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# The Establishment of Marine Protected Area Networks in China

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**Abstract**

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In recent decades, stimulated by declining ocean health and recognition of limitations of current conservation efforts, international and regional agencies have been promoting the establishment of MPA networks as a promising strategy to sustain marine ecosystems and amplify socio-economic benefits (PISCO 2007; IUCN-WCPA 2008; UNEP-WCMC 2008). As a country with over 30 years' experience of managing MPAs, China has established 260 MPAs in its coastal and marine areas (SOA 2015). However, a number of factors have hindered the development of MPAs and there is little use of systematic and scientific approaches to guide MPA planning in China. With China's commitments to expand the MPA coverage in its waters (CBD 2011; SOA 2012; SOA 2013) and develop an "ecological barrier" along the coast by connecting MPAs and islands (The State Council 2015), this study aims to assess frameworks for the establishment of MPA networks in China, with a focus on critical components that would contribute to a successful and effective network from China's perspective.

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## **Glossary of Abbreviations**

- ABARES:** Australian Bureau of Agricultural and Resource Economics and Sciences
- ADSSNMNR:** Administration of Dalian Spotted Seals National Marine Nature Reserve
- ANZECC:** Australian and New Zealand Environment and Conservation Council
- ANZECC-TFMPA:** Australian and New Zealand Environment and Conservation Council Task Force on Marine Protected Areas
- CAMPAM:** Caribbean MPA Network
- CAPAD:** Collaborative Australian Protected Areas Dataset
- CBD:** Convention on Biological Diversity
- CCICED-TEMP:** China Council for International Cooperation on Environment and Development-Task Force on Eco-Compensation Mechanisms and Policies
- CFP:** Common Fisheries Policy
- CIS:** Common Implementation Strategy
- CITES:** the Convention on International Trade in Endangered Species of Wild Fauna and Flora
- CPC:** Communist Party of China
- CSAS:** Canadian Science Advisory Secretariat
- DA-BFAR:** Department of Agriculture-Bureau of Fisheries and Aquatic Resources
- DENR:** Department of Environment and Natural Resources
- DOC:** Department of Conservation
- EBSA:** Ecologically and Biologically Significant Areas
- EC:** European Commission
- EEA:** European Environmental Agency
- EPBC:** Environment Protection and Biodiversity Conservation
- EU:** European Union
- FAC:** Federal Advisory Committee
- FAP:** Functional Area Planning
- GDP:** Gross Domestic Product
- GES:** Good Environmental Status
- HELCOM:** The Baltic Marine Environment Protection Commission

**ICM:** Integrated Coastal Management

**IEEP:** Institute for European Environmental Policy

**IMCRA:** Interim Marine and Coastal Regionalisation for Australia

**IOM:** Integrated Ocean Management

**IUCN:** The International Union for Conservation of Nature

**IUCN-WCPA:** The International Union for Conservation of Nature-World Commission on Protected Areas

**LGU:** local Government Unit

**LME:** Large Marine Ecosystem

**LOFSRI:** Liaoning Oceans and Fisheries Science Research Institute

**LOMA:** Large Ocean Management Areas

**MBP:** Marine Bioregional Plan

**MEPA:** Marine Ecological Protected Area

**MFZ:** Marine Functional Zoning

**MNR:** Marine Nature Reserve

**MOF:** Ministry of Fisheries

**MPA:** Marine Protected Area

**MSN:** Marine Protected Area Support Network

**MRPA:** Marine Resources Protected Area

**MSFD:** Marine Strategy Framework Directive

**MSPD:** Marine Spatial Planning Directive

**NAMPAN:** North American MPA Network

**NBS:** National Bureau of Statistics

**NEAMPAN:** North East Asia Marine Protected Areas Network

**NIPAS:** National Integrated Protected Areas System

**NOAA:** National Oceanic and Atmospheric Administration

**NPC:** National Planning Committee

**NRDC:** Natural Resources Defense Council

**NRSMPA:** National Representative System of Marine Protected Areas

**NSTC:** National Science and Technology Committee

**OSPAR:** The Convention for the Protection of the Marine Environment of the North-East Atlantic

**PAMB:** Protected Area Management Board

**PEMSEA:** Partnerships in Environmental Management for the Seas of East Asia

**PISCO:** Partnership for Interdisciplinary Studies of Coastal Oceans

**RSC:** Regional Sea Conventions

**RMP:** Regional Marine Planning

**UNEP-WCMC:** United Nations Environment Programme-World Conservation Monitoring Centre

**WSSD:** World Summit on Sustainable Development

**SAC:** Special Areas of Conservation

**SBQTS:** the State Bureau of Quality and Technical Supervision

**SGCPA:** Special Geographical Condition Protected Area

**SMPA:** Special Marine Protected Area

**SOA:** State Oceanic Administration

**SPA:** Special Protection Area

## Chapter 1 Introduction

In 2010, all governments party to the Convention of Biological Diversity (CBD) gathered in Japan, and agreed on the Aichi Target 11 that by 2020 to establish protection for at least 10 percent of their coastal and marine areas and conserve areas of particular importance for biodiversity and ecosystem services through ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures.

As one of parties that committed to the CBD, China updated its National Biodiversity Conservation Strategy and Action Plan, striving to control biodiversity decline and loss by 2020 through a series of conservation actions, including establishing a network of nature reserves (CBD 2011). In addition to the international agreement, domestic regulations in Marine Functional Zoning (MFZ) were announced to provide a marine spatial planning framework of the marine areas under China's jurisdiction. In 2012, the State Council authorized a system termed National Marine Functional Zoning (2011-2020), setting the goal to improve marine environment with an expansion of the MPA coverage in the sea areas under national jurisdiction to 5% and that in the nearshore marine areas to 11% by 2020 (SOA 2012). Recently, the National Main Functional Area Planning (FAP) was further approved by the State Council on August 1, 2015 (The State Council 2015). It highlights the strategy of area-based protection by connecting islands and MPAs to form an "ecological barrier" (The State Council 2015).

With such ambitious commitments to marine conservation, China sees many challenges ahead to reach its goal given the current status of MPAs. Since the 1980s, 260 MPAs have been designated in China, covering 3.3% of total marine areas under national jurisdiction (SOA 2015). The quantity of MPAs offers a good basis for large-scale marine protection, but the overall

effectiveness of MPAs, unfortunately, is far from satisfactory and performance of individual MPAs varies greatly. Furthermore, biodiversity is lost as a result of the uneven distribution of MPAs and exclusion of critical marine ecosystems in the areas so far designated (Liu and Qiu 2005; Ye et al. 2008). Chinese researchers attribute this situation to a series of problems including incomplete laws on MPA designation and management, a poorly-organized governance system for MPAs, limited funding, limited capacity of local governments and the unbalanced trade-off between economic development and conservation (Liu and Qiu 2005; Ye et al. 2008; Qiu et al. 2009).

Given the current practice of MPAs in China, China's goal to increase the number and areas of MPAs and provide more area-based protections, as well as MPA network benefits, developing a network of MPAs could be a valuable approach for China to accomplish the goal. In this context, this study aims to evaluate various frameworks for the establishment of MPA networks in China, with a focus on critical components that would contribute to a successful and effective network from China's perspective.

This study is organized in the following way. First is the Introduction followed by Chapter 2, "Methods", which outlines the major research questions and the methods used in this research. Chapter 3 "The Current State of MPAs in China", reviews the practice of MPA designation in China, including, the classification and purposes of MPA, current MPA governance systems, relevant laws and planning processes as well as challenges. Specifically, critical components that impede the development of MPAs in China are highlighted for the further analysis. In addition, this chapter identifies the progress toward MPA networks in China, such as relevant policy and projects. This chapter includes the results of interviews of MPA

practitioners with respect to their perceptions as to the barriers to MPA networks and the feasibility of frameworks to be applicable to China.

Chapter 4, “The Practice of MPA Networks in Other Jurisdictions”, reviews how MPA networks have been developed in the United States, Canada, Australia, New Zealand, European Union (EU) and the Philippines. Corresponding to the challenges of MPAs in China identified in Chapter 3, this chapter focuses on solutions and lessons from other nations that might be considered as options to serve China’s needs.

Chapter 5, “Establishing MPA Networks in China”, discusses how the experience from other jurisdictions could inform China in its efforts to establish MPA networks. It also takes into account frameworks for developing MPA networks in China based on findings from previous chapters to assist in selecting approaches for the way forward.

Chapter 6 concludes with findings from this research and offers a roadmap or recommendations for China to move forward in the establishment of MPA networks.

## Chapter 2 Methods

In order to reach the research goal for advice on how China can develop a framework of MPA networks, several critical questions must be answered. They include what is the current state of MPAs in China, what progress has been made on creating a MPA network in China, and what lessons and experiences from other jurisdictions would assist China to develop MPA networks? Answers to these questions are obtained through a combination of literature review of MPA networks in other nations and partly through semi-structured interviews with MPA researchers and practitioners in China.

With the aim to offer a national framework for China, the literature review focuses on national initiatives at the country level rather than a regional or site level. Six countries are chosen for a systematic literature review, i.e., the U.S., Canada, Australia, New Zealand, EU, and the Philippines. The primary criteria to choose these countries are that they have developed or they are in the progress of developing MPA networks. Instead of looking at the best practices, this study provides a range of experiences and strategies to build networks such that could be used to devise a solution tailored to China's needs. The references used include peer-reviewed journal articles, government documents, news reports, technical reports, and legislation. These references are either downloadable online or obtained from various libraries.

Considering that the unique governance structure in China may limit the applicability of international experience with MPA network frameworks, I also conducted qualitative interviews to explore Chinese expert perceptions of current practices of MPAs in China, and with respect to the development of MPA networks. Interviews were conducted in person from July to August

2015. The selection criteria for interviewees limit to persons who are MPA researchers, policy makers, and managers engaged in current MPA research, design or management and well-educated in managing MPAs and have a broad understanding of international and national MPA networks. Because decisions of MPAs in China are made using a top-down approach and managers at local governments have limited knowledge of MPAs, interviews are mostly conducted with interviewees working in national or regional research institutions, universities, and nationally designated MPAs. Seven interviewees participated in the interviews.

In this study, semi-structured interviews techniques and snowball sampling methods are used. A set of questions related to MPAs and MPA networks is presented to interviewees but the dialogue was undertaken in an open and flexible manner (Hennink and Bailey 2010). Interview questions include:

- What is your view of the state of MPA network development in China?
- What do you consider to be the factors that assist in developing MPA networks in China and what do you consider to be barriers?
- What do you know about the experience of other countries, i.e., U.S., Canada, Australia, New Zealand, European Union, and the Philippines?
- Do you think that this experience can offer ideas or approaches to assist China?
- What do you consider as the most effective and feasible tools to design MPA networks in China?

This research qualified for exempt status under the University of Washington's Human Subjects systems 45 Code of Federal Regulations (CFR) 46.101 (b)(x) from all 45 CFR

requirements and was approved with the Exempt Status Request #49917 by the Human Subjects Division at the University of Washington. The determination period is from June 24, 2015 to June 23, 2020.

## Chapter 3 The Current State of MPAs in China

The purpose of this chapter is to review the current MPA system in China, and to offer a rationale for establishing a network of MPAs in China. This chapter provides background information on the development of MPAs in China and reviews the current practices of MPAs in China. Interview results are also presented, followed by a list of challenges in current MPA practices in China. These challenges are also considered as potential drawbacks of networks planning, and thus, are reiterated and addressed in subsequent chapters. Finally, this chapter reviews the progress on developing MPA networks in China.

### 3.1 Background on MPAs in China

China has benefited from its extraordinary marine natural resources both ecologically and economically. With a sea area of 4.73 million square kilometers that extends across three climate zones—the temperate, subtropical and tropical, China hosts an exceptional marine biodiversity comprising around 20,300 recorded marine species as well as abundant non-renewable resources (Huang 1994; Qiu et al. 2009; Liu 2013). These marine resources, in turn, provide valuable ecosystem services supporting livelihoods and economy. According to the China's Ocean Development Report (2010), the ocean supplied over 20% of animal protein, 23% of petroleum resources and 29% natural gas in the country. In addition, a range of important industries dependent on marine areas, including fishing, aquaculture, maritime shipping, oil and gas exploitation and marine tourism, contributes 9.4% to China's overall GDP and is growing at an annual rate of 7.7% (SOA 2014). In particular, coastal and marine tourism is one of the most robust marine-related industries in recent years. The national tourism report notes that the

revenue from coastal and marine tourism accounts for 13.92% of the total revenue of national marine production in 2012 and increases at a rate of 18.56% annually (National Academy of Economic Strategy 2014)

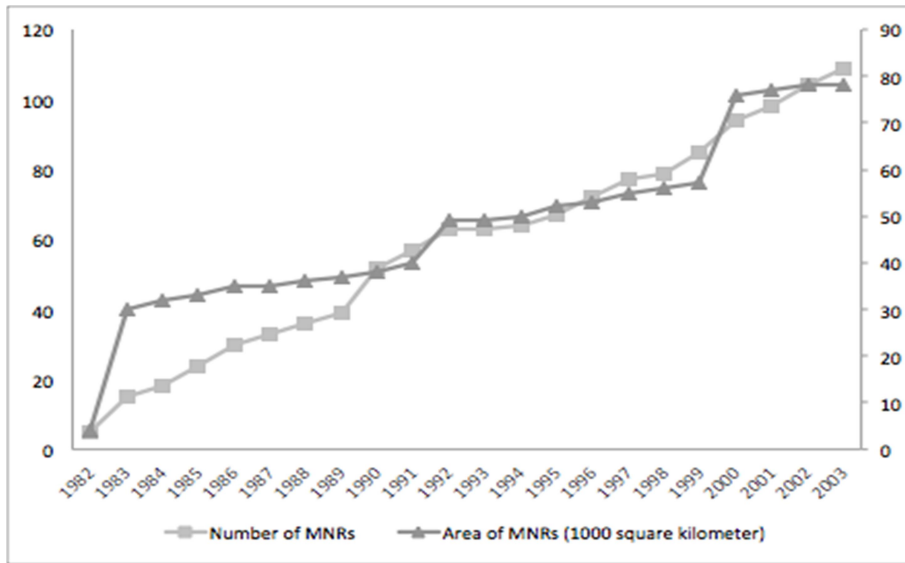
At the same time, coastal and marine ecosystems in China are facing serious threats. With the growing population and rocketing market demands in the past decades, the pressure on natural resources and marine ecosystems is unprecedented (Qiu et al. 2009). The coastal region plays a vital role in China's economy by attracting a wealth of capital investment and labor. Taking up only 14% of the total land area of China, coastal provinces support almost 43% of national population and contribute nearly 55% of the total national GDP (NBS 2014). As a consequence of the rapid urbanization, industrialization and population aggregation along coastal areas, the coastal and marine environment is degrading, marine species are suffering from overexploitation, and the conflicts of marine uses are escalating.

In response to these issues, a number of conservation efforts have been initiated in China. One important approach is the designation of MPAs. As of February 2016, 260 MPAs have been designated in China, covering 3.3% of total marine areas under the national jurisdiction (SOA 2015). MPA, in China's context, refers to two categories of marine reserves: Marine Nature Reserves (MNRs) and Special Marine Protected Areas (SMPAs). The key distinction between MNRs and SMPAs is the level of protection; MNRs are designed to provide full protection and prohibit extractive activities within the protected areas, while SMPAs are protected areas managed with a sustainable use of natural resources, allowing multiple uses (SOA 1995; SOA 2010). Both MNRs and SMPAs can be designated at a national, provincial, municipal or county level depending on the significance of the protected object (SOA 1995; SOA 2010). Currently,

92 national MNRs and SMPAs have been well-recorded and inventoried, but there exists an information gap on local-level MPAs, especially the municipal and county-level MPAs (Zhao, personal communication, Feb. 17, 2016). Due to local-level MPAs' relatively unimpressive management and the lower priority that they are given, there is no inventory proposed for MPAs at a local level so far.

### **3.2 History of MPAs in China**

The creation of MNRs in China can be seen as an extension of the nature reserve system, which previously focused on terrestrial protected areas. The first MNR in China, Snake Island Nature Reserve, was established in 1963 in the Bohai Sea, but the systematic designation and management of MNRs nationwide did not officially begin until the enforcement of "Marine Environmental Protection Law" in 1982 (Zhu 2009). During the past decades, the establishment of MNRs turns out to be highly related to the enactment of laws (Qiu and Li 2005) (See Figure 1). The most significant increase in the number and the area of MPAs correlates with the enforcement of "Law of The People's Republic of China on The Protection of Wildlife" in 1989, "Regulations of the People's Republic of China on Nature Reserves" in 1994, and "Management Measures of the Marine Natural Reserves" in 1995 (Qiu and Li 2005). China's commitments in international agreements and conventions also accelerated its campaign in reserves designation, for instance, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1982, the Convention on Biological Diversity (CBD) in 1992, and the Ramsar Convention on Wetlands in 1992.



**Figure 1.** Growth in the Total Number and Area of MNRs in China (Modified from Qiu and Li 2005).

In comparison with MNRs, SMPAs were developed more recently as a product of trade-offs between economic development and marine conservation. The term of SMPAs was first specified in 1992 with the approval of Regulation Planning of Special Marine Protected Areas by the State Council (1992). Furthermore, it was noted, in China Ocean Agenda 21 and Technical Directives for the Division of Marine Functional Zoning, that SMPAs have extraordinary values in managing marine resources protection and exploitation in China’s context and serve as a critical approach to reach the goal of sustainable development (NPC and NSTC 1994; SOA 1997). In 2005, the first SMPA was established in Ximen Islands, Zhejiang Province, which combines wetland and mangrove conservation with tourism (Yueqing Bureau of Ocean and Fishery 2015).

In 2007, China launched a set of national ecological reforms under the concept of “Ecological Civilization” first declared in the 17th Communist Party of China (CPC) National Congress. This started a new chapter in China’s environmental protection. The essence of “Ecological Civilization” reform is to balance economic development and environmental protection (Xu 2015). Regarding coastal and marine systems, this reform specifically highlights the necessity to establish a national park system as well as a better and stricter system of land and water resources protection (Zhang 2015). As a result, 33 National Marine Parks have been established since 2010, as a core component of SMPAs (Zhao, personal communication, Feb. 17, 2016). In addition, both MNRs and SMPAs have seen a remarkable growth in the number and the area throughout this reform.

