic conservation planning as demonstrated in this chapter aided in identifying different configurations of MPA networks in a given region, despite the different social, economic and governance constraints. The configurations from the scenarios could help to guide the design and establishment of MPAs in the region. Scenario planning and systematic conservation planning should be advocated to improve planning processes, and to complement coordinated expansion of MPAs in the country.

Another contribution of this thesis was the development of the network management performance assessment tool in Chapter 4. Roff (2014) suggested that a counterpart for "How is your MPA doing?" by Pomeroy et al. (2005) should be developed for MPA networks. The tool developed and the methods used to evaluate management performance of networks in Chapter 4 were new steps toward selecting indicators for monitoring and evaluation, and improving the framework for implementing MPA networks in the Philippines.

Lastly, in Chapter 5, I was able to describe different MPA networks and how their different governance contexts influenced participation, governance capacity, and management performance. Although it was quite challenging to detect patterns from only three networks because they were quite different from each other, these networks sampled are similar to others identified in Chapter 2. The results from Chapter 5 can aid other networks in the country to ensure participation of local governments in their initiatives, by implementing governance structures such as strong leadership, incentive systems, and participatory-measures, and governance processes such as accountability and transparency measures, as part of their institutional arrangements. These key elements in the institutional arrangements can mitigate conflict that may arise from the diversity and complexity socioeconomic and political contexts of individual local governments, which can also cause disinterest in participating in the network. Moreover, the influence of governance context could add to understanding of the likely trajectories and sustainability of the networks evaluated and other networks in the country. Hence, it will probably be important to use some information on governance context of all networks as indicators for

monitoring and evaluation or to help understand results of management performance assessments.

6.3.2 Contributions of this research to the development of MPA networks using scaled up approaches

Scaling up, as shown in the thesis chapters, can entail large transaction costs when trying to organize and facilitate discussions among neighbouring local governments, especially when the region has highly complex governance. In some cases, considerable resources and assistance from bridging organizations were required to scale up MPA design and management. Designing MPA networks was beyond the capacity of most local governments because of the increasing complexity and data requirements at increasing spatial scales. Most local governments lack the broader perspective and technical expertise to design MPA networks. Moreover, most of the networks mentioned in Chapter 2 were not self-organized but facilitated by donor-assisted projects and bridging organizations. Establishing MPA networks can be quite costly when local governments organize themselves without external support, and require local government leaders who are highly motivated, and have strong personalities and convictions.

Furthermore, from the perspective of interactive governance theory, MPAs are also heterogeneous systems with participating and non-participating social institutions that vary in numbers, composition, and backgrounds. According to Jentoft (2007), governance of these kinds of systems would require constant compromises and consensus-building, because conflict becomes an intrinsic part of governance. Some countries in the Coral Triangle, particularly the Melanesian countries, have much finer scales of governance, and are much more heterogeneous (Mills et al., 2010, Govan, 2009) compared to the Philippines. For example, there are 1,300 languages spoken in Melanesia (Landweer and Unseth, 2012), and although they can use a common language, the inability to fully understand each other may resort to conflict. In these countries, it might be much more difficult and costly to scale up to form MPA networks. Hence, it is important to first determine the feasibility of approaches to scaling up prior to attempting implementation, as well as the universal need to consider the institutional capacity of the local governments and communities in the interests of sustainability of MPA networks. To summarize, the key considerations listed below regarding scaling up to MPA networks in the Philippines were common to all my thesis chapters.

1. Conservation biologists and coastal resource management experts should aim to ***determine the feasibility of scaling up, prior to implementation in order to ensure progress and***

sustainability of MPA networks. This requires engaging with researchers from other disciplines, particularly the social sciences in order to look at the following factors:

a. ***Influence of diversity and complexity of governance*** – Scaling up as seen in this thesis entails cooperation and collaboration between self-governing local governments. We need to consider how much the diversity and complexity of governance influence cooperation of local governments within an MPA network. Very diverse and complex governance can negatively influence scaling up because of the difficulties of finding common goals and initiating concerted management efforts. Diversity and complexity might also reduce trust and affect working relationships of the local governments if they have different priorities and cannot compromise.

b. ***Transaction costs of facilitating and organizing collaborations*** – If governance is too diverse and complex, this might entail higher transaction costs of facilitating and organizing collaborations. It would take more time, effort, and finances to facilitate discussions among the local governments, and to sustain initiatives. In some cases, if the costs of organizing collaborations and coordinating efforts outweigh the benefits received by the stakeholders, local governments might become disinterested in working together.

c. ***Potential for expansion to increase MPA sizes and numbers, and to include other communities and local governments, or to scale up to higher levels of governance*** – Although scaling up will be limited to some extent, because of the costs of organizing and limits to governability, we should aim to determine the potential of local governments to progress by scaling up further. This could entail further expansion by implementing new MPAs (hopefully based on MPA designs that were recommended by bridging organizations), or involving more communities, local governments and, if possible, higher government entities such as provinces.

2. Conservation biology and coastal resource management are applied sciences. Their outputs are used by local MPA managers. Hence, we should ***consider and help to increase the capacity and potential for learning of the local MPA managers, communities, and local governments***, because they are the ones who are using the outputs that scientists produce and the conservation and management approaches prescribed.

a. ***Invest on local governments and communities that have good track records, and experience with conservation and management initiatives by providing them with resources and opportunities to increase their capacity*** – Not all local governments and communities have the same extent of experience and motivation. Based on this thesis, some local

governments and communities are more interested in and supportive of scaling up. We should continue to invest in these local governments and communities, because they can serve as examples and leaders that motivate other local governments and communities to initiate or sustain their efforts. Some local governments also take pride in their achievements when they become well-known and experienced in certain initiatives. For example, local governments who are known for ecotourism efforts and MPAs are usually sought and visited by other local governments to gain information.

b. ***Invest in influential people – local government officials, employees, and community leaders by providing them with resources and opportunities to increase their capacity*** – Similar to the previous point, there are particular people who are very influential in MPA network initiatives. Some of these people, when not in office anymore, have been forgotten and excluded from MPA network initiatives. It would be useful to keep these people involved, because of their commitment and knowledge. They could become local trainers or serve as mentors in their networks.

c. ***Capacity needs assessment for the local governments involved*** – Some local governments would require more assistance than others. A capacity-needs assessment will allow for better investments, so that the support will be more targeted to the respective needs of the local governments.

3. Based on this thesis, the ***inclusion of good governance processes, and other supporting structures*** and activities helped the networks sustain their initiatives and keep members interested.

a. ***Process elements such as transparency, accountability, and participatory measures should be embedded in management plans for MPA networks and memoranda of agreement*** – Process elements ensure that members participate and comply with their agreements. It was seen in this thesis, that networks that had these process elements were more motivated to participate and comply, which increased governance capacity and improved management performance. Without process elements, local governments lacked trust in the network and became disinterested in network initiatives.

b. Structures and activities should include incentive systems to motivate members to perform well, and regular general assemblies for feedback and to keep all levels of governance informed – Institutional arrangements could include incentive systems and regular general assemblies. Incentive systems motivate local governments to perform well. Regular general assemblies help with communication, feedback, and keeping different

governance levels informed. Both approaches help with increasing cohesiveness in an area, because it makes people feel they are respected and parts of a community.

6.4 Limitations of the thesis and future directions

6.4.1 Focussed on scaling up for MPA network formation and initiatives

A limitation of this study was that I focussed on how scaled-up approaches were used to develop MPA networks. Some of the collaborations of local governments had different objectives and purposes for establishment. Most of these local governments grouped themselves together primarily to increase efficiency of enforcing fisheries laws, and consider MPAs as secondary objectives.

Despite this limitation, I clarified the definitions of MPA networks in this thesis. I limited and defined the local government collaborations as social MPA networks with varying levels of engagement and involvement of different types of stakeholders for the purposes of sharing information, resources, experiences through meetings and other activities, and management responsibilities. I limited the scope to MPA networks and other activities that contributed to MPA networks, particularly fisheries enforcement and coastal resource management activities. There are other local-government collaborations in the Philippines, and some of these are engaged in terrestrial-based management (e.g. forest, watershed), and urban development (EU-PDF, 2010, GTZ, 2008). Although, these local government collaborations did not have marine-based objectives, some of the lessons presented in this thesis, particularly the influence of governance context on participation and governance capacity, can still be applied to those inland local governments.

6.4.2 Used a case study approach

This thesis used the Philippines as a broad case study, and four study sites. This limits my conclusions to specific areas, which may or may not be applicable to other parts of the Philippines and other parts of the Coral Triangle, or to regions in other parts of the world. However, I did highlight that the case studies that I have used are representative of the different sizes, objectives, and levels of engagements of local government networks in the Philippines, so might be more generally applicable. For example, there are two other provincial MPA networks in the Philippines: Oriental Mindoro MPA and Enforcement Network and Siquijor Province MPA Network. The network in Oriental Mindoro was established a year after the Batangas network, and was supported by Conservation International – Philippines (CI-Philippines, 2009). The network in Siquijor was supported

by the Coastal Conservation and Education Foundation, and was established more recently (pers. comm. R. Weeks). These provincial networks may be similar to Batangas and may benefit from the lessons from Batangas. Moreover, a variety of institutional arrangements and management activities (e.g. general assembly, local competition for best MPAs) from the case studies were presented. Other local governments and communities can benefit from these different management arrangements, choose to apply the approaches that might suit their network or local governments, and strengthen their governance processes to increase governance capacity and prevent problems with participation.

6.4.3 Focussed on measuring outputs rather than outcomes

In Chapter 3, I limited the study to measuring the expansion of MPAs in terms of area protected. I was not able to consider the contributions of different types of MPA types on effectively protecting biodiversity, because there was no information and research about the effectiveness of different MPA types. The Philippines have different types of MPAs based on the different legislations and levels of government implementation (White et al., 2014). For example, the national government implements marine parks (e.g. Tubbataha Reefs Natural Park, Hundred Islands Natural Park) that can have different levels of protection. Local governments establish no-take fish sanctuaries, and fishery marine reserves – areas that are open to passive fishing gear (e.g. hook and line fishing). Different types of MPAs have different levels of effectiveness when protecting biodiversity. Hence, measuring the percentage area protected does not ensure that the habitat is 100% effectively protected.

I limited measurement to management outputs in Chapter 4 because measuring management outcomes for MPA networks was beyond the scope of this thesis in terms of the requirements for time, effort, and finances. However, the tool developed to evaluate management performance of MPA networks in Chapter 4 is the first developed to assess management performance of MPA networks. It is essential to evaluate management performance to determine whether MPA networks contribute to minimising human impacts and account for positive or negative changes on coastal and marine resources. Evaluating management effectiveness of MPA networks would require evaluation not only of management performance (outputs), but also of social and economic impacts and biophysical changes, to determine the overall management outcomes and advantages of networks compared to individual MPAs.

Lastly, there were other contextual factors that influenced participation in and governance capacity of MPA networks. However, knowledge of these other contextual factors, outlined in Chapter 5, was incidental, mentioned by some of the key informants that were interviewed. The questionnaire I used in Chapter 5 was limited to questions that was based on the results in Chapter 2, the MPA literature (e.g. Christie et al. 2009, Lowry et al. 2009), and initial analysis of the data in Chapter 4. These questions asked about challenges experienced, conflicts resolved, knowledge about the significance, objectives, and effectiveness of the MPAs and the network, beliefs about benefits, costs, fairness and working relationships, and future prospects for activities related to MPAs and MPA networks, and did not go deeper into the history, culture and other contextual factors. However, despite the limitations of the contextual factors that we considered Chapter 5, I was still able to make generalizations about the influence of governance context on participation, governance capacity, and management performance. The lessons from Chapter 5, and the findings of this thesis as outlined in this General Discussion, highlight the importance of understanding governance when developing MPA networks using scaled-up approaches.