### **3.3 Classification of Marine Protected Areas in China**

The classification system of MPAs in China has two characteristics: the level of protection and the level of governance. In terms of the level of protection, MPAs are broadly divided into two categories, MNRs and SMPAs. MNRs can be interpreted as Category Ia - strict nature reserve - from the perspective of The International Union for Conservation of Nature (IUCN), i.e., it provides strict protection (Dudley 2008), while SMPAs correspond to IUCN Category VI - protected area with sustainable use of natural resources (Dudley 2008). Within each category, MPAs can be further classified by the conservation focus (see below). With respect to the level of governance, MPAs can be designated and administrated at a national, provincial, municipal, or county level. It should be added that de facto MPAs or areas that provide short-term protection, such as Aquatic Germplasm Resources Conservation Zones (Ministry of Agriculture 2011), seasonally closed fishing areas, underwater cultural heritage sites,

prohibited navigation zone, and military areas, are not included in the MPA system in China (Zhao, personal communication, Feb. 17 2016).

### **3.3.1 Marine Nature Reserves**

#### **3.3.1.1 Definition**

In Chinese law, Marine Nature Reserves are defined as “certain areas designated in accordance with laws from the coast, estuaries, islands, wetlands and marine areas including protected targets for the purpose of protecting marine nature environment and resources” (SOA 1995 Article 2).

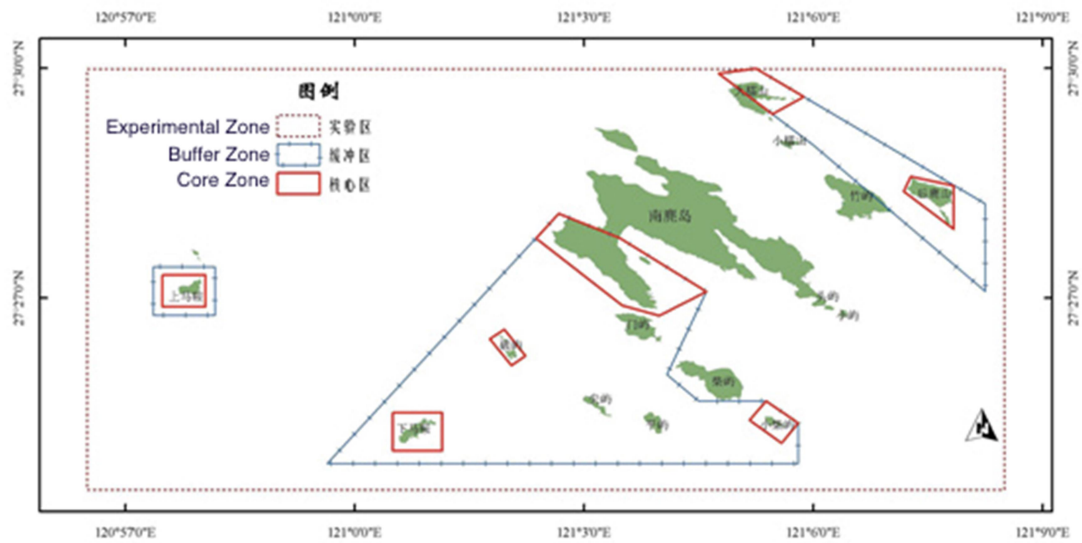
#### **3.3.1.2 Classification of MNR**

MNRs are divided into three categories by the objects they protect: MNRs that protect coastal and marine ecosystems, ones that protect marine species and ones that protect marine natural heritage and non-natural resources (SOA 1995; SOA 1998) (See Table 1). Unlike the IUCN categories or protected areas, protection objectives of MNRs are seldom specified through the classification system.

**Table 1.** The Classification of MNRs (SOA 1998 Page 2)

Categories	Protected Targets
Coastal and Marine Ecosystems	Estuaries ecosystems Tidepool ecosystems Salt marsh ecosystems Mangrove ecosystems Gulf ecosystems Seaweed bed ecosystems Coral reefs ecosystems Upwelling ecosystems Continental shelf ecosystems Island ecosystems
Marine Species	Marine rare and endangered species Marine economic species
Marine Natural Heritage	Marine geologic and geomorphological features Marine paleontological features Landscape/Seascape Marine non-natural resources

Although objectives may vary among MNRs, most MNRs are designed into three zones with different levels of protection (SOA 1995). In the core zone, human entrance and activities are strictly controlled except for the authorized scientific research and observations (SOA 1995). Outside the core zone is the buffer zone that allows human access, but that prohibits all activities that may harm the protected target (SOA 1995). Beyond to the buffer zone is the experimental zone, where extractive activities in accordance with guidelines are permitted (SOA 1995) (See Figure 2 as an example). In terms of temporal scales, some activities may be restricted depending on life patterns of species (SOA 1995).



**Figure 2.** Zoning of Nanji Island National MNR

Source: Nanji Island National MNR (<http://www.njld.org/Col/Col10/Index.aspx>)

In addition, MNRs can be designated at a national, provincial, municipal or county level, primarily through a rating system based on natural, social and managerial indicators of each category mentioned above, and assessed by a council consisting of department representatives and scientists (SOA 1998). Biological performance of a MNR site contributes most in the rating process and social and managerial aspects are assigned less weight (SOA 1998) (See Table 2). For target objects with global outstanding values in representation, rarity and diversity, the area can be exceptionally designated as a national MNR (SOA 1998).

**Table 2.** Rating Indicators for MNRs (SOA 1998 Page 3)

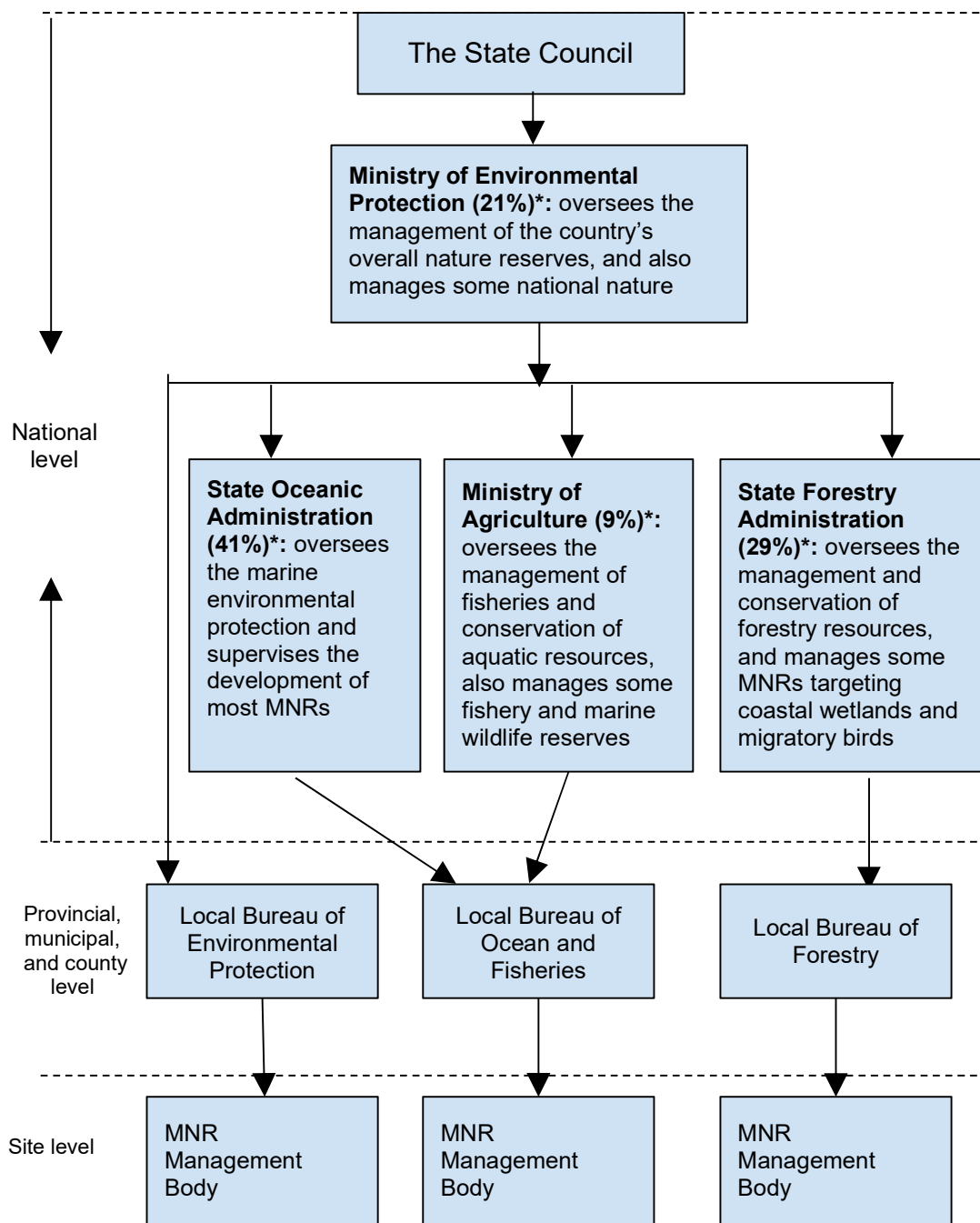
Indicators	Components	Weight
Natural Indicators	Representation, diversity, naturality, and rarity	70%
Social Indicators	Scientific values, socio-economic values, and size feasibility	20%
Managerial Indicators	Levels of scientific knowledge, infrastructure, and public support	10%

### 3.3.1.3 Institutional Structures

Under the national framework, the designation of MNRs is accomplished in a decentralized way. The national MNRs can be proposed by provincial governments or central government agencies and approved by the State Council (SOA 1995). Local MNRs are proposed by the government at the same level and approved by the government at a higher level, for instance, a municipally designated MNR would require approval from a provincial government (SOA 1995).

The management of MNRs in China is endowed with two aspects; it is part of the management of the overall nature reserves, and it is also part of the protection and conservation of the marine environment and resources (Zou 2003). The management system of Nature Reserves is defined as a system with both comprehensive and decentralized governance components (SOA 1995). The State Council is the top policy-making body that is responsible for the overall planning, designation, management, supervision, and approval of MNRs; the Ministry

of Environmental Protection oversees the comprehensive management of nature reserves in China; the Ministry of Forestry, the Ministry of Agriculture, the Ministry of Geology and Mineral Resources, the Ministry of Water Resources, and the State Oceanic Administration (SOA) are responsible for the management of various types of reserves (SOA 1995) ( See Figure 3).



**Figure 3.** Governance structure of MNRs in China (Adapted from Qiu 2010)

\*The Percentage (in terms of numbers) of the national MNRs managed by each agency. The local MNR data are not available (Ministry of Environmental Protection 2013).

### **3.3.2 Special Marine Protected Areas**

#### **3.3.2.1 Definition**

The SMPA is defined as “a certain area with special geographic space, ecosystem, living and non-living resources, and special needs for marine development, which should be managed by effective conservation tools and scientific exploitation approaches.” (SOA 2010a)

#### **3.3.2.2 Classification of SMPAs**

SMPAs can be classified into four categories based on their location, state of environment and resources, exploitation status, and needs of economic development (SOA 2010). These four categories are Special Geographical Condition Protected Area (SGCPA), Marine Ecological Protected Area (MEPA), Marine Resources Protected Area (MRPA) and Marine Park. Objectives are additionally clarified by category (SOA 2010a) (See Table 3). Furthermore, all types of SMPAs are divided into the following zones to minimize marine use conflicts: no-take zone, ecological restoration zone, sustainable use zone, and reserved zone (SOA 2010b). A no-take zone, which covers at least 30% of the total area of the SMPA, is the area which prohibits human activities (SOA 2010b). In the ecological restoration zone, conservation and restoration are priorities and only authorized activities and projects would be permitted (SOA 2010b). In the sustainable use zone, activities that would not harm the environment and resources are allowed (SOA 2010b). Lastly, the reserve zone is reserved for future uses (SOA 2010b).

Similar to MNRs, SMPAs are also designated at national and local levels. National SMPAs are those of significant values in ecological protection, ecotourism, resources exploitation or national interests (SOA 2010b; SBQTS 2011). The designation would require an assessment report based on a set of indicators that are more focused on the socio-economic conditions of the site and public engagement in comparison to MNRs.

**Table 3.** Categories and objectives of SMPAs (SOA 2010a Article 10)

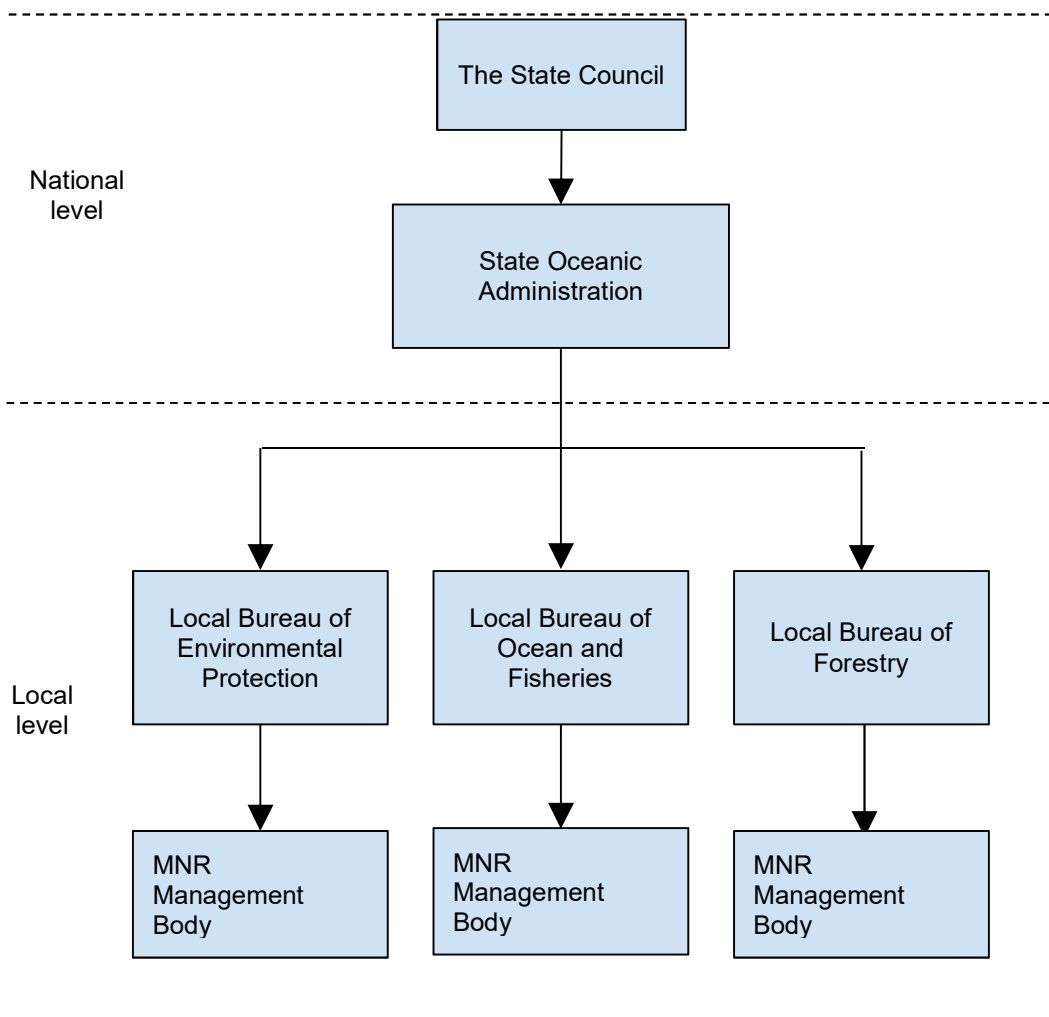
Category	Objective
Special Geographical Condition Protected Area	Sustain sea areas and islands of significant oceanic rights and interests and outstanding hydrodynamic conditions
Marine Ecological Protected Area	Conserve marine biodiversity and ecosystem services
Marine Resources Protected Area	Promote the sustainable use of marine resources, including biological, mineral, and oil and gas resources
Marine Park	Sustain the marine ecological and cultural values and promote ecotourism

### 3.3.2.3 Institutional Structures

SMPAs share a similar institution structure with MNRs in terms of taking a comprehensive and decentralized governance approach. SMPAs are proposed by local government agencies, evaluated by a SMPA council consisting of representatives from relevant government agencies and scientists, and finally approved by the SOA (SOA 2010a). For transboundary SMPAs that cover more than one administrative unit (county, municipality or

province), the designation process would be coordinated by a higher-level government (SOA 2010a).

With respect to management, SOA is responsible for the overall designation, planning, management and supervision of SMPAs in the nation (SOA 2010a) (See Figure 3). Local administrations, including bureau of ocean and fisheries, bureau of forestry, and bureau of environmental protection, are further in charge of the implementation and management at a site level (SOA 2010a).



**Figure 3.** The Governance Structure of SMPAs (SOA 2010a)

### 3.4 Other approaches relevant to MPAs in China

In addition to MPAs, the National Marine Functional Zoning (MFZ) Scheme was released in 2002, offering a broad framework of managing marine uses (Sun 2002). A new planning scheme updated the MFZ in 2012, dividing marine areas into eight types of functional zones based on the water quality in a sea area. These functional zones include Port and

Navigation Zone, Agriculture and Fishery Zone, Marine Protection Zone, Mineral and Energy Zone, Tourism and Recreation Zone, Industrial, and Urban Development Zone, and Reserved Zone for other uses (SOA 2012). The Marine Protection Zone could be considered as MNRs and SMPAs in the MFZ schema.

### **3.5 Relevant laws and regulations**

China has established a legal basis for MPA designation, planning, implementation, and management. The Environmental Protection Law (amended in 2014), Marine Environmental Protection Law (1982), and Administration of the Right to Use Sea Areas (2001) are three overarching laws comprising the legal basis of environmental protection and marine conservation. Under this schema, MNRs and SMPAs are independently regulated by a set of laws and national standards. MNRs follow the general legal regime of nature reserves adopted by the State Council, the 1994 Regulations on Nature Reserves, as well as specific legal guidelines on MNRs, including the 1995 Measures on the Management of Marine Nature Reserves, the 1998 Standards on Categorizing Marine Nature Reserves (GB/T17504-1998), and the 2004 Technical Specification for the Management of Marine Protected Areas (GB/T 19871-2004). Alternatively, SMPAs are regulated by the 2010 Measures for the Administration of Special Marine Reserves (GB/T 25054-2010), the 2010 Standard for the Classification and Categorization of Special Marine Protected Area (HY/T 117-2010), the 2010 Technical Directives for the Designation of Special Marine Protected Area, and the 2010 Technical Guidelines for Functional Zonation and the overall plan compiling (*sic*) of special marine protected area (HY/T 118-2010), and the 2010 National Marine Park Reviewing Standard

adopted by SOA. Furthermore, local-level MPAs would be regulated by measures and regulations enacted by provincial or municipal administrations.

In addition to laws on MPAs, other relevant laws and regulations to marine conservation include the 1986 Fisheries Law, the 1989 Administration of the Work for Protection of Underwater Cultural Relics (amended in 2015), the 1993 Implementation of Wild Aquatic Animal Protection, and the 2002 National Marine Functional Zoning Scheme (amended in 2012).

### **3.6 Expert Perspectives on Current Status of MPAs in China**

Considering that the unique governance structure in China may limit the applicability of international experience, from July to August 2015 I conducted qualitative interviews to explore MPA practitioners' views of current practices of MPAs in China. In addition, I interviewed MPA practitioners with respect to the development of MPA networks. The selection criteria for interviewees limit to persons who are MPA researchers, policy makers, and managers engaged in current MPA research, design or management and well-educated in managing MPAs and have a broad understanding of international and national MPA networks. Because there are relatively few expert practitioners in China, a total of seven interviews were conducted (see Chapter 2), with interviewees consisting of two people from governmental agencies, three researchers from national research institutions, one person from academia, and one manager from a nationally designated MPA. The participants are coded as Government, Researcher, Academia, and Manager - each identified only with an informant number in this thesis.

This research qualified for exempt status under the University of Washington's Human Subjects Systems 45 Code of Federal Regulations (CFR) 46.101 (b)(x) from all 45 CFR requirements and was approved with the Exempt Status Request #49917 by the Human Subjects

Division at the University of Washington. The determination period is from June 24, 2015 to June 23, 2020.

All interviewees stated that the MPA is a vital tool to conserve biodiversity and habitats, but there was agreement that the current practice of MPAs in China is not adequate to provide protection. It is claimed that many existing MPAs, are a product of opportunistic decisions made by local governments, instead of systematic and scientific planning (Researcher 1, Researcher 2, Government 1, and Government 2). Similarly some observe administrative boundaries have also restrained the size and boundary design of MPAs and result in planning that makes no sense in terms of ecological connectivity, and thus can be considered as an obstacle for the development of networks (Government 1 and Researcher 2). When it comes to the official status and definition of MPA networks, interestingly, not all participants are familiar with the institutional structure discussed above. Interviewees' perceptions are basically regarding the ecological benefits of networks and high costs for implementation, with little understanding of the social and economic aspects (Government 1, Government 2 and Researcher 2). Given this concern of the ecological benefits and implementation costs of MPA networks, as well as of the limited capacity of local governments, Government 1 suggested that designation of MPA networks should come second after management capacity is built. Researcher 1 and Academia 1 suggested that a small-scale or a regional network of MPAs for certain species might be more feasible than a national initiative for MPA networks. Another comment from Government 2 indicated that the ultimate goal for China would be to create a comprehensive, representative, and adequate MPA network, but how to reach this goal heavily relies on national strategies being developed. It was observed, though, there is currently no evidence that there is the political will to advance this concept. These

interviews are consistent with and confirm the challenges identified in the emerging literature from researchers with respect to MPAs and MPA networks.

### **3.7 Challenges**

Despite the fact that China has been committed to establishing MPAs for over 30 years and has created a number of MPAs in its Territorial Sea, challenges exist in seven aspects. First, there is no systematic planning for MPAs at a national scale in China (Qiu et al. 2009). It is recognized that biodiversity is lost as a result of an uneven distribution of MPAs and exclusion of critical marine ecosystems in the limited marine area planning that has been done (Cui and Liu 2006, Ye et al. 2008). Geographically, nearly half of national MPAs are located in the Yellow Sea, while only four National MPAs are established in the South China Sea and they are much smaller in size than other MPAs. In addition, these do not correspond to the priority areas identified in National Biodiversity Strategy and Action Plan (CBD 2011). In terms of protected objects, inter-tidal ecosystems, mangroves, rare and endangered species, and islands are the priority targets, yet coral reefs, natural monuments, estuaries, salt marshes, upwelling systems, geographic features receive less attention in conservation (Ye et al. 2008). Furthermore, ecological connectivity, which has been globally recognized as a key principle in biodiversity conservation and MPA networks, is little discussed in China's marine research (e.g., Huang et al. 2012; Du et al. 2015), or in the designation criteria for MPAs (SOA 1995; SOA 2010a)

Second, current laws and regulations are inadequate to support the effective management of MPA systems. Many of these laws and regulations were enacted in the late-1900s and have not been updated to address new challenges since then, such as the 1994 Regulations on Nature Reserves and the 1995 Regulations on Marine Nature Reserves. For example, socio-economic

considerations and public engagement are little covered in these laws. In addition, these two regulation documents, as core legislation for MPAs, have relatively low priority for enforcement. There are no specific laws for MNRs and SMPAs as of yet. Researchers also argue that these regulations fall short of a clear statement and a specific guideline for implementation, monitoring and evaluation (Jim and Xu 2003; Qiu 2010; Yao 2014). Furthermore, it is noted that the low management effectiveness of MPAs is partly attributed to the lack of consistency and coherency in the current laws and regulations and lack of an overarching legal framework to coordinate efforts of managing MPAs in a bigger picture (Zhu 2009; Yao 2014).

Third, the current governance mechanisms are another major obstacle for an effective and efficient management of MPAs in China. As mentioned above, MPAs in China are managed by different government agencies depending on their type. Researchers argue that these agencies usually compete with each other on MPA designation and development and there is also little effective communication and coordination between the comprehensive administration department and other relevant agencies, which results in the disorder of management and repetition of designation (Qiu and Li 2005; Cui and Liu 2006; Zhu 2009). At a site level, evidence suggests that local governments usually take greater responsibilities for and have greater influence on MPA selection, zoning, and planning than the central government (Qiu et al. 2009). Many important decisions made by local governments are driven by economic interests with limited insights on conservation and requirements for promotion and without the advantages of bottom-up approaches (Qiu et al. 2009; Liu 2010). Furthermore, in order to make it easier for local governments to manage MPAs, MPAs are usually designed within the administrative boundaries, i.e., a county, regardless of the trans-boundary ecological processes. This also helps explain that the protection of biological diversity is ineffective in China.

Fourth, dealing with the relationship between conservation and economic development has been a hotspot in China's MPA research. In contrast to terrestrial protected areas that mostly lie in the undeveloped western China, MPAs in China are experiencing a rapid economic transition characterized by expanding urbanization and industrialization in the coastal regions (SEPA 2005; Qiu 2010). The conflict rises with the degradation of the marine environment as a result of the growing economic development needs. Although MNRs are established to offer conservation, they are mostly managed to provide full protection and permanent closure and rarely take consideration of socio-economic impacts. Furthermore, the relationship between local communities and MNRs is often a contested issue (Qiu and Li 2005; Cui and Liu 2006; Qiu 2010; Ma et al. 2013). Because many traditional uses of marine resources are restricted and alternative livelihoods are not available once a MNR is established, local communities are often unwilling to support MNRs or comply with regulations. The concept of eco-compensation has been recently incorporated into the MPA management system in China, which seeks to charge marine resource users and compensate land users or suppliers of ecosystem services for the cost that resulted from environmental protection policies via the government and market mechanism (CCICED-TEMP 2006; Zhang et al. 2009; Gray and Jones 2012; Liu et al. 2013). The first regulation on eco-compensation for MPAs went into force at a provincial level on March 1, 2016, but a national policy has not been made yet (Fang et al. 2016). As a complementary approach for MNRs, SMPAs allow a range of sustainable uses of resources within the protected area. However, how to reach a balance of development and protection has been a challenge for SMPAs (Liu 2006). Many local governments perceive SMPAs as a symbol of administrative achievement and a potential source of tourism revenues, and their commitment to conservation turns out not as effective as they promised especially when the planning is primarily driven by

economic interests (Qiu et al. 2009; Ma et al. 2013). Therefore, the trade-off between economic development and marine conservation remains a focus in the future MPA selection and management.

Fifth, the lack of funding and personnel for management has hindered the development of MPAs in China. Under the current governance structure, the central government provides limited funds to cover the cost of infrastructure in newly established national MPAs, and it is local governments that provide personnel and funds for the daily management and enforcement of individual MPAs (Qiu and Li 2005; Qiu et al. 2009; Zhu 2009). The limited funding restricts needed scientific research and social surveys on established and potential MPA sites (Zhu 2009). In addition, a large proportion of MPAs in China, especially locally designated MPAs, become “paper parks” because they do not have specific management bodies (Qiu et al. 2009; Zhu 2009).

Sixth, monitoring and evaluation, as a crucial component in the adaptive management scheme, is not well designed in China’s case. It is noted that only a few MPAs in China have an independent and long-term monitoring program (Qiu et al. 2009). For some MPAs covered by 18 ecological monitoring regions established by the SOA in 2004, the status of representative and fragile inshore ecosystems is monitored (Qiu et al. 2009). Despite these monitoring programs, the ecological monitoring data provide little insight to the management effectiveness of MPAs, without a separation of monitoring inside MPAs from that outside MPAs (Qiu et al. 2009). Besides, as required by the SOA, 27 MPAs in China undertook a self-evaluation. This management effectiveness evaluation gives an emphasis on the governance conditions, such as personnel, funding, and management plan, but gives “no information on the status and trends of species and habitats protected within the MPAs” (Qiu et al. 2009 Page 603). This self-evaluation

is also considered not reliable without an independent and transparent process (Researcher 1; Qiu et al. 2009).

Seventh, national commitments and willingness are decisive in any formation of MPAs. Although responsibilities for MPA designation and planning have devolved to local governments, the central government plays a significant lead role in managing MPAs nationwide. The recent establishment of Marine Parks (Xu 2015) and the proposal for eco-compensation (CCICED-TEMP 2006) are the two examples. Thus, in this context, what strategies can be taken to meet the goal that expands the MPA coverage and ultimately creates a comprehensive, adequate and representative network of MPAs depends on the central government.

### **3.8 Rationale for China to establish a network of MPAs**

MPA networks are widely recommended in the MPA literature as they provide broader ecological and social benefits than small isolated MPAs (PISCO 2007; IUCN-WCPA 2008; UNEP 2008). In China's context, the development of a network of MPAs can have significant benefits. Ecologically, networks may be useful to preserve critical habitats and maintain biological biodiversity, which is under increasing pressures resulting in loss and degradation. In comparison to creating a single large-scale MPA that may meet the ecological needs, an ecological network of several to many small to moderately sized MPAs turns out more cost-effective without a compromise of ecological benefits (IUCN 2008, UNEP 2008), and thus, would be more feasible in China to conserve biodiversity. In addition, the establishment of MPA networks usually requires a comprehensive and systematic planning at a broader scale, which would help push China to create an inclusive, coordinated and comprehensive management scheme for MPAs and other ocean uses. Furthermore, the implementation of an MPA network

would likely address a number of challenges in China's MPA management by promoting the interaction of governance at different levels, facilitating the sharing of information and lessons learned, and allowing for a more efficient use of resources (IUCN 2008; UNEP 2008). With the respect of social benefits, the development of MPA networks can help enhance the public awareness of marine conservation, improve human well-being, and resolve conflicts in marine uses (IUCN-WCPA 2007). From a political point of view, the benefits from networks that improve the resilience of ecosystems and livelihoods as well as sustain ecosystem services are a close match with the spirit of "ecological civilization", which aims to strike a balance between nature, society, and economy. Last but not least, the promotion of networks would be likely to help China accomplish its commitments on the CBD Aichi Target 11 and fulfill its goal to expand the MPA coverage in the sea areas under national jurisdiction to 5% by 2020 (SOA 2012).

### **3.9 Current progress in developing a network of MPAs**

As declared in the 12th Five Year Plan, one of the goals of MPA management from 2013 to 2018 is to expand the coverage of MPAs and speed up construction of the MPA network (SOA 2013). On August 1, 2015, China released revisions to the policy for National Main Functional Area Planning, which promotes the strategy of area-based protection by creating an "ecological barrier" connected by islands and MPAs in the sea areas under its jurisdiction (The State Council 2015). This is the first policy in China that highlights the necessity of connectivity in marine conservation. No follow-up guidelines or laws have been issued yet, but there are several projects in progress regarding developing a network of MPAs in China. Since 2012, North East Asia nations, including China, Japan, North Korea, South Korea, and Russia, have

been discussing the planning of an effective and representative North East Asia Marine Protected Areas Network (NEAMPAN), which aims to conserve marine species and their habitats, promote sustainable use of resources, and facilitate regional cooperation in MPA management (NEAMPAN 2014). Six existing MPAs under China's jurisdiction are selected as NEAMPAN sites. In addition to NEAMPAN, Nanji Islands National MNR was selected as a pilot site to develop a small-scale MPA network for marine species under the program of Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). The project of Demonstration of Estuarine Biodiversity: Conservation, Restoration and Protected Area Networking in China is also undertaken, but is primarily focused on developing a social network (SOA et al. 2012). Other potential targets for MPA networks can be fish in the Yangtze River basin (e.g., Huang et al. 2016) as well as endangered species, such as Chinese white dolphin (*Sousa chinensis*) and spotted seals (*Phoca largha*), and natural and cultural heritage (Wang and Han 2007; Zhang, personal communication 2015; Lu and Zhou 2016).

### **3.10 Summary**

The current practices of MPAs in China are characterized with a combination of a top-down policy-making process and decentralized designation and management. The commitments to international agreements and the release of laws and regulations in the past decades have stimulated the increase in number and size of MPAs. However, many MPAs in China turn out to be not effective in protecting biodiversity and habitats, as a result of the lack of systematic planning of MPAs and lack of a legal framework at a national level. Additional elements include the conflict between socio-economic interests and conservation objectives, the lack of communication between different departments and across levels of governments, insufficient

funding, and inadequate monitoring and evaluation. To develop a successful and effective network of MPAs, how other countries have dealt with these issues is considered in order to obtain insights and alternative approaches that might inform China's development of MPA networks.

## Chapter 4 The Practices of MPA Networks with Potential Relevance to China

This Chapter provides a review of experiences of developing MPA networks in the U.S., Canada, Australia, New Zealand, EU, and the Philippines. The reason I chose these countries is that they have made commitments and taken actions for developing MPA networks. The experience and lessons from these jurisdictions is expected to inform China's efforts to create its own network, especially when those countries share similar problems or objectives toward MPAs as China. In order to help China address the challenges identified in the network planning (See Chapter 3), this chapter emphasizes a set of targeted components, which include 1) the legal framework, 2) the institutional structure, 3) criteria, methods or tools applied for the MPA network planning, 4) level of science applied for the systematic design, 5) stakeholder engagement 6) trade-offs between economic development and conservation, and 7) monitoring and evaluation. Because of the difficulty in accessing funding information of each country, the financing strategies are not covered.

### 4.1 USA

Currently, U.S. has established more than 1,700 MPAs within its Exclusive Economic Zone (EEZ) and the Great Lakes (Wenzel 2015). Of those, nearly one quarter are members of a national system of MPAs, established with common goals and objectives by federal, state and tribal authorities (Wenzel 2015). A national system of MPAs was developed, as required in the Presidential Executive Order 13158 of 2000, to strengthen and expand the nation's MPA programs and eventually to protect natural and cultural resources. This national system can be

envisioned as a social network that ties member sites together and supports them to “achieve the conservation and management objectives that could not be accomplished by individual MPAs or MPA programs working independently” (Wenzel 2015 Page 4). In addition to facilitating stewardship and building the capacity of MPA programs through an institutional network, the national system aims to provide opportunities to identify and develop ecologically connected networks to maximize conservation benefits, although its function is not much advanced so far.

In contrast, some states have initiated ecological MPA networks within the state jurisdiction. For instance, California’s MPA network, which is organized into four sub-regions, is the home of the most comprehensive regional ecological network in the U.S. (California Department of Fish and Wildlife 2016). For migratory species, such as whales, sea turtles, and pelagic fish, that may pass through multiple nations, U.S. also seeks to establish regional MPA networks and enhance international cooperation for the protection. These regional and international networks include the Caribbean MPA Network (CAMPAM) and the North American MPA Network (NAMPAN) (Gulf and Caribbean Fisheries Institute 2016; National Marine Protected Areas Center 2013).

#### **4.1.1 The Legal Framework**

Presidential Executive Order 13158 of 2000 provided the impetus for the development of a National System of MPAs within the EEZ of the U.S. as well as the Great Lakes to protect the significant natural and cultural resources. The Order clearly specifies the goals of the national system: “connecting sites and programs into regional and national networks; building the capacity of MPA sites and programs; and strengthening the national coordination among federal MPA agencies and with ocean stakeholders” (Wenzel 2015 Page 2). To strengthen the

implementation for the achievement of the goal, the Order further called for the establishment of the National MPA Center (MPA Center) and the development of a framework for the national system of MPAs.

Under the national system, individual MPAs in the U.S. can be designated at a Federal, State, territorial, and tribal levels (UNEP-WCMC 2008). A number of Federal laws relevant to MPA have contributed to the establishment of MPAs for various purposes, which include, but not limited to those following: the National Marine Sanctuaries Act (1972), National Wildlife Refuge System Administration Act (1966), Magnuson-Stevens Fishery Conservation and Management Act (1976; amended 2006), Coastal Zone Management Act of 1972, Endangered Species Act (1973), Marine Mammal Protection Act (1972), National Park Service Organic Act (1916), National Historic Preservation Act (1966), Antiquities Act (1906) and Wilderness Act (1964). In addition to the Federal laws, State-designated MPAs are also bound by State laws and regulations, for instance, the California's MPA network was established under the Marine Life Protection Act (1999).

#### **4.1.2 Institutional structure**

MPAs in the U.S. are designated and managed independently by a variety of agencies at federal, state, tribal, and local levels (Wenzel 2015). The federal MPA programs comprise the National Park System, National Wildlife Refuge System, National Marine Sanctuary System, National Marine Fisheries Services programs, National Estuarine Research Reserve System and Marine National Monuments (Wenzel 2015). The agencies responsible for each program are described in Table 4. Authorities over state and local-level MPA programs include fish and

wildlife agencies, coastal zone management programs, fishery management agencies, parks and recreation agencies, and others (Wenzel 2015).