6.4.4 Future directions for research and management

I have mentioned in Chapters 3, 4 and 5 a few other research questions that can be addressed to advance knowledge of MPA networks and scaled-up approaches. To summarise, the following studies would be useful to address the limitations of this thesis:

1. Using the scenarios developed in Chapter 3, we could improve our knowledge of the contributions of different approaches to MPA expansion by determining how much they contribute to addressing objectives for fisheries, connectivity, and social and economic characteristics. Moreover, we could use the maps I created either to guide expansion of MPAs in the Verde Island Passage, or consult with various stakeholders to ascertain which approach (e.g. non-systematic vs. systematic, uncoordinated vs. coordinated) and spatial context (e.g. study region vs. province vs. municipalities) are more appropriate for MPA network planning and/or implementation, and which approach is more likely to be used. Understanding the perceptions of different stakeholders will help to better understand how to bridge the knowledge-implementation gap.

2. Improve the tool and research methods developed to assess management performance for Chapter 4 to accommodate the nuances of different kinds of local-government

collaborations that address more diverse objectives for coastal and marine management, and to establish indicators that can be linked with results of biophysical assessments and social-impact studies to improve understanding of the benefits of MPA networks compared to individual MPAs.

3. Analyse other contextual factors that influence participation, governance capacity, and management performance. Other approaches and the methods and theories of other disciplines might be required to better understand the influence of contextual factors. For example, ethnographic information is necessary to understand the influence of culture on participation and other human interactions that influence trust and governance capacity.

6.5 Conclusion

The aim of this thesis was to advance knowledge of MPA networks, and show how scaled-up approaches enhance and limit the design and management of MPA networks. Understanding how MPA networks are developed and managed is important to determine the advantages of networks over individual MPAs. Using the Philippines as a case study in this thesis, I was able to present the value-added benefits of scaling up to form MPA networks. Perceived advantages of local-government collaborations were supported in this thesis, because scaling up improved the planning process and design of MPAs, accelerated MPA establishment, and improved management of individual MPAs. However, I have also highlighted that establishing local-government collaborations entails large transaction costs and might not be sustainable, particularly in regions with highly diverse and complex governance where scaling up is prescribed. This thesis also highlights that, although MPA networks seem to be more advantageous and appropriate than uncoordinated MPAs for abating the continuous decline of coastal and marine ecosystem health, it is imperative that we understand governance constraints to ensure proper design, implementation, and sustainability of MPA networks.

APPENDICES

Appendix A. Detailed description of each MPA expansion scenario simulated in this study.

Appendices B to F contain detailed information on the suitability layers and decision trees for the uncoordinated and coordinated scenarios.

Scenario	Description	Spatial context	Suitability layer	Expansion Rules	Conservation objectives
1. ***Uncoordinated*** MPA establishment undertaken by local governments individually	MPAs were established either by communities and/or local governments independently, without guidance or with only minimal guidance from bridging organizations and without consideration of ecological processes across areas larger than municipalities. This depicted the situation prior to efforts to establish the Verde Island Passage MPA network. This situation could recur if efforts to sustain collaborative partnerships diminish.	***Municipal waters (individual municipalities):*** Territorial waters of local governments (within 15 km from the shore of each municipality) based on the Local Government Code.	***Uncoordinated:*** Suitability for MPAs was based on the characteristics of the MPAs established before coordination began in 2008, and from key informant interviews. Factors used to determine suitability of planning units for MPA establishment include habitat types, accessibility, and distance to another MPA.	***Uncoordinated:*** The decision tree used the suitability layer and spatial context to determine the location of potential MPAs. The MPA sizes from the database (prior to 2008) were used to inform the simulation for assigning sizes of MPAs.	Test if 20% of each habitat was protected in each municipality.
2. ***Partially coordinated*** MPA establishment undertaken by local government alliances	Efforts to coordinate MPA planning and management were undertaken by alliances of local governments, each with one to five municipalities in a shared bay, gulf, or coastal stretch. Within alliances, local governments were collaborating to establish MPAs. Support was	***Shared municipal waters across alliances***: Local governments in an alliance may have an agreement to jointly manage their municipal waters as recommended by the Fisheries Code.	***Coordinated:*** Suitability for MPAs was based on the characteristics of areas where MPAs were established when coordination was initiated and facilitated by CI-Philippines from 2008 onwards. Factors used to determine suitability of planning units for MPA	***Coordinated:*** The decision tree used the suitability layer and spatial context to determine the location of potential MPAs. The MPA sizes from the database (from 2008-2010) were used to inform the	Test if 20% of each habitat was protected in shared municipal waters within each alliance.

Scenario	Description	Spatial context	Suitability layer	Expansion Rules	Conservation objectives
	provided by bridging organizations to identify potential MPAs using ecological information about the region.		establishment included habitat types, fisheries importance, and land-based and coastal threats.	simulation for assigning sizes of MPAs.	
3. ***Fully coordinated*** MPA establishment undertaken by local governments and their corresponding provincial governments	Efforts to coordinate MPA planning and management were in place at the provincial level. Each provincial government was working with its respective local governments to schedule MPA establishment with support from bridging organizations using ecological information across the province.	***Shared municipal waters across provinces***: Local governments across provinces may have an agreement to jointly manage their municipal waters as recommended by the Fisheries Code.	***Coordinated*** as described above	***Coordinated*** as described above	Test if 20% of each habitat was protected in shared municipal waters within each province.
4. ***Systematic*** approach to MPA establishment in ***individual municipal waters***	This scenario involves establishment of MPAs by individual local governments with guidance from conservation planning software and ecological information about the Verde Island Passage. There is no coordination between municipalities.	***Municipal waters (individual municipalities)*** as described above for scenario 1	***Inverse of the uncoordinated suitability layer*****:** The inverse of the uncoordinated suitability layer was used as the cost layer to encourage protection of more suitable areas. Using the uncoordinated allowed for comparison of areas protected with the uncoordinated	***Marxan:*** Maximise the achievement objectives while constraining establishment of MPAs based on the annual average rate of establishment prior to and during coordination.	Protection of 20% of each habitat in each municipality.