**Table 4.** Federal MPA Programs and Agencies (Wenzel 2015)

Federal MPA programs	Goal	Agencies
National Park System	Preserve natural and cultural resources and values of the national park system	The National Park Service, a bureau of the Department of the Interior
National Wildlife Refuge System	Conserve, manage, and restore fish, wildlife, and plant resources and their habitats	The United States Fish and Wildlife Service
National Marine Sanctuary System	Improve the conservation, management, and sustainable use of marine resources; enhance public awareness and understanding of the marine environment; sustain ecosystem services	NOAA
National Marine Fisheries Services programs	Rebuild and maintain sustainable fisheries; conserve and restore marine species and their habitats	National Marine Fisheries Service and Regional Fishery Management Councils
National Estuarine Research Reserve System	Protect estuarine land and water	NOAA and coastal states partnerships
Marine National Monuments	Protect historic and prehistoric sites in U.S. marine waters	United States Fish and Wildlife Service, National Oceanic and Atmospheric Administration

As for a national system of MPAs, the Order states that “the Department of Commerce and the Department of the Interior in consultation with the Department of Defense, the Department of State, the United States Agency for International Development, the Department of Transportation, the Environmental Protection Agency, the National Science Foundation, and other pertinent Federal agencies shall develop the national system” (Section 4). In particular, the MPA Center is established within National Oceanic and Atmospheric Administration (NOAA) to guide the development and implementation of the national system of MPA as required by the Order. It should be noted that the MPA Center does not have an authority to “designate or establish new MPAs or alter protection afforded by existing MPAs” (Wenzel 2015 Page 25). Instead, it serves as conduit that supports and coordinates the system by offering information, technologies, and strategies (Wenzel 2015). In addition, Marine Protected Areas Federal Advisory Committee (MPAFAC) is authorized by the Order to offer expert advice to the Secretaries of Commerce and the Interior. MPAFAC is composed of 20 members representing broad areas of expertise, including natural and social science, commercial and recreational fishing, oil and gas, tourism, tribal and state governments, environmental organizations, and others (National Marine Protected Areas Center 2014). Although the Order only applies to federal agencies and does not affect actions of state and tribal agencies, collaboration across levels of governments, various sectors, and jurisdictional boundaries are proposed in the national system and contribute to the networking of individual MPAs in the nation.

#### **4.1.3 Methods**

To meet the overall purpose of the national system, common goals and objectives are defined with inputs from various stakeholders and the MPAFAC. These goals and objectives, i.e.,

conserving natural heritage, cultural heritage and sustainable production, are also serving as criteria for the inclusion of the national system of MPAs (Wenzel 2015).

While a quarter of existing MPAs have been selected as members of the national system based on the criteria, it has been shown that many other sea areas are not adequately protected, and thus, require the expansion of the national system (Wenzel 2015). A primary approach suggested in the Framework is to identify important conservation gaps and fill them through the development of new MPAs and MPA networks. Specifically, the gaps include 1) representation gaps, “where a particular habitat, ecosystem, or cultural resource type is either unrepresented or underrepresented in the national system” (Page 21); 2) ecological gaps, where important species, habitats, ecosystems or processes are not adequately protected to reach the conservation goal; and 3) management gaps, where the existing management objective or governance types do not fully support the goal of conservation and sustainable use (Wenzel 2015). Other universally recognized principles of MPA network design would also be considered in the decision-making process, such as representativeness, replication, precautionary design, resilience, viability, and connectivity (Wenzel 2015). However, much work remains at a theoretical level and few specific design guidelines of ecological networks are confirmed in the national system yet. Some State MPA networks are taking a more progressive approach in the network planning, such as siting algorithms adopted in the Florida Keys (Leslie et al. 2003) and a combination inputs of decision-making support tools and stakeholders’ comments applied in north central California (Gleason et al. 2010).

#### **4.1.4 Level of Science Applied for the MPA Network Design**

The development of MPA networks relies on the best available science and information, which includes natural science, social science, customary and local knowledge and other sources. At a national level, the MPA Center works collaboratively with partners in each region to identify conservation gaps in U.S. MPA networks (Wenzel 2015). The result would be further used for identify priority conservation areas to meet the system's natural heritage and sustainable production goals. Where information is limited, it is suggested by the national system that network designers should take a precautionary approach and take action to protect areas, rather than delaying the process to wait for more or better data (Wenzel 2015). In order to maximize and enhance linkages among ecosystems and individual MPAs, a science-based tool to measure connectivity is currently being developed by the national system (National Marine Protected Areas Center 2015).

In addition to natural science, social science is another important guideline that supports the MPA planning (National Marine Protected Areas Center 2003). The MPA Center has developed its national strategy for MPA social research and provides information for other partners (National Marine Protected Areas Center 2003). Priority social research themes include governance, use patterns, attitudes and perceptions, economics of MPAs, communities, and cultural heritage and resources (National Marine Protected Areas Center 2003).

#### **4.1.5 Stakeholder Engagement**

Within the national system, MPA center adopts a participatory and transparent approach to engage various stakeholders throughout the process. Stakeholders are involved primarily through MPAFAC and other mechanisms (Wenzel 2015). As mentioned above, MPAFAC

includes broad stakeholder communities from diverse perspectives, such as academia, scientists, fishing industries, tourism sectors, energy industries, and others. At the early stage of the development of the national system, the MPAFAC, agencies at all levels as well as non-governmental stakeholders are engaged to build up the framework for the national system as required by the Order. At the site level, diverse approaches are undertaken to involve stakeholders. For example, National Marine Sanctuary Advisory Councils (Council) are community-based advisory groups advising management and protection of the sanctuary. The Council is composed of representatives from conservation, education, research, fishing, tourism and recreation, boating and shipping, and others (NOAA National Marine Sanctuaries 2016).

#### **4.1.6 Trade-offs between Economic Development and Conservation**

Because the primary goal of MPAs within the national system is conservation, trade-offs between economic development and protection are considered but are not required in the designation process (Lauren Wenzel, personal communication March 18, 2016). For individual MPAs, the socio-economic impact may be demonstrated in the scientific evaluation of each MPA proposal.

#### **4.1.7 Monitoring and Evaluation**

At the national level, the MPAFAC has developed recommendations for monitoring and evaluation using an analytical framework for the evaluation of the national system and has proposed application of evaluation planning tool (Marine Protected Areas Federal Advisory Committee 2009). However, limited implementation has been undertaken by the MPA Center so far (Lauren Wenzel, personal communication March 18, 2016). Most monitoring and evaluation are currently performed at a site level.

#### **4.1.8. Summary**

The establishment of the national system of MPAs provides a common approach for the marine conservation with a design of common goals and selection criteria, which can be seen as a model for China to organize and manage its MPAs for an overarching goal. The MPA Center also plays a crucial role in guiding and coordinating the development of MPAs within the system. Nevertheless, it turns out that the function of the national system seems limited at this stage, especially in contributing to the creation of ecological networks for a couple of reasons. First, the legal force of the Executive Order defines the priority of this policy. Second, State laws, which are considered as a major impetus for the establishment of MPAs, makes the designation and planning of MPAs complicated in the U.S.'s context.

#### **4.2 Canada**

The Government of Canada, in collaboration with provincial and territorial governments, Aboriginal groups, industries, academia and environmental organizations, is leading the development and implementation of a national network of marine protected areas (Government of Canada 2011). The primary goal of the network is to “provide long-term protection of marine biodiversity, ecosystem function and special natural features” (Government of Canada 2011 Page 6). Besides, sustaining ecosystem services and improving public awareness of marine environment are included as secondary goals of the national network (Government of Canada 2011). This national network of MPA will be composed of 13 bioregional networks that share common goals, principles and selection criteria outlined in the National Framework for Canada's Network of Marine Protected Areas (National Framework) (Government of Canada 2011). The bioregion, in Canada's context, refers to a biogeographic division of Canada's marine waters out

to the EEZ and in the Great Lakes, identified through a national science advisory process based on attributes similarity such as bathymetry, influence of freshwater flows, and species distribution. (Fisheries and Oceans Canada 2009; Government of Canada 2011)

#### **4.2.1 Legal Framework**

Federally, Canada passed progressive marine conservation legislation, the 1996 Oceans Act, which provides a framework for integrated oceans management and assigns the Minister of Fisheries and Oceans with the leading role in the development of a national system of MPAs (Government of Canada 2011). Canada's Oceans Strategy (2002), Oceans Action Plan (2005), and the Health of the Oceans Initiatives (2007) are further launched to foster the implementation of a national MPA network.

A spectrum of specific and complementary mandates is offered under three federal departments and agencies to establish and manage MPAs in Canada (See Table 5). Three core MPA programs independently administrated by these agencies contribute to the development of a network (Government of Canada 2005). These programs include: Oceans Act MPAs that protect marine species and their habitats as well as areas of high biodiversity, Marine Wildlife Areas that conserve habitats of wildlife such as migratory birds and endangered species, and National Marine Conservation Areas that protect natural and cultural marine heritage (Government of Canada 2005). In addition to these core programs, National Parks, Migratory Bird Sanctuaries with marine components are also considered to comprise a network (Government of Canada 2011). In 2005, three federal agencies released Canada's Federal Marine Protected Areas Strategy, which outlines how their respective MPA programs can collectively form a cohesive and complementary network in Canada (Government of Canada

2005; Government of Canada 2011). Furthermore, the National Framework was developed to guide the overarching and strategic planning of MPA networks in 2011.

**Table 5.** Federal Legislation and Policy Tools for Establishing and Managing Marine Protected Areas (Government of Canada 2005 Page 14)

Federal Department/Agency	Legislation	Policies
Fisheries and Oceans Canada	-Oceans Act -Fisheries Act -Species at Risk Act	National Framework for Establishing and Managing Marine Protected Areas
Environment Canada	-Canada Wildlife Act -Migratory Birds Convention Act -Species at Risk Act	- Migratory Bird Sanctuary Policy, Criteria and Procedures - Criteria for Selecting Candidate National Wildlife Areas -Habitat Conservation Program Strategy
Parks Canada	-Canada National Marine Conservation Areas Act -Canada National Parks Act	- National Marine Conservation Areas Policy - Canada's National Marine Conservation Areas System Plan

#### 4.2.2 Institutional structure

At a national level, three federal departments and agencies - Fisheries and Oceans Canada, Environment Canada and the Parks Canada Agencies - are playing a leading role in the development and implementation of a network of MPAs (Government of Canada 2010). As

mentioned above, authorities establish and manage their respective MPA programs, each with its own objective and management approaches. It has been noted that communications and collaborations among these federal agencies “have not always been consistent and have tended to evolve opportunistically” (Government of Canada 2005 Page 7), and hence, calls for the development of strategic partnerships and the establishment of interdepartmental working groups. The specific governance for MPA network planning will be established at the bioregional scale, “preferably using existing multi-sector Integrated Ocean Management (IOM) governance structures developed within the five Large Ocean Management Areas (LOMAs)” (Government of Canada 2011 Page 17). The general IOM management bodies are composed of “an executive-level oversight committee, a director-level management committee, a stakeholder advisory committee and a technical working group” (Government of Canada 2011 Page 17). Representatives from both federal agencies and provincial/territorial governments are to be involved in the bioregional network planning (Government of Canada 2011).

#### **4.2.3 Methods**

The National Framework suggests that the first step for creating a network is to identify Ecologically and Biologically Significant Areas (EBSAs) based on scientific criteria, such as uniqueness or rarity, special importance for life-history stages of species, and biodiversity (Government of Canada 2011). This process would require enormous inputs from individual agencies and stakeholders, as well as collective planning efforts at a national scale (Government of Canada 2005). For those areas identified in the initial planning phase, scientific guidance would be adopted for the selection of areas to form a representative network to ensure the network design is consistent with broader Integrated Oceans Management initiative (Government

of Canada 2011). Recommendations would also be solicited for configuring networks with regard to design criteria, including connectivity, replication and adequacy (Government of Canada 2011). In addition to areas with significant ecological benefits, sites that are important to coastal communities socially and economically can be considered for inclusion in the network where they are compatible with the overarching goal and selection criteria of the network (Government of Canada 2011).

#### **4.2.4 Level of science for the MPA Network Design**

To build a national network, available scientific, traditional, economic and community information for the bioregion is compiled and analyzed for planning (Government of Canada 2011). In addition, a number of workshops, organized by federal agencies such as Canadian Science Advisory Secretariat (CSAS), foster the incorporation of scientific advice into the decision-making (Fisheries and Oceans Canada n.d.a) .

#### **4.2.5 Stakeholder Engagement**

The Oceans Strategy (2002) proposed a variety of forms of stakeholder engagement in the IOM governance model, ranging from “a relatively narrow advisory function to the actual delegation of powers that might possibly be embodied through a co-management arrangement” (Kearney et al. 2006 Page 87). With regard to the national MPA network planning, stakeholder involvement seems remain at representative and advisory level. According to the National Framework (2011), interest groups are invited throughout the network planning process, which include First Nations, federal, provincial and territorial agencies, industries, and environmental organizations. Internet-based MPA mapping system and outreach approaches would also be

applied to increase public awareness of marine issues and enhance public participation in creating the MPA networks (Government of Canada 2005).

#### **4.2.6 Trade-offs between Economic Development and Conservation**

Established and managed within a IOM framework that seeks to develop “a comprehensive way of planning and managing human activities so that they do not conflict with one another” (Fisheries and Oceans Canada 2005 Page 13), Canada’s MPA network considers human uses and socio-economic impact analysis as a critical step in the design. The National Framework states that experts’ advice in cost and benefit analysis as well as the socio-economic impact analysis are taken into consideration throughout the planning (Government of Canada 2011). In addition, scenario planning may be employed in the comprehensive design of the national network and provide alternatives for stakeholders and decision-makers, with the goal of maximizing ecological benefits and minimizing socio-economic costs (Government of Canada 2011). Zoning and other management tools can also be applied to address the conflicts of uses at a site level (Government of Canada 2011).

#### **4.2.7 Monitoring and Evaluation**

Because the development of Canada’s national network is in an early stage, monitoring and evaluation is not complete yet. An adaptive management framework has been recommended for managing Canada’s MPA network (Government of Canada 2005; Government of Canada 2011). A range of indicators, which may include ecological, governance, social, economic and cultural performance, will be identified to determine if objectives are being met (Government of Canada 2005). Furthermore, collaboration and coordination among multiple partners across

different levels would be anticipated in the monitoring and evaluation system (Fisheries and Oceans Canada n.d.b).

#### **4.2.8 Summary**

A key lesson from the case of Canada is that the development and management of MPA networks can be achieved through the division of bioregions under the IOM framework. Obviously, this would require enormous inputs of resources to define the bioregion and set up the governance system. Mostly importantly, the central government must have strong willingness to support the national program. Although Canada remains slow in achieving its goal to protect at least 10% of coastal and marine waters by 2020, its efforts in specifying bioregions based on the scientific research, incorporating three different core programs to form a network, and applying scenario planning to minimize the socio-economic impacts of MPAs may be helpful to China.

#### **4.3 Australia**

As committed by the Australian Government at the 2002 World Summit on Sustainable Development (WSSD), a National Representative System of Marine Protected Areas (NRSMPA) was developed within a bioregional framework in 2012. The primary goal of the NRSMPA is “to establish and manage a comprehensive, adequate and representative system of MPAs to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems, and to protect Australia’s biological diversity at all level” (ANZECC 1998a Page 5). The NRSMPA consists of MPAs in Commonwealth, State and Territory waters and some associated intertidal areas and covers a total area of 3.1 million square kilometers of ocean, almost a third of Australia’s marine territory (ANZECC 1998a; Vince et al.

2015). In addition, Australia's States and the Northern Territory have recently created a network of 19 marine parks in South Australia that are carefully designed to protect marine habitats and biodiversity while also continuing to support sustainable marine use activities (National Parks South Australia 2014).

#### **4.3.1 Legal Framework**

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) serves as a national schema for the development and the management of reserves. It specifies the goal of environmental protection and biodiversity conservation, defines assessment and approval process of reserve declaration, and recognizes the role of indigenous people in conservation. Under the EPBC Act, Australia's Oceans Policy (Commonwealth of Australia 1998) identifies the need to protect marine biodiversity through Regional Marine Planning (RMP). The Oceans Policy, however, was recently placed in abeyance and the RMP has been replaced with Marine Bioregional Plans (MBPs), which promote an ecosystem-based approach and integrated management across jurisdictional, sectoral and disciplinary boundaries (Vince et al. 2015). With the Commonwealth Government's commitment to establish a national system of MPAs, the Guidelines for Establishing the National Representative System of Marine Protected Areas (NRSMPA) was developed by ANZECC Task Force in 1998 to assist and promote the establishment of NRSMPA (ANZECC 1998a). The Australian Government later developed the Strategic Plan of Action for the NRSMPA (1998b) and the Interim Marine and Coastal Regionalisation for Australia (IMCRA) (1998). These legislative documents provide a national and regional policy framework for the establishment of the NRSMPA.

Other Commonwealth legislative mandates that support the development of the NRSMPA include, but are not limited to, the National Parks and Wildlife Conservation Act 1975, the Whale Protection Act 1982, Endangered Species Protection Act 1992, Great Barrier Reef Marine Park Act 1975, and the Historic Shipwrecks Act 1976. Mandates and policy tools at a state level also contribute to the establishment of MPAs within the State jurisdiction.

#### **4.3.2 Institutional Structure**

The establishment of the NRSMPA takes a top-down approach with cross-jurisdictional cooperation of the Commonwealth, State and Northern Territory agencies relevant to conservation (ANZECC 1998b). The States and Northern Territory declares MPAs under their jurisdiction, which is within three nautical miles of the land. The Commonwealth generally has responsibility from three nautical miles to the Exclusive Economic Zone. Within some jurisdictions, local government may be involved in the MPA planning and management, while the ultimate decision is made by the responsible Minister in each jurisdiction (ANZECC 1998b). Furthermore, responsible agencies vary depending on the type of reserves. For example, the Director of National Parks and Wildlife Service administers parks and reserves proclaimed under the National Parks and Wildlife Conservation Act; the Australian and World Heritage Group of Environment Australia is responsible for the management of the reserves designated under the Historic Shipwrecks Act 1976 (ANZECC 1998b).

To facilitate the progress of the NRSMPA, the Commonwealth also plays a coordinating role, with the advisory inputs from ANZECC Task Force on Marine Protected Areas (TFMPA), in ensuring national consistency in data exchange, the network planning, and the interpretation of the application of the IUCN categories to the NRSMPA (ANZECC 1998a).

### 4.3.3 Methods

Australia's MPA network is developed under the MBPs, which aims to provide a strategic framework for marine conservation. Four marine regions in Australia's ocean territory - South-west, North-west, North and Temperate East - have released their respective marine bioregional plans (Department of the Environment n.d.a). The MBPs include the selection of the regional MPA network, identification of the region's key species, habitats, natural processes, human uses, priority areas, as well as the benefits and potential impact of the network, and a monitoring plan for the network (ANZECC 1998a). To maximize conservation outcomes of the NRSMPA, national guidelines recommend that one or more examples of ecosystems within each bioregion should be represented in the MPA network (ANZECC 1998a).

The development of the NRSMPA is based on three key principles: comprehensiveness, adequacy and representativeness (DFO and WWF 2009). The process for the development of MPAs within the NRSMPA is described as follows. The initial step is baseline data collection and ecosystem mapping. A list of candidate areas within 60 bioregions identified through IMCRA processes will be confirmed using identification criteria (See Table 6). The guideline recommends that one or more examples of ecosystem in each bioregion must be represented in the network (ANZECC 1998a). Then national and regional priorities will be specified through identification of threatening processes, gap analysis for existing MPAs within each IMCRA region, socio-economic impact analysis and other tools (ANZECC 1998a). Selection criteria will be applied for a further sites selection from candidate areas (See Table 6) (ANZECC 1998a). Finally, the feasibility of potential MPAs will be assessed and negotiated before the establishment (ANZECC 1998a).

**Table 6.** Identification and Selection Criteria for MPA designation within the NRSMPA (ANZECC 1998a)

Identification Criteria	Representativeness
	Comprehensiveness
	Ecological importance
	International or national importance
	Uniqueness
	Productivity
	Vulnerability assessment
	Biogeographic importance
	Naturalness
Selection Criteria	Economic interests
	Indigenous interests
	Social interests
	Scientific interests
	Practicality/feasibility
	Vulnerability assessment
	Replication

#### **4.3.4 Level of Science for the MPA Network Design**

Because the goal of the NRSMPA is to establish a comprehensive, adequate and representative system, the national component of this project highly relies on the scientific data. The Strategic Plan requires a set of research activities to assess comprehensiveness, adequacy and representativeness for the NRSMPA, including ecosystem mapping, gap analysis using IMCRA and the Collaborative Australian Protected Areas Dataset (CAPAD), and assessment on viable MPA size, vulnerable ecosystems and other targets. Community and industry knowledge are also required to be incorporated into the database through a series of targeted mechanisms (ANZECC 1998b). In addition to data collection, data management is another core activity for the development of the NRSMPA. This may include data refinement and standards application to transfer comparability of MPAs datasets for a further data sharing across the NRSMPA (ANZECC 1998b). Marine data management systems, such as the National Marine Information System, the Australian Coastal Atlas, the Marine and Coastal Data Directory of Australia, and the CAPAD, have been developed to improve the data organization and accessibility (ANZECC 1998b). Furthermore, human activities are identified in the MBPs, but social and economic objectives are not the focus of the MBPs (Vince et al. 2015). The socio-economic assessment is often performed in addition based on a regional marine reserve network proposals by the Australian Bureau of Agricultural and Resource Economic and Sciences (ABARES) with assistance of the fishing sector (Department of the Environment n.d.b).

#### **4.3.5 Stakeholder Engagement**

Stakeholder consultation and indigenous involvement are two key principles for Australia's MPA network planning (ANZECC 1998a). To ensure that stakeholder engagement is

incorporated into the development of the NRSMPA, a set of requirements has been identified in the Strategy Plan, which include the identification of stakeholders and their issues, provision of sufficient information to all stakeholders, and representation of key stakeholders on community advisory committees (ANZECC 1998b). The stakeholder engagement takes a variety of forms, ranging from multi-stakeholder workshops and meetings to a 90-day public comment period in the review of the draft marine bioregional plans and reserve network proposals (ANZECC 1998b). Furthermore, education and training are provided to improve stakeholders' awareness of environmental and ethical values, and thereby facilitate their involvement (ANZECC 1998b).

#### **4.3.6 Trade-offs between Economic Development and Conservation**

Trade-offs are not mentioned for the Commonwealth component of the NRSMPA, while they are considered in a regional MPA planning. For example, Marxan with Zones, a decision-support tool designed for managers and decision-makers in MPA planning, was applied in Southwestern Australia to identify the optimal MPA locations given defined planning objectives (Center for Ocean Solutions 2011). Multiple scenarios were developed based on a range of varying parameters and all the scenarios were further evaluated based on the socio-economic impacts to stakeholders. It is important to note that that this analysis requires a large amount of socio-economic data, a high level of experience and skills in model running and interpretation, and most importantly, an agreed planning objective. Evidence shows that the objectives are usually driven by the policy players. In the case of a network of marine parks in South Australia, the Environment Minister Ian Hunter stated that fishermen that have been impacted by the sanctuary zones were in the minority and suggested that a balance should be pursued (Neindorf et al. 2015). In 2015, the State government attempted to introduce the Marine Parks Amendment

Bill into the network of marine parks in South Australia, which would cut the number of marine sanctuary zones for the benefits of fishing and tourism industries (Pittaway and Neindorf 2015). However, this approach that claimed to achieve a balance of economic development and conservation has been questioned (Pittaway and Neindorf 2015).

#### **4.3.7 Monitoring and Evaluation**

The performance evaluation for the NRSMPA is required at three interrelated spatial scales - a site level, a system level, and a bioregional level (ANZECC 1998b). Therefore, the monitoring and evaluation of the NRSMPA is conducted by the Commonwealth in collaboration with the States and the Northern Territory. A Best Practice Model has been adopted for the performance assessment of the NRSMPA, which focuses on the “development of outcome-based performance indicators which are strongly linked to the goals and objectives sought by managers and stakeholders” (ANZECC 1998b Page 35). Additionally, process-based indicators that emphasize the timeline and resources will be incorporated into the evaluation (ANZECC 1998b).

#### **4.3.8 Summary**

The NRSMPA in Australia has been controversial for its piecemeal or ad hoc decision-making as a result of a race for the completion (Vince 2014). It has been criticized that the network was established for “residual reserves” that are mostly placed outside of areas threatened by commercial and other activities and hence fail to live up to its conservation promise (Pressey 2012; Vince 2014; Vince et al. 2015). Furthermore, the turn over of the Australian government has been an obstacle for achieving the long-term goal. The recent 2013 election campaign by the Coalition Government shifted the focus from oceans issues as an environmental concern to sustainable fisheries, arguing that the current MPA policy was

threatening the livelihood of the trawlers and the tourism industry (Franklin 2010; Vince 2014). In July 2014 the newly elected Commonwealth government placed the Commonwealth Marine Reserves Network and management plans under review (Vince et al. 2015). Besides, several reviews state that the governance structure of the ocean planning lacks consistency and integration (Vince 2014; Vince et al. 2015). During the period of the MBPs, processes have been delivered independently, even after the restructuring made by the newly elected government (Vince 2014; Vince et al. 2015). Additionally, the growing disengagement of state-level governments has led the NRSMPA to a Commonwealth rather than a national project (Vince et al. 2015). These lessons may inform China the importance of a simple and cohesive approach to manage marine environment. South Australia's experience in developing a system of marine parks within the NRSMPA framework may also be useful for China's marine parks program.

#### **4.4 New Zealand**

As a Party to the United Nations Convention on Biological Diversity, New Zealand has committed to establishing a network of marine protected areas (CBD 2014a). The network is intended to “protect representative examples of the full range of marine habitats and ecosystem, and also understanding, rare, distinctive or internationally or nationally important marine habitats and ecosystems” (Department of Conservation and Ministry of Fisheries 2005 Page 10).

##### **4.4.1 Legal Framework**

The Marine Protected Areas Policy (the MPA Policy) provides a primary framework for New Zealand's initiative to create a network of MPAs. A combination of marine management tools with the support of a spectrum of legislation has been applied under the MPA Policy to contribute to the network (See Table 7). Of these management tools, Marine Reserves is the core

tool in the development of a representative network. However, the Marine Reserves Act is being reviewed for its lack in flexibility by only allowing no-take marine reserves for the purpose of conservation for scientific study as well as its limit in addressing a number of issues, such as inadequate consultation processes and isolated MPA proposals considerations (Ministry for the Environment 2016). Responding to these problems, the New Zealand's Government recently proposed a new Marine Protected Areas Act in support of a comprehensive and adaptive network of MPA (Ministry for the Environment 2016). In addition, New Zealand has developed Marine Protected Areas Classification, Protection Standard and Implementation Guidelines (2008) as a basis for the MPA planning.

**Table 7.** Management Tools and Legislation that contribute the network of MPAs (Department of Conservation and Ministry of Fisheries 2005)

Marine Management Tools	Legislation	Goals
Marine Reserves	The Marine Reserves Act 1971	Protect 1) representative examples of the full range of marine communities and ecosystems that are common or widespread, 2) outstanding, rare, distinctive, or internationally or nationally important marine communities or ecosystems, and 3) natural features that are part of the biological and physical processes of marine communities or ecosystems
Fisheries Act Tools	The Fisheries Act	Prohibit all fishing in particular areas and prohibit particular fishing methods
Resource Management Act Tools	The Resource Management Act	Establish protected areas in coastal plans
Special Legislation	N/A	Restrict particular activities, such as marine dumping and trawling
Wildlife Refuges, Sanctuaries and Management Reserves	The Wildlife Act 1953	Protect particular species and their habitats in defined areas
Other Conservation Areas	The Reserves Act 1977	Provide protection through establishing National Parks and other conservation areas

Customary Fisheries Management Tools	The Fisheries Act	Provide customary fishing use and management practices
Marine Mammal Sanctuaries	The Marine Mammals Protection Act 1978	Protect marine mammals
Cable Protection Zones	The Submarine Cables and Pipeline Protection Act 1996	Prevent marine-based activities that may threaten cables
Crown Minerals Act Tools	The Crown Minerals Act (CMA) 1991	Ensure that activities under the CMA are managed that minimize adverse impacts on MPAs
Maritime Transport Act Tools	The Maritime Transport Act (MTA) 1994	The MTA tools, such as shipping controls and anchoring restrictions, can be integrated to minimize threats to biodiversity
Biosecurity Act Tools	The Biosecurity Act	The Biosecurity Act tools, such as controls on movement of pests and controlled area notice provision, can be used to bolster other management measures

#### **4.4.2 Institutional Structure**

The Department of Conservation (DOC) and the Ministry of Fisheries (MOF) are two primary players in managing New Zealand's coastal and marine environment. The DOC is responsible for managing MPAs under the Marine Reserves, the Wildlife Act, and Marine Mammal Protection Act (Ministry of Primary Industries 2014). In collaboration with regional councils, DOC also administers coastal and marine areas under the Resource Management Act (Ministry of Primary Industries 2014). The MOF manages fishing and fisheries resources under the Fisheries Act and effects from endangered species under the Biosecurity Act (Ministry of Primary Industries 2014). Furthermore, the DOC and the MOF are jointly responsible for the monitoring and evaluation for the network, with assistance from the expert offshore panel and independent science advisors as required in the Implementation Plan (Department of Conservation and Ministry of Fisheries 2005).

Because New Zealand takes different approaches to manage offshore and nearshore marine environment, the responsible agencies vary by scales. Planning for offshore MPAs will involve government agencies working with “tangata whenua”, the indigenous peoples of New Zealand, and user groups at a national level, while the nearshore planning will be implemented at a regional level (Department of Conservation and Ministry of Fisheries 2005).

#### **4.4.3 Methods**

To establish a representative MPA network, New Zealand takes a science-based approach consistent with habitat and ecosystem classification and an inventory of marine protected areas (Ministry of Fisheries and Department of Conservation 2008). The New Zealand's classification system consists of five key attributes that categorize the marine environment. They include 1)

biogeographic region, 2) environment type, 3) depth, 4) exposure, and 5) habitat type (Ministry of Fisheries and Department of Conservation 2008). In addition, all sets of management tools are mapped and assessed against a protection standard to determine whether management tools applied are effective to provide adequate protection to the areas (Ministry of Fisheries and Department of Conservation 2008). This has presented an inventory of MPAs for a further gap analysis and priority identification.

#### **4.4.4 Level of Science for the MPA Network Design**

As mentioned, the MPA network planning in New Zealand is based on science. This drives a range of scientific research and analysis to ensure the network achieves the goal. The Government has initiated a national scale gap analysis for coastal marine habitats and MPAs in its Territorial Sea jointly by Department of Conservation and Ministry of Fisheries (Department of Conservation and Ministry of Fisheries 2011). As a result, habitat and management tools mapping at a national scale as well as a MPA inventory are produced. In addition, expert knowledge from scientists and stakeholders has been mapped to complement the bias of the bioregion result (Department of Conservation and Ministry of Fisheries 2011). In terms of social and economic aspects for the MPA network design, the MPA Policy includes it as one important component for MPA research, but does not provide further requirements on socio-economic requirements (Department of Conservation and Ministry of Fisheries 2005). Instead, the new proposed MPA Act, which is in the progress of consultation, aims to address this problem and calls for achieving a balance between marine environment protection and commercial, social and cultural values maximization (Department of Conservation and Ministry of Fisheries 2011; Ministry for the Environment 2016).

#### **4.4.5 Stakeholder Engagement**

As claimed in the MPA Policy Implementation Plan, stakeholders are involved through a range of stages from a low level of observation in documents preparation period to a high level of consultation for the MPA planning (Department of Conservation and Ministry of Fisheries 2005). To improve public knowledge in marine environment and facilitate stakeholder involvement, an interactive web-based mapping tool-National Aquatic Biodiversity Information System-has been built and is accessible to the public.

#### **4.4.6 Trade-offs between Economic Development and Conservation**

The MPA Policy requires that adverse impacts on existing users of the marine environment should be minimized when selecting new MPAs (Department of Conservation and Ministry of Fisheries 2005). However, its consideration for the social and economic impacts is very limited in practice. The new proposed law intends to balance the socio-economic uses and conservation by requiring an analysis of the economic impact of a proposed MPA as part of the decision-making process (Ministry for the Environment 2016). To minimize the impact on existing uses and property, the Government will provide compensation for commercial fishers (Ministry for the Environment 2016). In addition, the new proposed MPA Act suggests that MPA will not be placed in areas where there is petroleum or mineral mining unless the permit holder agrees, considering that bolstering the oil, gas and mineral mining industries is one important element of the Government's Business Growth Agenda (Ministry for the Environment 2016).

#### **4.4.7 Monitoring and Evaluation**

The monitoring and evaluation, as required under the MPA policy, assesses the performance of the MPA network, with a focus on individual MPAs' biodiversity objectives and performance of the MPA management tools (Department of Conservation and Ministry of Fisheries 2005). The evaluation results are to be incorporated into an annual report for further decision-making (Department of Conservation and Ministry of Fisheries 2005). No specific indicators for the evaluation of the New Zealand's network are presented yet.

#### **4.4.8 Summary**

New Zealand takes a comprehensive approach in planning a representative MPAs network to maximize biological and ecological benefits. Its national initiative of ecosystem mapping, inventory developing, and gap analysis provides a solid basis for the MPA selection, which may offer valuable insights for China to develop a systematic planning for MPAs. Similar to China's MNR, the Marine Reserves Act in New Zealand provides full protection with limited socio-economic considerations. As the development of the network proceeds, the conflicts among different marine sectors become intense, especially the marine tourism industry, which contributes to over NZ \$11 billion annually to the New Zealand's economy, criticized that the sector's interests are strongly under-represented in the MPA proposal (Cropp 2016). One solution that New Zealand proposes is a new law to manage all management tools within the network, improve the consultation process and add a compensation mechanism. This may indicate that China could take a legislative approach to better respond to the trade-offs and conflicts of interests in establishing a MPAs network.

## **4.5 The European Union**

Under the UN CBD, the EU has committed to ensure that 10% of its coastal and marine areas are protected by 2020 (CBD 2014b). To meet this target, the EU has implemented the Natura 2000 network of protected areas, established by the Habitats and Birds Directives, in its coastal and marine areas as well as the Regional Sea Conventions that provide a coordination platform for its Member States to create an ecologically coherent and representative MPA networks (EEA 2015a). The development of the network is driven by a policy framework comprising international, EU, regional, and national legislation and initiatives, while the implementation of MPA networks highly depends on individual Member States. For the purpose of this study, this section will focus on the legal framework for the development of MPAs and MPA networks in the EU.

### **4.5.1 The Legal Framework**

A number of international, EU, regional, and national agreements and initiatives support the development of MPAs and MPA networks in the EU. At the international level, a policy goal was specified that conserve at least 10% of coastal and marine areas through establishing representative and effectively managed MPA networks as committed to the CBD (CBD 2014b; EEA 2015a).

In parallel with international commitments, the European Commission (EC) adopted a set of directives, each with different objectives. The EU legislation includes the Habitats Directive, the Birds Directive, the Marine Spatial Planning Directive (MSPD), the Common Fisheries Policy (CFP), and the Marine Strategy Framework Directive (MSFD) (See Table 8). Under the Birds and Habitats Directive, the Natura 2000 network was designated to help these directives

achieve its goals (EC 2016a). The Natura 2000 network serves as a major contributor to the MPAs in the EU's seas with the coverage of over 4% as of the end of 2012 (EEA 2015a; EEA 2015b). However, the distribution of MPAs is biased as a result of a coastal focus of the Habitats Directive and a lack of knowledge about marine species and habitats in offshore areas (EEA 2015a; EEA 2015b). In addition, the distribution and the size of Natura 2000 sites varies across countries (EEA 2015a; EEA 2015b). In 2013, only 6 of 22 Member States had sufficiently met the Natura 2000 in terms of MPA designation for all relevant marine habitat types (EEA 2015a). Furthermore, because the Habitats and Birds Directives are narrowly focused on rare habitats and vulnerable species, it has been argued that these directives fail to adequately protect marine ecosystems without providing a holistic approach (EEA 2015a). As a solution, the EU adopted the MSFD in 2008, seeking to bridge the gap and guide the establishment of an ecologically coherent and representative network by introducing design principles (EC 2008; 2015a). The MSFD requires that each Member State develop a marine strategy for its waters, in coordination with other nations within the same marine region through the Regional Sea Conventions (RSCs) (EC 2008). Four Regional Sea Conventions are described in Table 9.