Scenario	Description	Spatial context	Suitability layer	Expansion Rules	Conservation objectives
			community-based scenario (1).		
5. ***Systematic*** approach to MPA establishment facilitated by local government ***alliances***	This scenario involved establishment of MPAs by local government alliances with guidance from conservation planning software and ecological information about the Verde Island Passage.	***Shared municipal waters (alliances)*** as described above for scenario 2	***Inverse of the coordinated suitability layer*** as described above	***Marxan*** as described above	Protection of 20% of each habitat in shared municipal waters within each alliance.
6. ***Systematic*** approach to MPA establishment facilitated by ***provincial networks***	This scenario depicted MPA establishment by provincial governments together with their local governments with guidance from a conservation planning software and ecological information about the Verde Island Passage.	***Shared municipal waters (provinces)*** as described above for scenario 3	***Inverse of the coordinated suitability layer*** as described above	***Marxan*** as described above	Protection of 20% of each habitat in shared municipal waters within each province.
7. ***Systematic*** approach applied to a ***regional MPA network***	This scenario depicted MPA network formation using conservation planning software, whereby the spatial boundaries of governance units within the Verde Island Passage region were not considered.	***Shared municipal waters (region)*** Boundaries of governance units were not considered in the VIP region.	***Inverse of the coordinated suitability layer*** as described above	***Marxan*** as described above	Protection of 20% of each habitat across the Verde Island Passage.

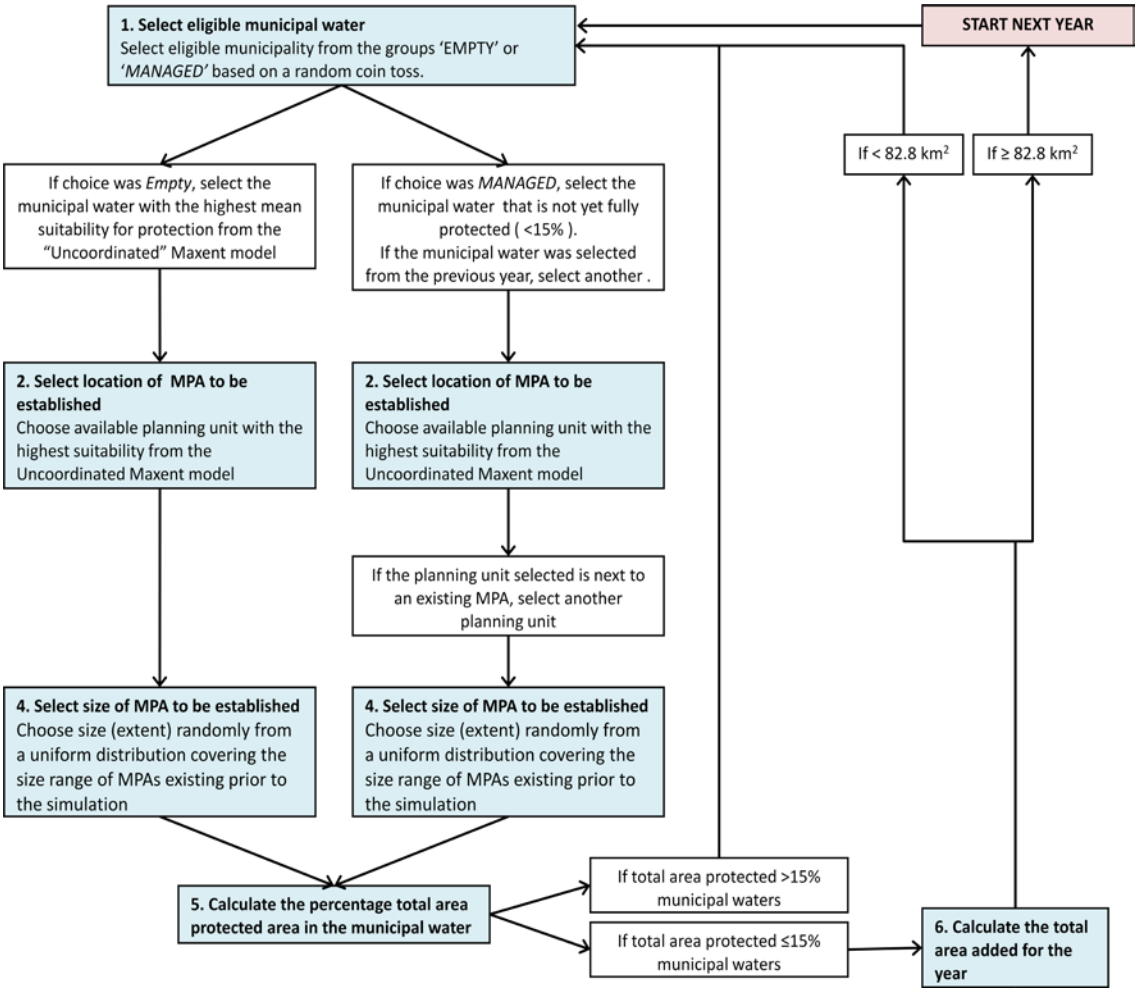
Appendix B. **Factors, decision rules, and spatial predictors used to inform the suitability layers for the uncoordinated scenario (US) and coordinated scenarios (CS).** √ indicates that the spatial predictor was used to create the suitability layer for the scenario. ***** - See note at the bottom of the table.