In addition to MPA designation under the directives and RSCs, Member States can designate national protected areas for marine features of domestic interest, for instance, the Portuguese MSFD Program of Measures (EEA 2015a). Nationally designated sites comprise nearly one third of the total coverage of MPAs in the EU waters (EEA 2015a).

**Table 8.** The EU Policies Supporting the Creation of MPA Networks in Europe’s Seas (Adapted from EEA 2015a; EC 2015; IEEP and NRDC 2008)

Directives	Goal	Conservation Measures
The Habitats Directive, 1992	Protect vulnerable natural habitats and wild fauna and flora	Special Areas of Conservation (SACs)
The Birds Directive, 1979	Conserve a specific list of bird species	Special Protection Areas (SPAs)
The Marine Spatial Planning Directive, 2014	Manage marine activities and promote the sustainable use of marine and coastal resources	Marine Spatial Planning
The Common Fisheries Policy, 2002	Manage fisheries for both stock conservation and environmental purposes	Does not require the development of MPAs, but provides a tool to reduce environmental and ecological impacts of fishing
The Marine Strategy Framework Directive, 2008	Achieve good environmental status (GES) throughout the entire European marine areas by 2020	Requires spatial protection measures contributing to the creation of the network

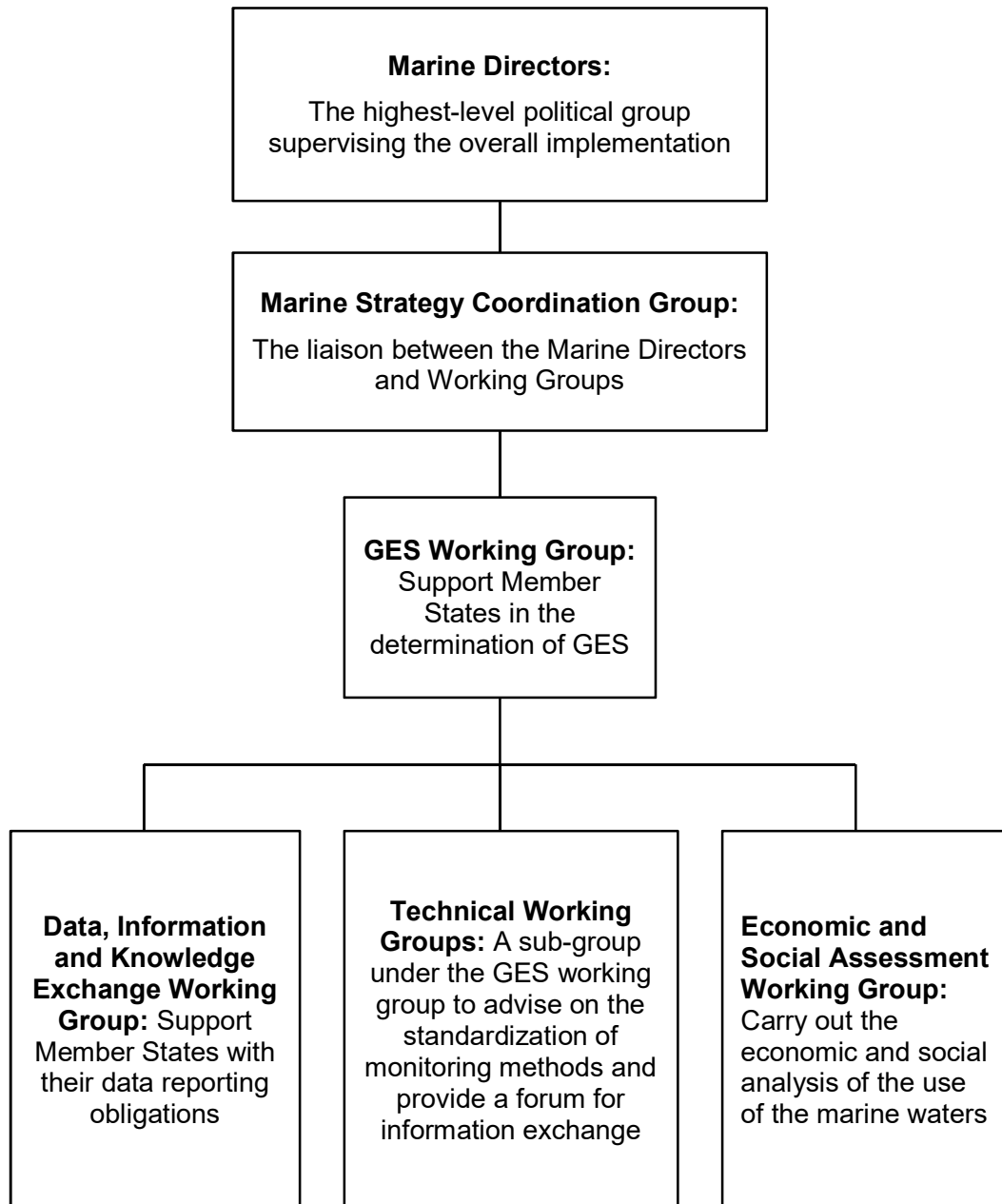
**Table 9.** Regional Sea Conventions (adapted from EEA 2015a Page 13; JNCC 2015)

Regions	Regional Sea Convention	Goal
The Northeast Atlantic Ocean	OSPAR Recommendation 2003/3	Set up a MPA network consistent with the CBD targets for marine and coastal regions by 2012 and have the network well managed by 2016
The Baltic Sea	HELCOM Recommendation 15/5, 1994; HELCOME Recommendation 35/1, 2014	Create an ecologically coherent and effectively managed network of coastal and marine Baltic Sea Protected Areas
The Mediterranean Sea	Barcelona Convention, COP17-Paris Declaration; Barcelona Convention, COP18, 2013	Set up a MPA network consistent with the CBD targets; Develop a region-wide network of Mediterranean MPAs and meet the 10% coverage target by 2020
The Black Sea	Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, 2009	Conserve the Black Sea biodiversity and habitats

#### 4.5.2 Institutional Structure

Under the policy framework provided by the EC, Member States are responsible for designating and designing MPAs within their coastal and marine waters. In order to facilitate the implementation of the MSFD throughout different governance levels, the EC and Member States have set up a hierarchy of coordinating groups under the program of Common Implementation Strategy (CIS) (See Figure 4). Within each Member State, a competent authority or authorities will be designated for the implementation of the MSFD (Article 7 EC 2008). In addition, the

creation of the network relies on regional cooperation. Article 6 of the MSFD requires that Member States use existing regional institutional cooperation structures, including mechanisms of RSCs, to coordinate their management with neighboring countries (EC 2008).



**Figure 4.** Management Structures of Common Implementation Strategy (EC 2016b)

### **4.5.3 Methods**

MPAs and MPA networks can be designated under three schemes: Natura 2000 network, RSCs, and National legislation. The Natura 2000 Network is established through the Habitats and Birds Directives, which mainly protect rare habitats and vulnerable species (EC 2016a). The MSFD promotes a more holistic approach for the network planning through the RSCs. To achieve coherent and representative networks of MPA, the MSFD introduced network design principles (EEA 2015a). These include representativeness, adequacy, viability, connectivity, replication, protection level and best available science (EEA 2015a).

As required under the MSFD, Member States across a marine region or sub-region should cooperate to develop a marine strategy for the marine waters (EC 2008). The marine strategy includes an initial assessment of pressures and impacts on their marine waters, a socio-economic analysis of marine uses, and a determination of Good Environmental Status (GES) for the waters concerned (Article 8 and Article 9 EC 2008). Methodological standards and criteria will also be developed to allow the comparison between marine regions and sub-regions (Article 9 EC 2008). Based on the initial assessment, Member States will establish a set of environmental targets and associated indicators for the further progress tracking (Article 10 EC 2008).

### **4.5.4 Level of Science for the MPA Network Design**

The MSFD requires that Member States within a marine region or sub-region should “undertake an analysis of the features or characteristics of, and pressures and impacts on, their marine waters”, in particular the predominant pressures and impacts (EC 2008) (See Table 10). Social and economic analysis of marine uses and of the cost of degradation of the marine environment is also required for Member States (EC 2008).

**Table 10.** Indicators of Characteristics, Pressures, and Impacts (EC 2008, Annex III)

Characteristics	Physical and chemical features
	Habitats types
	Biological features
	Other features (e.g., chemicals)
Pressures and Impacts	Physical loss
	Physical damage
	Other physical disturbance
	Interference with hydrological processes
	Contamination by hazardous substances
	Systematic and/or international release of substances
	Nutrient and organic matter enrichment
	Biological disturbance

#### 4.5.5 Stakeholder Engagement

Article 19 of the MSFD requires a public consultation procedure for the implementation of the Directive within each jurisdiction (EC 2008). Materials relevant to the Marine Strategies, such as initial assessment, environment targets, and monitoring and evaluation programs, will be available for the public to ensure that they are well informed (EC 2008). Interested parties can also be involved through a variety of management bodies, such as RSCs, Scientific Advisory Bodies and Regional Advisory Councils (EC 2008).

#### **4.5.6 Trade-offs between Economic Development and Conservation**

The trade-off between economic development and conservation is not a big issue in the EU, as stakeholders have agreed on the benefits that SACs and SPAs could potentially offer (IEEP and NRDC 2008). To minimize the social and economic impacts of MPAs, the MSFD recommends an integrated management approach and requires Member States undertake socio-economic analysis as a part of Marine Strategy (EC 2008). Besides, the recent MSPD establishes a framework for marine spatial planning (MSP) to systematically manage marine activities, which could potentially play a crucial role in advancing MPA designation in a holistic ecosystem-based approach (EC 2015).

#### **4.5.7 Monitoring and Evaluation**

In the EU policy context, the MSFD requires Member States establish and implement coordinated monitoring programs for the assessment of the GES of their marine waters based on a list of indicators (Table 8). Standardized methods for monitoring and assessment are also required for the comparison between monitoring and assessment results (Article 11 EC 2008). However, no overviews have been developed to assess the management effectiveness of the EU's MPA networks so far (EEA 2015b).

#### **4.5.8 Summary**

Even though the EU has built a legal framework for developing MPAs and MPA networks, the enforcement of legal instruments remain questionable (IEEP and NRDC 2008; EEA 2015a; EEA 2015b). Progress on implementation of MPA networks in the EU has been slow and large differences in MPA coverage exist across marine regions and individual Member States (EEA 2015a; EEA 2015b). Furthermore, it is recognized that there is considerable overlap and complexity in the policy framework for establishing MPA networks (EEA 2015a; EEA

2015b). For instance, Denmark and Sweden have to designate MPAs for the same marine areas under OSPAR, HELCOM, the Birds and Habitats Directives, and national law (EEA 2015b). In response, the EAA recommends the development of a common understanding of MPA networks in the EU context, which may include “clear vision and high-level goals framing the EU MPA network envisaged under the MSFD”, a classification of MPAs distinguishing various purposes, and operational criteria for MPA network designation and evaluation (EEA 2015a Page 28). A comprehensive and transparent evaluation mechanism is also called for to specify the next step for building MPA networks (EEA 2015a).

Despite of these challenges in the EU MPA network planning, the experience from the EU could provide China with inspiration on a broad scheme of creating MPA networks in coordination with coastal provinces. The ecosystem-based approach introduced by the MSFD and MSPD offers an opportunity to apply a holistic approach for the MPA network designation and management. The MSPD, in particular, shares similarity with China’s Marine Functional Zoning, and hence may be useful in China’s setting. In addition, the RSCs enforced in the EU could facilitate China’s initiatives at a regional scale.

#### **4.6 Philippines**

The Philippines has established over 1,200 MPAs throughout its territory and most of MPAs have been designated and managed by communities in collaboration with local governments (Arceo et al. 2008). Reviews have proved that these community-based MPAs are somewhat successful in gaining community acceptance and achieving local-scale fisheries and conservation goals (Alcala and Russ 2006; Govan et al. 2009; Horigue et al. 2012). However, the localized scoping makes MPAs in the Philippines unable to address issues happening in a large

scale, such as regional-scale ecological processes and resilience to climate change (Weeks et al. 2010; Horigue 2012). Furthermore, many of these MPAs in the Philippines can be considered as “paper parks” due to the lack of enforcement (Arceo et al. 2008; Campo and Aliño 2008; Horigue et al. 2012). Motivated by the interest to enhance fisheries management, biodiversity conservation, and individual MPAs performance, as well as to attract fishery and tourism investments related to the good environmental governance commitments, numerous efforts have been made to scale up individual, locally-managed MPAs to form social and ecological networks (Christie and White 2007; Lowry et al. 2009; Armada et al. 2009; Eisma-Osorio et al. 2009; ECOGOV 2011; Horigue et al. 2012).

#### **4.6.1 Legal Framework**

In the Philippines, MPAs can be established at a national level under the National Integrated Protected Areas System (NIPAS) Act or at a local (municipality or city) level under the Local Government Code of 1991 (White et al. 2002). The NIPAS Act applies to nationally declared MPAs and primarily serves a broad framework for protected areas in the Philippines (White et al. 2002). Currently, there are 240 MPAs established through the NIPAS and the remainders are established under the Local Government Code of 1991, which granted local government units (LGUs), namely the barangay, municipality, city and province, the authority to manage coastal and marine resources out to 15 kilometers offshore (Vu 2014). The Code has also been considered as one key factor that contributes to the growth in number of municipal MPAs in the Philippines (White et al. 2002). Furthermore, the Fisheries Code provides for the establishment of MPAs to conserve fisheries (White et al. 2006).

#### 4.6.2 Institutional Structure

In the Philippines, three authorities are responsible for the establishment and management of MPAs, including the Department of Environment and Natural Resources (DENR), the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), and the LGUs (White et al. 2006). Both national departments have different foci in protection but their mandates may sometimes overlap. In addition, the DENR has been assigned with the authority over-all nationally designated MPAs through the NIPAS Act (White et al. 2006). The Protected Area Management Board (PAMB), in particular, was established under the DENR as required by the NIPAS Act to guide the overall of MPAs (White et al. 2002). The DA-BFAR is mandated in the Fisheries Code of 1998 with an emphasis on managing fishery and aquatic resources (White et al. 2006).

Although the DENR and the DA-BFAR have been playing a central role in the implementation of the national policy framework, active MPAs and MPA networks planning are undertaken by LGUs (White et al. 2002; Lowry et al. 2009). “Municipal fish sanctuaries and marine reserves can be established solely through a municipal ordinance without national government approval” (White et al. 2002 Page 10). Even the funding for the conservation may be taken from the LGUs internal revenue allotment (IRA) (White et al. 2002). In terms of MPA networks, inter-local government alliances and other institutional networks, such as MPA Support Network (MSN), have been developed to coordinate MPA efforts and scale up to form MPA networks (Horigue et al. 2012)

### 4.6.3 Methods

Researchers claim that the existing MPAs in the Philippines are already ecologically connected, “with larval dispersal facilitated by hydrodynamic influenced by the archipelagic nature of the country and the monsoon cycles” (Horigue et al. 2012 Page 19; P.M. Aliño pers. comm. as cited in Horigue et al. 2012; G. Russ pers. Comm. as cited in Horigue et al. 2012). In addition, MPA sites are mostly adjacent with each other and, hence, can be considered as networks (Horigue et al. 2012). Therefore, the development of MPAs in the Philippines is scoped as scaling up to “fishing grounds, entire bays and gulfs, marine biodiversity corridors and seascapes”, which will eventually contribute to the national network of MPAs (Horigue et al. 2012 Page 19). In addition to the scale-up, new MPA sites would be designated based habitats representation, presence of species of special interest, larval connectivity, resource uses, and others (CI-Philippines 2009). Increasing the no-take MPAs proportion is also being called for to reinforce the protection (CI-Philippine 2009).

In order to achieve the goal of scaling individual, locally-managed MPAs up to MPA networks, the Philippines started the work from developing social, institutional and learning networks (Lowry et al. 2009). A number of social networks have been established in the Philippines regionally and nationally, such as Coastal Resources Management Network (CRM Net), MPA Management and Monitoring Network (MPA Net), National Aquatic Resources Research and Development System (NARRDS), and Philippine Locally Managed Marine Area Network (PLMMA) (White et al. 2006). At a smaller scale, local governments alliances, for example, alliance of neighboring municipal governments, has been adopted as a popular means for networking through facilitating information sharing and community-based management

across borders (Lowry et al. 2009). This innovative formation of collaborative partnerships has proved effective at easing the conflicts between local governments by sharing managing costs and patrolling responsibility (Horigue et al. 2012).

#### **4.6.4 Level of Science for the MPA Network Design**

Information required for the planning of MPAs and MPA networks covers an assessment of environmental and resource use patterns, identification of issues and concerns, socio-economic conditions and a stakeholders analysis (White et al. 2006). The stakeholder analysis, as a focus of the preparation for the establishment of MPAs, will draw out the stakeholder groups who will benefit from and who will pay the cost for a MPA (White et al. 2006). Another approach recommended to take is to understand the linkages of geomorphology of the basins and the role of bottom topography in ocean circulation among basins, as well as, identify the marine corridors that connect major biogeographic regions (White et al. 2006; Lowry et al. 2009).

#### **4.6.5 Stakeholder Engagement**

Because most MPAs in the Philippines are managed by communities or local governments, stakeholders are considered as a key player throughout the decision-making process and their benefits from a MPA are prioritized in the planning (White et al. 2006; Lowry et al. 2009). As noted earlier, stakeholders are identified in the preparation process, with an analysis of benefits and costs from the stakeholder perspective. In addition, community education is provided to inform stakeholders the essence and objective of the project and ultimately support their decision-making (White et al. 2002). There are different experiences in many other jurisdictions where stakeholders are involved solely through consultation, local community members in the Philippines are encouraged to contribute to the baseline data

collection as well as monitoring and evaluation, though this would require communities should be well mentored (White et al. 2006).