Factors considered for the location & size of MPAs	Spatial Predictors	Rationale explained by key informant interviews and scientific literature	US	CS
1. Establishment of MPAs by adjacent *barangays* or local government units	Distance from another MPA	MPAs tend to clump together in one area, since local governments who are interested in implementing MPAs tend to establish more than one MPA in their municipality. Some municipalities in the country have one MPA in each village within their waters, provided that fishing communities were interested as well.	√	
2. Accessibility, visibility from barangay, and ability to enforce and monitor resource regulations	Distance from the shoreline Distance from roads	Even though municipal waters were set within 15 km from the shoreline, most MPAs were established within 5 km of the shore for ease of enforcement. This enabled MPA guards to easily see violators and apprehend them, since most of the guards only have non-motorized bancas. MPA guardhouses were set close to roads and near villages to allow ease of access and cheaper maintenance.	√	√*
3. Habitat health, productivity and type; perceived benefit of implementing MPAs for tourism purposes apart from achieving fisheries objectives	Habitat type	Productive and healthy habitats were protected mostly to sustain biodiversity, abundance and biomass of flora and fauna, and reduce impacts of threats apart from fisheries and other human activities. However, habitats that were also degraded were protected to allow them to recover (e.g. mangrove rehabilitation). Data on habitat health was available only for the existing MPAs; hence habitat type was used as a surrogate. Coral reefs were protected mostly due to the potential added benefits of allowing access to certain zones of the MPAs for tourism purposes. Communities then have an added or alternative source of income by introducing user fees, serving as tour guides, and involvement in other tourism-related activities (White and Cabanban, 1982, Christie and White, 2007). Mangrove MPAs were also initiated, since they are potential areas for establishing boardwalks and paddle-boat tours wherein tourists can observe associated fauna (e.g. birds, reptiles, fireflies). Increasing representation will aid in maintaining connectivity within patches of the same habitat types (e.g. coral reefs to coral reefs; seagrass bed to seagrass bed) and	√	√

Factors considered for the location & size of MPAs	Spatial Predictors	Rationale explained by key informant interviews and scientific literature	US	CS
		between habitat types (e.g. mangrove to seagrass; coral reef to seagrass) (Mumby, 2006, McCook et al., 2009)		
4. Shoreline development	Distance from developed areas and other threats	MPAs were not established in areas (e.g. ports and factories) most likely to be affected by human impacts. This was to allow recovery and reduction of disturbances (IUCN-WCPA, 2008).		√
5. Marine threats	Presence of marine threats (e.g. illegal fishing)	Areas that are heavily fished are also protected since they are assumed to be important habitats or highly productive areas (e.g. coral reefs, upwelling areas for pelagic species).		√
6. Temperature refugia and larval entrainment potential	Temperature refugia (data not available) Larval entrainment potential	Areas identified as temperature refugia should be protected to reduce threats that may affect them since they can provide propagules after a bleaching event. Larval source and sink areas should be protected to maintain connections (Almany et al., 2009, McCook et al., 2009). Areas deemed to have high larval entrainment potential (based on icthyoplankton distribution, chlorophyll concentrations & larval dispersal modelling) should be protected since they can serve as good sources and sinks of larvae (Campos and Aliño, 2008).		√
7. Presence of threatened species and marine megafauna	Presence of threatened species & marine megafauna	Communities are now protecting turtle nesting sites and dolphin, whale and whale shark sightings since they are seen as potential ecotourism sites, following the success of various whale shark interactions and whale watching tours.		√

*Used only distance to shoreline for the scenario, because motorized boats have become available for patrolling and did not limit guards to access MPAs anymore. The boats came from Conservation International – Philippines who supported and facilitated coordination of the local governments

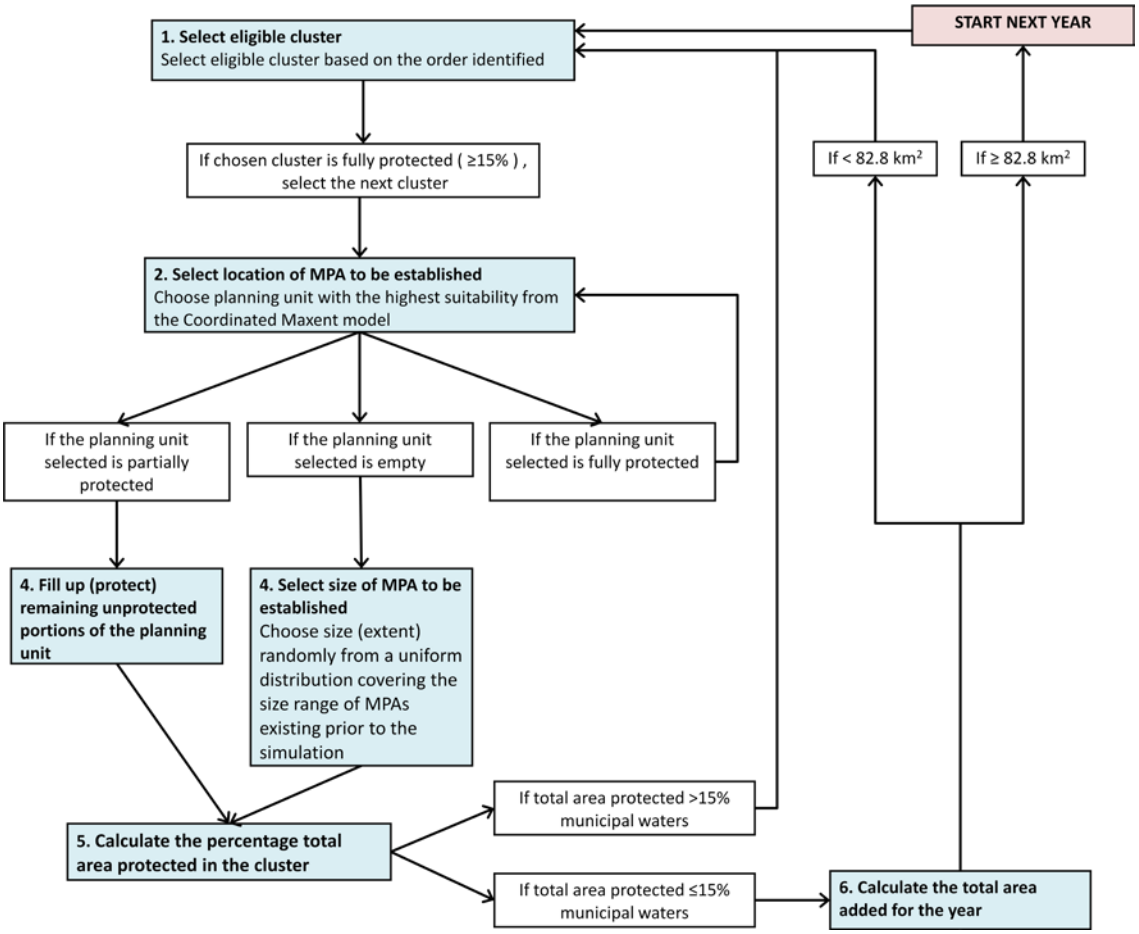
Appendix C. Scenario 1 - Uncoordinated MPA establishment. This decision tree describes the steps taken to simulate uncoordinated community and/or locally-based MPA establishment. A single municipality can establish one or more MPAs in a single year, provided that it does not exceed the percentage area allowed for MPAs based on the Fisheries Code. White boxes present alternate routes. Explanations for main steps are detailed in Appendix D.



Appendix D. Scenario 1. Uncoordinated MPA establishment and rationale for main decision steps. Information for the rationale was based on interview data, policy information, MPA databases, and literature.

Steps	Rationale
Step 1. Select eligible municipal water	I used a random coin toss to select a group of local governments, because I assumed there are equal chances of an MPA being established in municipal waters that have MPAs (MANAGED) or not (EMPTY). Although each local government was urged to have an MPA in its area, depending on the beliefs and objectives of the chief executives and communities, some municipalities have none and others have more than one. I capped protection to 15% of the total area of municipal waters based on the mandate of The Philippine Fisheries Code. I used the suitability model to inform our choice of municipality without existing MPAs because we are assuming that municipalities that are most suitable overall will be the most willing to accept new MPAs.
Step 2. Select location of MPA to be established	The local government and community select areas for MPA establishment, after a baseline assessment and/or series of public consultations. I used the Maxent model as a surrogate for the baseline assessment, since we are assuming that the planning units with the highest modelled suitability are most likely to have MPAs established. The new MPAs will be at least 1 km away from the nearest MPA in order to allow space for subsistence fishers. I selected the minimum distance since we are assuming that MPAs will still be close to each other and to the shoreline for ease of enforcement, which best represents reality.
Step 4. Select size of MPA to be established	The local government and community compromise on the total area to be protected. This is done through a series of public consultations. I used the size range of community-based MPAs, established prior to coordination, to inform our selection so we can best represent reality.
Step 5. Calculate the total percentage of water protected	Local governments are responsible for zoning their municipal waters (e.g. areas to be utilized for fishing, shipping lanes). I assumed more than one MPA would be established within a single municipal water area within one year. However, I limited protection to just 15% of the total municipal water. If the size selected contributed to excess protection, the model went back to Step 4 and selected another size.
Step 6. Calculate the total area added for the year	Local governments and communities decide to establish MPAs at different barangays (villages) within the municipality nearly at the same time. I assumed more than one MPA would be established within a single municipal water within one year. Hence, if the average annual rate of establishment (e.g. 82.8 sq km) was not achieved, protection in other areas or the same municipal waters was allocated.

Appendix E. Scenarios 2 and 3- Partially and Fully Coordinated Scenarios. This decision tree presents the steps taken during two levels of coordinated MPA establishment. An alliance of two or more municipalities (Scenario 2) and all municipalities within provinces (Scenario 3) can establish one or more MPA in a single year, provided that they do not exceed the percentage area allowed for MPAs based on the Fisheries Code. White boxes present alternate routes. Both alliances and provinces are referred to here as "clusters" of municipalities. Explanations for main steps are found in Appendix F.



Appendix F. Scenarios 2 and 3. Two levels of coordinated MPA establishment and rationale for main decision steps. Information for the rationale was based on interview data, policy information, MPA databases, and literature (when stated).

Steps	Rationale
Step 1. Select eligible shared municipal waters	Local governments in clusters (within alliances or provinces) collectively decide to establish MPAs in their shared municipal waters. Sharing municipal waters can potentially increase the sizes of their MPAs. Some clusters have had support from bridging organizations and some have not. Partnering with a bridging organization (e.g. NGO) makes clusters work more efficiently. I assumed that the clusters that benefited from external support gained a lot of experience, and were already working well together. These alliances were then were able establish MPAs more efficiently and faster compared to other alliances. I created an order of selection based on the suitability model and interviews. I assumed that alliances that are most suitable overall and have more experience will be the most willing to establish new MPAs. I used the same limit to shared municipal waters as in the uncoordinated scenario, so I capped additions of MPAs once 15% of the total shared municipal waters were protected.
Step 3. Select location of MPA to be established	The cluster selects the area for MPA establishment, after a baseline assessment. A series of public consultations and field visits with their respective communities are undertaken to decide whether expansion of existing MPAs can be done or new MPAs can be established adjacent to the existing MPAs. Fisher representatives are taken on site visits to discuss the locations and boundaries of the MPAs. I used the Maxent model as a surrogate for the planning process for MPA expansion, since I are assuming that the pixels from the Maxent model with the highest suitability are most suitable for MPA establishment. I assumed that planning units that were only partially protected would have MPAs expanded to occupy their full extents. I assumed that protection of empty planning units adjacent to protected planning units constituted expansion of the adjacent MPA. In contrast, establishment of MPAs in empty planning units next to other empty planning units constituted new, not expanded, MPAs.
Step 4. Select size of MPA to be established	The clusters and their communities compromise on the total area to be protected. This is done through a series of public consultations. I used the size range of coordinated MPAs to inform our selection so I can best represent reality.
Step 5. Calculate the total percentage of water protected	Local governments within a cluster coordinate zoning of their municipal waters (e.g. areas to be utilized for fishing, shipping lanes). I assumed more than one MPA would be established within a cluster within one year. However, I limited protection to just 15% of the total municipal waters in a cluster. If the size selected contributed to excess protection, the model went back to Step 2 and selected the next shared municipal water.
Step 6. Calculate the total area added for the year	Local governments within a cluster in consultation with their communities decide to establish MPAs at different barangays (villages) within clusters nearly at the same time. I assumed more than one MPA would be established within a cluster within one year. Hence, if the average annual rate of establishment (e.g. 82.8 sq km) was not achieved, protection in other areas or the same cluster was allocated.