#### **4.6.6 Trade-offs between Economic Development and Conservation**

In the Philippine's context, competing priorities of marine uses mostly occur at a stakeholder level. There are cases where fishers oppose the establishment of MPAs because they perceive that other marine users, such as tourism operators and recreation divers, have access to the areas and can benefit from MPAs, while they will be deprived of the fishing grounds (Balgos 2005). Furthermore, the Integrated Coastal Management (ICM) has been adopted and applied in the Philippines that aims to integrate conservation into the socio-economic context (White et al. 2006; Balgos 2005). However, it is argued that LGUs actually have limited capacity in conducting the trade-off between environmental protection and social welfare and infrastructure development programs as a result insufficient financing to support the LGUs to execute the devolved functions of ICM (Balgos 2005).

#### **4.6.7 Monitoring and Evaluation**

Monitoring and evaluation are regarded as a critical means to improve the MPA management and promote MPA networks in the Philippines. As mentioned earlier, many MPAs in the Philippines are considered to be poorly managed or "paper parks" and previous assessment showed that only 10-15% of the MPAs were effectively managed. Recent studies claimed an increase of effective MPAs to 20-30%, primarily attributed to the application of an MPA management effectiveness rating system, with a focus on governance indicators (White et al. 2006; Arceo et al. 2008; Alcala et al. 2008). Other surveys on biophysical conditions are also undertaken to determine if the MPA sites meet the ecological objective (White et al. 2006).

#### **4.6.8 Summary**

The MPA networks, in the Philippine's context, are characterized by both social and ecological connectivity (White et al. 2006). In particular, social networks, which have been developed through local governments alliances and national and regional institutional networks, can contribute to the improvement of management of MPAs where there is political will and local benefit. This innovative approach to scale up individual sites to networks could be helpful for China considering the similarity of both countries with respect to the institutional structure where local governments are playing a critical role in the MPA designation and management and the wide range of MPA performance over the nation. In the meantime, the shortcomings of this approach are obvious. The social networks or alliances can be constrained by a variety of factors, such as a lack of sustainable financing and political interest changes of leadership (Horigue et al. 2012). Furthermore, the alliances usually have "limited capacity to design MPA networks with region-scale and ecosystem-based perspectives" (Horigue et al. 2012 Page 23). Therefore, a key lesson for the development of an ecologically and socially connected MPA network would be how to set up a national framework that could draw benefits from social networks but also could make sure the information is efficiently delivered downwards and upwards through different levels of governance.

#### **4.7 Summary**

The review above of experience and practices of these jurisdictions in developing MPA networks reveals a lot of similarities. First, to create a network at a national level, an inter-departmental management body seems necessary in coordinating the network and facilitating communication across levels of governance, for example, the MPA Center in the U.S., the

ANZECC TFMPA in Australia, and PAMB in the Philippines. Second, common approaches, including clear statement of goals, objectives, selection criteria, and evaluation methods, could be a crucial to the implementation and management effectiveness of MPA networks. Third, as for the information required for the preparation of the network design, a combination of scientific data and community knowledge has been widely used over these jurisdictions. Fourth, all of these jurisdictions take a variety of forms of stakeholder engagement supported by shared data, including representation in the regional or local advisory councils, consultation on the MPA proposal, and involvement in the baseline data collection and evaluation processes. Fifth, socio-economic analysis is required in most jurisdictions to identify and reduce the impact of MPA on key industries and livelihoods, while specific management tools could vary by countries depending on the financing and policy players' perception of conflicts and interests. Finally, it is widely recognized that monitoring and evaluation is a significant means to improve the management effectiveness and frame the high-level goals. Evaluation indicators should also be carefully designed based on the goals and objectives.

Approaches taken by these jurisdictions differ from each other as a result of varying perceptions of problems, goals, as well as existing legal frameworks and governance systems. Management tools adopted and applied by the jurisdictions above can be divided broadly into three types. The first is through the bioregional planning. Countries like Canada, Australia, and New Zealand are developing representative networks of MPAs consistent with the marine bioregional planning, which requires significant inputs from the scientific research and gap analysis at a broad scale. The MSFD in EU also recommends the MPA designation within the RSCs mechanism. The second approach is to scale up to social, institutional and learning

networks in order to improve the management effectiveness, which has been applied in the Philippines. The last strategy is to create an inventory of MPAs as applied in the national system of MPAs in the U.S. Table 11 summarizes the experience and practice from those jurisdictions reviewed in this thesis.

**Table 11.** Summary of National Practice in Developing MPA Networks

Jurisdictions	Legal Framework	Institutional Structure	Methods for Designation	Level of Science for the Network Design	Stakeholder Engagement	Trade-off Analysis	Monitoring and Evaluation
US	<p>Presidential Executive Order 13158 of 2000</p> <p>A Framework for the National System of MPAs</p> <p>A spectrum of Federal laws support MPAs of various purposes</p>	<p>Relevant agencies at federal, state, and local levels are involved in the designation and management</p> <p>The MPA Center coordinates the national system with the assistance of MPA FAC</p>	<p>Provide common goals and selection criteria for the inclusion of the national system</p> <p>Gap analysis</p> <p>No design criteria for the ecological network</p>	<p>Best available science, including natural science, social science, and local knowledge</p>	<p>FAC at national level and council committee at site level</p>	<p>Not considered yet</p> <p>Socio-economic analysis may be conducted at a site level</p>	<p>Not developed yet at a national level, but would prefer an adaptive management system</p>
Canada	<p>The 1996 Oceans Act</p> <p>A set of implementation documents</p> <p>Mandates under three federal departments</p>	<p>National level: Fisheries and Oceans Canada, Environment Canada, and the Parks Canada</p> <p>The existing multi-sector IOM governance structure</p>	<p>Bioregional approach consistent with the broader IOM initiative</p>	<p>Scientific, traditional, economic and community information for the bioregion</p> <p>Workshops for incorporating scientific advice into policy making</p>	<p>Stakeholders are involved through the representation and consultation</p> <p>Internet-based MPA mapping system are accessible for the public</p>	<p>Consider socio-economic impacts within the IOM framework</p> <p>Scenario planning</p>	<p>Not completed yet, but would prefer an adaptive management system</p>

Australia	<p>The EPBC Act and the Ocean Policy</p> <p>Strategic Plan of Action for the NRSMPA and the IMCRA</p> <p>Other Commonwealth legislation also supports diverse types of MPAs within the NRSMPA</p>	<p>Top-down approach through cross-jurisdictional cooperation of the Commonwealth, State and Northern Territory agencies</p> <p>Coordinating role of ANZECC TFMPA</p>	<p>Developed under the MBPs</p> <p>Processes include ecosystem mapping, gap analysis, candidate sites selection, and conservation priority specification based on a set of criteria</p>	<p>Mostly rely on scientific data</p> <p>Community and industry knowledge are also applied</p> <p>Data management systems are developed</p>	<p>Consultation and representation</p> <p>A 90-day public comment period of the proposal</p>	<p>Not mentioned for the commonwealth component of the NRSMPA, but considered in a regional MPA planning, with the use of Marxan with Zones</p>	<p>Required at a site, system, and bioregion level</p> <p>Two sets of indicators: outcome-based and process-based indicators</p>
New Zealand	<p>The MPA Policy</p> <p>A new proposed MPA Act is under review</p> <p>A combination of marine management tools are developed under a spectrum of legislations</p>	<p>DOC and MOF, in collaboration with regional councils</p> <p>Responsible agencies vary by scales</p>	<p>A science-based approach consistent with habitat and ecosystem classification and an inventory of MPAs</p> <p>A national-scale gap analysis</p>	<p>A combination of bioregion data and expert knowledge from scientists and stakeholders</p>	<p>Consultation and representation</p> <p>An interactive internet-based MPA information system is accessible</p>	<p>Provide compensation for commercial fisheries and avoid conflicts with significant industries (recommended by the proposed MPA Act)</p>	<p>Assess the performance of the network with a focus on individual MPAs' biodiversity objectives and effectiveness of the MPA management tools</p>
European Union	<p>The Habitats and Birds Directive, the</p>	<p>Member States are responsible for the</p>	<p>MPAs and MPA networks can be</p>	<p>An analysis of biophysical</p>	<p>Public consultation</p>	<p>Minimize the socio-economic</p>	<p>No overview has been developed yet</p>

	CFP, the MSFD, and the Natura 2000 Network	MPAs designation and planning under the RSCs, the CIS mechanism, and other institutional cooperation structures	established under the Natura 2000 Network, RSCs, and national legislation	conditions of, and pressure and impacts on the waters required within each marine region  Socio-economic analysis of marine uses are required	Stakeholder representation in RSCs and a variety of advisory councils	impacts through an assessment of social and economic conditions  MSP may be applied to manage marine uses	Standardized methods are called for the comparison across marine regions
The Philippines	NIPAS Act, the Local Government Code of 1991, and the Fisheries Code	National level: DENR and DA-BFAR, with the assistance of PAMB  Local level: LGUSs	Scaling individual MPAs up to networks  Develop criteria for the selection of new MPAs  Expand the proportion of no-take MPAs  Develop social networks and inter-local governments alliances	Assessment of environmental and resource use conditions and stakeholder analysis  Identification of marine corridors that connect major biogeographic regions	Consultation for the proposal  Involvement in the monitoring and evaluation  Community education is provided	MPAs are attempted to be incorporated into the ICM scheme, but the enforcement is a problem	Develop a MPA management effective rating system and conduct biophysical surveys

## Chapter 5 Establishing MPA Networks in China

As noted in Chapter 2, China has committed to expanding the MPA coverage in its coastal and marine areas to 5% by 2020 and called for an area-based protection by creating an “ecological barrier” connected by islands and MPAs under its jurisdiction (The State Council 2015). At the same time, China is confronting a set of challenges in its current MPA planning and management. They include 1) a lack of systematic planning of MPAs at a national scale, 2) inefficient governance mechanisms, 3) limited capacity of local governments in managing MPAs, especially in dealing with the conflict of protection and resource uses, 4) the tension between local communities and MPA authorities as a result of inadequate stakeholder engagement, 5) insufficiency of financing and other resources, and 6) inadequate monitoring and evaluation. Given the gap between China’s commitments and current status of MPAs, this chapter offers four frameworks based on findings in Chapter 3 and responses from interviewees for China to create its MPA networks, taking into account the challenges identified above. I first describe the frameworks and then they are evaluated with respect to overcoming the challenges faced by China in developing a MPA network.

### **5.1. Framework 1: Create a National System with an Inventory of MPAs**

This scenario is similar to the U.S. national system of MPAs that provides common selection criteria for the network and improve capacity over MPAs, instead of focusing on the ecological connectivity. The network is developed in a top-down approach in this framework. To ensure the implementation, a national framework of MPA networks would be expected to guide the national efforts, and a national coordinating agency can be established to support the network

by offering information, technologies, and strategies such as the role of the MPA Center in the U.S. As recognized in the experience in other countries, it is important to create an inventory of MPAs to build a national network (National Marine Protected Areas Center 2015; Ministry of Fisheries and Department of Conservation 2008). The case of the U.S. and New Zealand has indicated that the inventory of MPAs can maintain baseline information, provide basis for the gap analysis and prioritization identification at a national scale, and eventually assist the development of ecological networks of MPAs (National Marine Protected Areas Center 2015; Ministry of Fisheries and Department of Conservation 2008).

Currently, China has an inventory of MNRs and SMPAs both at a national level. This inventory covers the location, size, protection targets, management authority, and year of establishment, but lacks a spatial and functional component that could allow a more organized and comprehensive analysis of the dataset. Furthermore, the remainder of MPAs, accounting for almost two-thirds of the total number of MPAs in China, has not yet been documented. Therefore, one possible approach for China to fill this knowledge gap and assist in the creation of the network is to update the inventory. The ideal inventory could include not only the MNRs and SMPAs at all levels but also the de facto sites compatible with the common goals of the network, which may include Aquatic Germplasm Resources Conservation Zones, seasonally closed fishing areas, underwater cultural heritage sites, prohibited navigation zones, and military areas. In addition, a GIS-based spatial component can be introduced to provide a better display of MPAs and operation on the database. Managerial component of each MPA sites can also be incorporated into the inventory as New Zealand adopted, such as infrastructure, personnel, and management effectiveness that can be obtained through a management rating system like the Philippines.

In the Chinese context, creating such a national system could be meaningful to address the disorder and competition of government departments in designating and managing MPAs and enhance the coherence of MPAs to reach the goal. Furthermore, the development of a national inventory would fill an information gap and provide the basis for a comprehensive and systematic planning in a top-down approach. Nevertheless, having the inventory is not enough to reach the goal of expanding the MPA coverage to 5%. Other management tools should be combined with the inventory to expand the network, for example, identify conservation and management gaps and design MPA selection criteria consistent with the overarching goal. Another challenge of the implementation is the political willingness as interviewees have noted. This would further affect the adjustment of existing institutional structure and investment for the update of inventory.

## **5.2 Framework 2: Develop Social Networks**

Different from Framework 1 that stays at a national level, this Framework proposes a decentralized or bottom-up approach to scale up individual MPAs to networks. This alternative is based on the model used in some areas of the Philippines, reflecting the crucial role of local governments as well as their limited capacity in designating, and planning and managing MPAs. As described in Chapter 2, there is no mechanism that offers an opportunity for MPA managers, stakeholders, the public and other private sectors to communicate and collaborate in China. Limited funding sources, the lack of knowledge of MPA management, and conflicts between local communities and MPA authorities have led to the unimpressive management of MPAs in China. The development of social networks could be expected to address this problem by building consensus on common issues, fostering information sharing, institutionalizing the

mechanisms for administration, improving social acceptance, and promoting sustainable financing (White et al. 2006). Within this scenario, local governments might also be able to develop capacity to deal with the conflicts between socio-economic interests and ecological objectives as well as the conflicts with local communities, with more comprehensive knowledge regarding the management of MPAs. Furthermore, the case of the Philippines indicates that neighboring local governments can share the cost of monitoring and responsibility of patrolling (Horigue et al. 2012). Social networks can be established at all levels, ranging from local government alliances to regional institutional and learning networks.

Horizontally, networks can also be categorized by sector, such as baseline data collection, monitoring and evaluation, or by types, such as MNRs, SMPAs, and Marine Parks. Recognizing the synergic ecological, social and economic benefits that can be created by social networks, possible sites to implement this Framework can be the region with a cluster of adjacent MPA sites, such as Shandong Province where four national MNRs and 17 National SMPAs have been established.

Regarding feasibility, the deep concerns on how to improve the management effectiveness of MPAs in China might make this Framework feasible (Researcher 1 and Government 1). In addition, Researcher 1 suggests that information sharing can be an important strategy to enhance the performance of MPAs in China. The recent project in networking protected areas to restore estuarine biodiversity with a social network perspective also depicts China's interest in this idea of social network (SOA et al. 2012). Given the fact that the administrative boundary restricts the size and boundary design of existing MPAs, the formation of institutional networks across boundaries could be a significant step to take for the further

development of ecological networks. Still social networks have limited ability to protect ecological processes at a large scale. They are also unable to provide adequate protection for areas of significant values but not yet designated as MPAs. Through scaling up to networks, it is important to ensure the consistency with national policies, which would require an efficient mechanism to connect the social networks with the central government policies and vice versa.

### **5.3 Framework 3: Develop Regional MPA Networks**

An alternative Framework is to establish ecological networks of MPAs at a regional scale, based on interviewees' suggestions and the current network-related projects in China. In this case, the network could be designed for a variety of goals and objectives based on the needs of the region. For example, it can be developed for the purpose of biodiversity conservation and located in a region with abundant biodiversity but not yet adequately protected. Potential sites can be the priority areas identified in the National Biodiversity Strategy and Action Plan (CBD 2011). Specifically, these may include the East China Sea along Zhejiang and Fujian Provinces, as suggested by Manager 1, and the South China Sea. The East China Sea along Zhejiang and Fujian Provinces is in the progress of developing a regional network based on Nanji Island National Marine Nature Reserve (Manager 1), and the South China Sea has internationally important habitats and resources while is under serious threats of loss, degradation, and pollution (Vu 2014). The network can also be developed to protect rare and endangered species or species with significant values (Researcher 1). Chinese white dolphin (*Sousa chinensis*) and spotted seals (*Phoca largha*) are two example species that are under the consideration for creating MPA networks in Pearl River Delta and the Bohai Sea respectively (Conservation International 2016; ADSSNMNR and LOFSRI 2015). Also, a region with significant social and economic values

can be considered to develop an MPA network. For instance, SMPAs and marine parks can be connected as a network to maximize the benefits from tourism but also maintain the ecological performance as the network of marine parks as seen in the case of South Australia. The specific design criteria for the regional networks can be determined by regional authorities, experts, and stakeholders, which may include biophysical conditions, representation of habitats, larval connectivity, presence of species, and existing resource use patterns. To ensure that the governance mechanism will match with the spatial scale of MPA networks, it is critical to enhance the interaction of different levels of governments by establishing a coordinating agency or institutional networks. Because an ICM scheme has been proposed and applied in several coastal cities in China with a recommendation of creating regional councils, this management mechanism of ICM could be likely to be used to manage regional MPA networks (Zhao et al. 2012; Academia 1). Under this Framework, collaborative strategies can also be developed for attracting investments and monitoring and evaluation.

In comparison with a national MPA network, a network at a regional scale could be more feasible to implement. It requires fewer inputs than the national initiative without a compromise of addressing major environmental and ecological concerns in marine areas and the goal of expanding the MPA coverage by designating new sites. Furthermore, the alternative of regional MPA networks reflects the variable management capacity and various needs across regions. However, this approach is unable to protect and manage coastal and marine areas in a systematic and holistic way. The development of regional networks would be likely to become opportunistic rather than offer a comprehensive planning through an ecosystem-based approach.