Appendix G. Local government income classifications from the Philippine Local Government Code of 1991, and Department of Finance. Unit of currency is Philippine Peso

A. Provinces

Class	Average Annual Income
First	P 450 M or more
Second	P 360 M or more but less than P 450 M
Third	P 270 M or more but less than P 360 M
Fourth	P 180 M or more but less than P 270 M
Fifth	P 90 M or more but less than P 180 M
Sixth	Below P 90 M

B. Cities

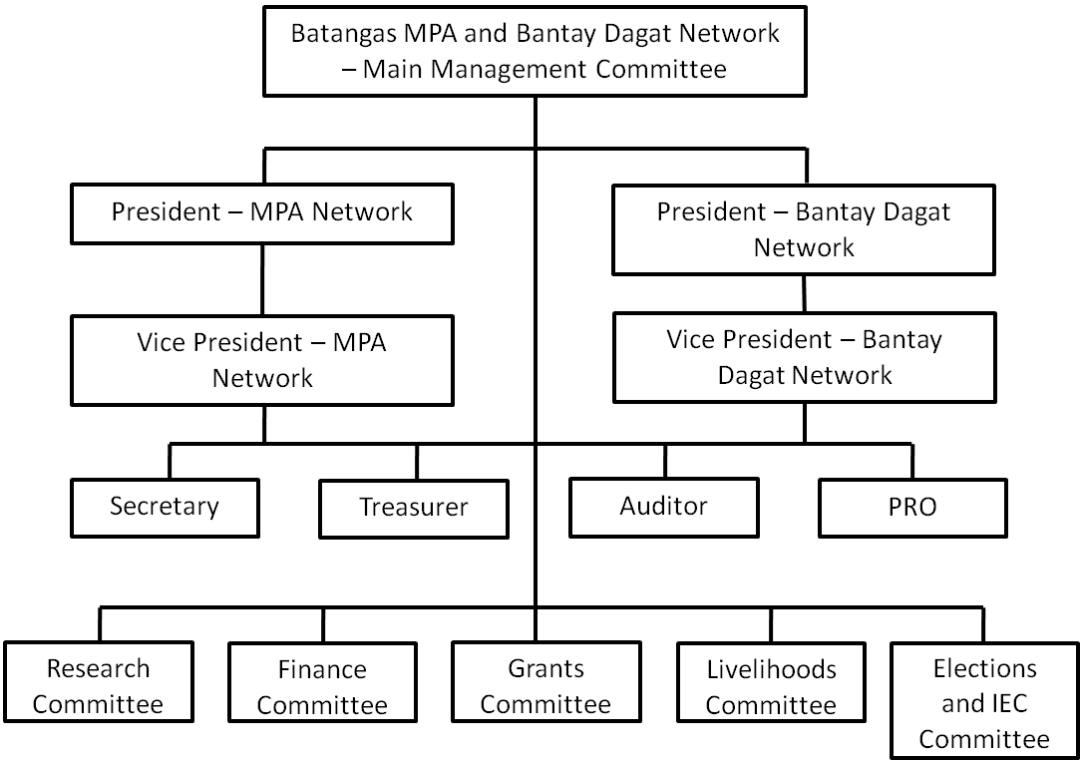
Class	Average Annual Income
First	P 400 M or more
Second	P 320 M or more but less than P 400 M
Third	P 240 M or more but less than P 320 M
Fourth	P 160 M or more but less than P 240 M
Fifth	P 80 M or more but less than P 160 M
Sixth	Below P 80 M

C. Municipalities

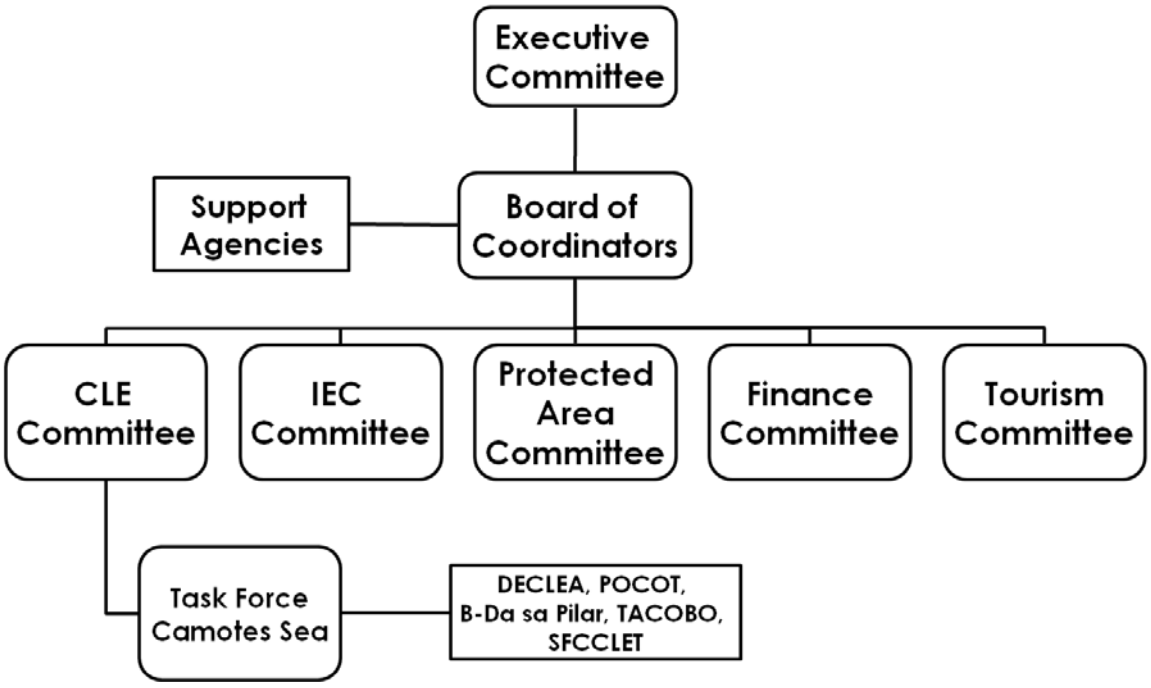
Class	Average Annual Income
First	P 55 M or more
Second	P 45 M or more but less than P 55 M
Third	P 35 M or more but less than P 45 M
Fourth	P 25 M or more but less than P 35 M
Fifth	P 15 M or more but less than P 25 M
Sixth	Below P 15 M

Appendix H. Organizational structure of the three networks evaluated

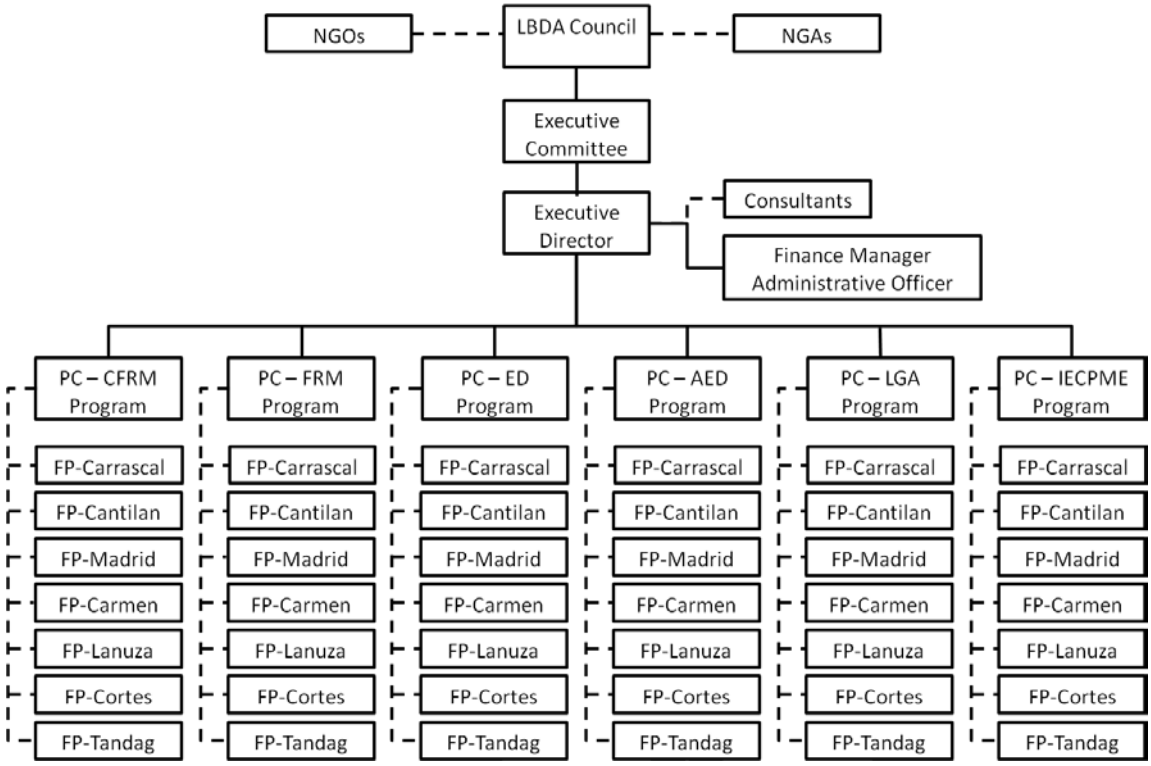
A. Batangas MPA and Enforcement Network



B. Camotes Sea CRM Council



C. Lanuza Bay Development Alliance



Appendix I. Income classification of local governments in each network

A. Batangas MPA network (Batangas Province, 1st class province)

Town	Income class
Balayan	1st
Batangas City (Capital)	1st
Bauan	1st
Calaca	1st
Calatagan	2nd
Lemery	1st
Lian	3rd
Lobo	3rd
Mabini	1st
Nasugbu	1st
San Juan	1st
San Luis	4th
San Pascual	1st
Taal	3rd
Tingloy	5th

B. Camotes CRM Council

Town	Income class
Danao City	3rd
Pilar	5th
Poro	4th
San Francisco	3rd
Tudela	5th

C. Lanuza Bay Development Alliance

Town	Income class
Cantilan	2nd
Carmen	5th
Carrascal	4th
Cortes	4th
Lanuza	4th
Madrid	4th
Tandag City (Capital)*	-

*Tandag was re-assessed for income classification in 2012, and awaiting classification either as a city or municipality.

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