#### **5.4 Framework 4: Develop a National Representative MPA Network**

The last Framework to be considered is to establish a national representative network of MPAs, based on the approaches taken by Canada, Australia, and New Zealand. According to the findings in Chapter 3, the development of a representative network of MPAs heavily relies on an appropriate national framework consistent with the existing legislation and a set of strategic implementation plans. This would also require China to enact a more comprehensive legislation that could incorporate laws and regulations relevant to MNRs, SMPAs and other management measures, as well as provide a guideline to lead the national efforts to create a network. The practice from the EU indicates that standardization is important factor to create a successful MPA network. For China, a nation consisting of 10 coastal provinces that takes decentralized approach in the MPA designation, standardization would also be crucial in the implementation. Therefore, several components can be considered to be included in the proposed legislation, i.e., overarching goals and objectives, the institutional structure, design processes, criteria, stakeholder involvement, socio-economic considerations, and monitoring and evaluation. The goals and objectives of networks, especially, should be determined through an open and transparent process and reflect both the needs of a network and the objectives of individual MPAs (IUCN 2008). Plus, in China's context, socio-economic perspectives should be fully considered in the goal setting process and network design principles. Social-economic impacts analysis and scenario modeling can be utilized to minimize the potential conflicts between traditional uses or significant industries and conservation. In addition, an inter-departmental management body would be recommended to coordinate the national network and facilitate the communication across departments and levels of governance. With respect to the implementation, the national network can be designed through a marine bioregional planning. Four large marine

ecosystems (LMEs) have been identified in China: the Yellow Sea, the East China Sea, the Kuroshio Current, and the South China Sea (Qiu et al. 2008). Many research institutions and administrative agencies are also established in each region supporting the scientific research and management of its sea areas, which provides a basis for the implementation of marine bioregional planning. Finally, “MPA networks are not created rapidly, but evolve over time with good planning” (White et al. 2006 Page 58). Thus, it is important to develop a monitoring and evaluation system in collaboration with local agencies and build an adaptive management mechanism to ensure the network can evolve and ultimately achieve its goal.

Framework 4 can be considered as the ideal approach of all the scenarios in terms of conservation outcomes by offering a holistic approach to protect the marine environment and resources and address the current issues in the MPA management. Implementation of this Framework can be seen as a significant reformulation of MPA policy in China and would require a strong political commitment and support from a national level. Significant costs would be required to implement the legislation, scientific research, and capacity building would also be expected in this Framework.

### **5.5 Evaluation of the Ability of Four Frameworks to Address the Challenges in Current MPA Practice in China**

Overall, these four Frameworks help address some of the current challenges with different focus (Table 12). Framework 1, which creates a national system with an inventory, could be helpful in providing a basis for the systematic and comprehensive planning, fostering the legislation, and improving the governance mechanism at a national level. However, it has limited contributions to the development of an ecological network. The capability of this Framework to address issues at a site level, such as the trade-offs between development and

conservation and tensions between local communities and MPA authorities, might not be as effective as Framework 2 that utilizes a bottom-up approach.

Framework 2 aims to create social networks in a decentralized or bottom-up fashion would be expected to help improve the management capacity of local governments for MPAs and ease the tension with local communities through information sharing and communication. This model could also be helpful in developing sustainable financing strategies (White et al. 2006). Similar to Framework 1, this scenario has limited capability to offer comprehensive and adequate protection. Its scoping would also make it difficult to influence the decision made at a national level, such as development of a national framework.

Framework 3, which calls for development of a regional network, can expand the MPA coverage in China's marine areas, and therefore, meet the commitments. The governance mechanism may also be improved through the application of ICM. Developing regional networks of marine parks and networks for other purposes may also help China better respond to different needs in the region, e.g., the need for economic development. This scenario could be more feasible than Framework 4 – a national representative network – at present, but it still cannot provide a holistic approach for a broad-scale MPA network design.

Framework 4 is expected to not only provide comprehensive and representative protection for marine ecosystems but also improve the overall management effectiveness of MPAs. It can be considered as the optimal alternative to address the most challenges in current practices of MPAs. However, the implementation of this Framework anticipated great barriers, especially from the national willingness to commit and the limited funding so far allocated to this purpose.

**Table 12.** Evaluation of the Ability of Four Frameworks to Address the Challenges in Current MPA Practice in China

Challenges	Unsystematic planning of MPAs	Incompleteness of current laws and regulations	The inefficient governance mechanism and limited capacity of local governments	The conflict between economic development and conservation	Tension between local communities and MPA authorities	Insufficient funding	Monitoring and Evaluation	Political Willingness
Framework 1	Maybe, could be a basis for a systematic planning	Yes	Yes	Maybe, depending on national guidelines	No	No	Maybe	Not very strong
Framework 2	No	No	Yes	Maybe	Yes	Yes	Maybe	Strong
Framework 3	No	No	Yes, through the ICM scheme	Yes	Maybe	Yes	Yes	Good
Framework 4	Yes	Yes	Yes	Yes	Yes	Maybe	Yes	Not strong

The column of national willingness is based on the responses from interviewees. Yes means the framework is able to address the challenge and no means the framework is not able to solve the issue. Maybe means that the framework might be helpful to address the challenge, which may require additional management tools. Strong means that the interviewees present strong willingness to consider the implementation of framework; good means interviewees are interested in the framework but do not have strong willingness to implement it at present; not very strong means that the interviewees do not show some interest for the framework but the willingness to implement it is not very strong; and not strong, which is the least willingness means that interviewees do not have strong willingness to make the framework happen.

## **5.6 Summary**

To sum up, the four Frameworks above provide potential pathways for China to develop a network of MPAs. It should be noted that these Frameworks are not mutually exclusive. Alternatives can be adopted in the different stages and a combination of these alternatives can be applied depending on China's needs. For example, a national system with an inventory and social networks can be developed before creating an ecological network. Alternatively a regional MPA network can be established as a pilot for the further development of a national network. For the implementation of each Framework the following components should be taken into consideration:

First, an appropriate legal framework is fundamental to achieve an effective MPA network (IUCN 2008). Although China has specific legislation and regulations for MNRs and SMPAs separately and an MSP scheme to manage different marine uses, these laws and regulations are considered not adequate to support the systematic planning of MPAs.

Consistency and coherency is another concern without an overarching framework for the integrated management of MPAs and MPA networks. Therefore, creating a strategic legislation framework would be the critical step to take for the development of MPA networks. More importantly, strategic implementation plans should be developed to facilitate the implementation, which may include, but not limited to national guidelines for the implementation with plain and accessible language, designation criteria, statutory procedures of stakeholder engagement, and evaluation indicators.

Second, a well-organized institutional structure contributes to an effective and sustainable MPA network. As noted in Chapter 2, China takes a combination of top-down and bottom-up approach in MPA management. Through the top-down governance, the central government functions as a top policy-making body and a variety of national departments are responsible for overseeing the developing of different types of MPAs. The lack of communication between departments has been a major obstacle for developing MPAs. In contrast, despite the greater power to designate and manage MPA sites, local governments have limited capacity in the MPA management as well as limited experience in engaging stakeholders, without the benefits of bottom-up governance. Given China's long-standing tradition of top-down governance, the role of the central government would be significant in improving the institutional mechanism (Qiu et al. 2009). Some strategies that can be taken by the central government may include establish a coordinating agency to facilitate the communication between different departments and promote standardization for local governments.

Third, data collection and management are fundamental components in the MPA network design. Practice in the countries reviewed above suggests that available science for the planning

could include a regional profile of biophysical features, distribution of key habitats, and socio-economic use patterns. Community knowledge and stakeholder analysis are sometimes applied as well. Furthermore, decision-support tools are playing a crucial role in the planning, such as MARXAN that identifies the optimal MPA locations with defined objectives (Center for Ocean Solutions 2011). These experiences may inform China to put the focus on a variety sources of information and compile the data to support the decision-making.

Fourth, stakeholder engagement can be considered as an important factor to promote the development of a successful MPA network in China, especially given the conflict between traditional uses and MPA authorities. Many types of potential stakeholder participation can be taken into account, ranging from communication and consultation, where participation is relatively informal, to negotiation, where decision-making power is shared among stakeholders (Pomeroy and Douvere 2008). In addition, stakeholders can be involved not only in the preparation process but only in the monitoring and evaluation (White et al. 2006). Most importantly, experience from Canada, New Zealand, and the Philippines indicate that an effective stakeholder engagement is predicated on information accessibility, which would require China to create a much more open and transparent procedure to involve stakeholders.

Fifth, “economic and social considerations are fundamental pillars of sustainable development and important components of best practice for planning and implementing MPA networks” (IUCN 2008 Page 20). In China’s context, social and economic benefits and impacts of MPAs and MPA networks have largely been overlooked. One solution could be a community-wide education with a presentation of the best practices in China or other jurisdictions. Furthermore, although compensation has been promoted in some cases to ease impacts on

resource users, conflicts between economic development and conservation remain a big issue in the MPA design. The review in Chapter 3 indicates that the resolution mostly relies on the interest and perception of policy players, which would refer to the central government and local governments in China's case. Because the central government has adopted and applied the construct of "Ecological Civilization" to seek the balance of development and protection, it is critical to ensure responsibilities for achieving this objective are devolved to local governments. Considering that decisions made by local governments are usually prone to economic interests as a requirement of promotion, ecological and conservation dimensions should be included into the promotion indicators as well. Additionally, the central government can play an active role in building stationary processes for socio-economic impact analysis and provide technical support for local governments.

Sixth, creating and maintaining MPA networks requires sustainable financing. Different from individual MPAs that are frequently supported by local governments or national funding, the MPA networks should seek a sound financing strategy to achieve the long-term conservation goal. Four main elements of a successful financing strategy are suggested by IUCN: 1) sharing costs and management responsibilities, 2) building diverse portfolios, 3) creating administrative and governance systems to track and report the spending, and 4) political support for implementation (IUCN 2008).

Last but not least, monitoring and evaluation provide feedback that assists an adaptive management of MPAs. This would require a careful design of monitoring and evaluation indicators consistent with the goals and objectives of the MPA network at an early stage (IUCN 2008). As suggested in the case of EU, the indicators should also allow the comparability of

indicators across borders. Besides, the evaluation should be undertaken in an independent and transparent process.

## Chapter 6 Conclusions

In order to help China to develop its MPA networks and to address major issues in MPA development, this thesis reviews the current status of MPAs in China and evaluates four Frameworks for China to consider as it develops its MPA networks with consideration of the barriers. This research applies a qualitative approach by using literature review regarding experiences of developing MPA networks in the U.S., Canada, Australia, New Zealand, EU, and the Philippines. A semi-structured interview technique is also used to collect information in China concerning opinions from government agencies, researchers, MPA managers, and academia with respect to the network development.

As a way to assess possibilities, four Frameworks are developed with an analysis of pros and cons. These Frameworks include: 1) creating a national system with an inventory of MPAs, 2) developing social networks, 3) developing regional ecological networks of MPAs, and 4) developing a national representative network. The first two Frameworks are more focused on the enhancement of governance system through connecting individual MPAs as a social, institutional, and learning network, which could provide opportunities for creating an ecologically coherent network, while Frameworks 3 and 4 give an emphasis on the ecological connectivity and representativeness at regional and national scales. Given different focuses of each Framework, elements can be applied at different stages and a combination of scenarios can be used depending on China's needs.

Furthermore, responding to the barriers in the current planning and management of MPAs in China, this study concludes with several recommendations for the implementation of MPA networks as follows:

1. Develop an overarching legal framework to guide the systematic and strategic planning of effective MPA networks.
2. The central government should take an active role in improving a governance mechanism, such as establishing a coordinating agency and set up a standardized procedure for local governments to use in MPA designation.
3. Building the capacity of local governments can be achieved through creating social networks.
4. In addition to the core funding, innovative financing strategies should be developed to help achieve the long-term goal.
5. A combination of scientific information and community knowledge should be applied in the MPA network planning. Socio-economic benefits and impacts should be fully considered. Modeling software can also be provided to support the decision-making.
6. A higher level of stakeholder engagement should be promoted, for example, establishing an advisory committee, to facilitate information sharing.
7. Establish long-term monitoring programs for MPAs and independent evaluation processes. Monitoring and evaluation indicators should be carefully designed consistent with the goals and objectives. Also, indicators should allow the comparability between different regions.

## References

- ADSSNMNR (Administration of Dalian Spotted Seals National Marine Nature Reserve), and LOFSRI (Liaoning Oceans and Fisheries Science Research Institute). (2015). Scientific Report of Dalian Spotted Seals National Marine Nature Reserve.
- Alcala, A. C., and Russ, G. R. (2006). No-take marine reserves and reef fisheries management in the Philippines: a new people power revolution. *AMBIO: A Journal of the Human Environment*, 35(5), 245-254.
- Almany, G. R., Connolly, S. R., Heath, D. D., Hogan, J. D., Jones, G. P., McCook, L. J., ... and Williamson, D. H. (2009). Connectivity, biodiversity conservation and the design of marine reserve networks for coral reefs. *Coral Reefs*, 28(2), 339-351.
- ANZECC (Australian and New Zealand Environment and Conservation Council). (1998). Guidelines for Establishing the NRSMPA. Retrieved from <http://www.environment.gov.au/system/files/resources/b5a7d0e1-ad86-4a24-8b34-ae9b49d8a2d0/files/nrsmpa-establishing-guidelines.pdf> (Accessed on March 30 2016).
- ANZECC Task Force on Marine Protected Areas. (1999a). Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments. *Environment Australia*, Canberra.
- ANZECC Task Force on Marine Protected Areas. (1999b). Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments. *Environment Australia*, Canberra.
- Arceo, H. O., Alino, P. M., and Gonzales, R. O. M. (2008). Where are we now with marine protected areas. *Reefs through time*, 145-152.
- Armada, N., White, A. T., and Christie, P. (2009). Managing fisheries resources in Danajon Bank, Bohol, Philippines: an ecosystem-based approach. *Coastal Management*, 37(3-4), 308-330.
- Balgos, M. C. (2005). Integrated coastal management and marine protected areas in the Philippines: concurrent developments. *Ocean & Coastal Management*, 48(11), 972-995.
- California Department of Fish and Wildlife. (2016). California's Marine Protected Area (MPA) Network. [Wildlife.ca.gov](http://wildlife.ca.gov). Retrieved from <https://www.wildlife.ca.gov/Conservation/Marine/MPAs/Network> (Accessed on March 18 2016).
- Campos, W. L., and Aliño, P. M. (2008). Recent advances in the management of marine protected areas in the Philippines. *Kuroshio Science*. 29-34.
- CBD. (Convention on Biological Diversity). (2011). China National Biodiversity Conservation Strategy and Action Plan (2011-2030). Retrieved from <https://www.cbd.int/doc/world/cn/cn-nbsap-v2-en.pdf> (Accessed on February 22, 2016).

- CBD. (Convention on Biological Diversity). (2014a). New Zealand's Fifth National Report to the United Nations Convention on Biological Diversity. Retrieved from <https://www.cbd.int/doc/world/nz/nz-nr-05-en.pdf> (Accessed on April 7, 2016).
- CBD. (Convention on Biological Diversity). (2014b). Fifth Report of the European Union to the Convention on Biological Diversity. Retrieved from <https://www.cbd.int/doc/world/eur/eur-nr-05-en.pdf> (Accessed on April 10, 2016).
- CCICED-TEMP (China Council for International Cooperation on Environment and Development-Task Force on Eco-Compensation Mechanisms and Policies). (2006). Eco-Compensation Mechanisms and Policies in China. Retrieved from <http://www.caep.org.cn/english/paper/CCICED-TF-Summary-Report-on-Eco-compensation-Policy-in-China.pdf> (Accessed on March 12 2016)
- Center for Ocean Solutions. (2011). Decision Guide: Selecting Decision Support Tools for Marine Spatial Planning. The Woods Institute for the Environment, Stanford University, Stanford, California. 54 pp.
- Christie, P., and White, A. T. (2007). Best practices for improved governance of coral reef marine protected areas. *Coral Reefs*, 26(4), 1047-1056.
- Commonwealth of Australia. (1998a). Australia's Oceans Policy. Retrieved from <http://www.environment.gov.au/archive/coasts/oceans-policy/publications/pubs/policyv1.pdf> (Accessed on March 22, 2016).
- Conservation International China. (2016). The Establishment of a MPA Network of Chinese White Dolphin. Retrieved from <http://www.conservation.org.cn/index.php?r=news/view&id=9> (Accessed on April 27 2016).
- Conservation International Philippines. (2009). Scaling up from MPAs to Seascapes: Lessons Learned from the Sulu-Sulawesi Seascape. Quezon City. 72 pp.
- Cropp, A. (2016). Tourism industry wants more say over proposals for marine protected areas. Retrieved from <http://www.stuff.co.nz/business/77870058/Tourism-wants-more-say-over-concession-charges-for-marine-protected-areas> (Accessed on April 7, 2016).
- Cui, F. and Liu, B.Y. (2006). Main problems in marine protected areas in China and the underlying causes. *Journal of Ocean University of China* (Social Science Edition) 2006;2:12–6 [in Chinese].
- Department of Conservation and Ministry of Fisheries. (2005). Marine Protected Areas Policy and Implementation Plan. Wellington, New Zealand. 25 pp.
- Department of Conservation and Ministry of Fisheries. (2011). Coastal marine habitats and marine protected areas in the New Zealand Territorial Sea: a broad scale gap analysis. Retrieved from <http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-protected-areas/coastal-marine-habitats-marine-protected-areas.pdf> (Accessed on April 5, 2016).
- Department of the Environment. (Australia) (n.d.a). Marine Bioregional Plans. Retrieved from <http://www.environment.gov.au/marine/marine-bioregional-plans> (Accessed on April 2. 2016).
- Department of the Environment. (Australia) (n.d.b). Commonwealth Marine Reserves. Retrieved from <http://www.environment.gov.au/topics/marine/marine-reserves/overview/background> (Accessed on April 3, 2016).

- Environment Protection and Biodiversity Conservation Act 1999 (Australia). Retrieved from <https://www.legislation.gov.au/Series/C2004A00485>(Accessed on April 2, 2016)
- Du, J.G., Ye, G.Q., Zhou, Q.L., Chen, B., Hu, W.J. and Zheng, X.Q. (2015). Progress and Prospects of Coastal Ecological Connectivity Studies. *Acta Ecologica Sinica*,2015,35 (21):6923-6933 [in Chinese].
- Dudley, N. (Editor) (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland:IUCN. x + 86pp.
- EC. (European Commission). (2008). Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (MSFD).
- EC. (European Commission). (2015). Maritime spatial planning. Retrieved from [http://ec.europa.eu/maritimeaffairs/policy/maritime\\_spatial\\_planning/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/policy/maritime_spatial_planning/index_en.htm) (Accessed on April 1,2 2016).
- EC. (European Commission). (2016a). Natura 2000. Retrieved from [http://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/index_en.htm)(Accessed on April 12, 2016).
- EC. (European Commission). (2016b). Implementation of EU Coastal and Marine Policy. Retrieved from [http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/implementation/index\\_en.htm](http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/implementation/index_en.htm) (Accessed on April 13, 2016).
- EEA (European Environmental Agency). (2015a). Marine Protected Areas in Europe's Seas-An Overview and Perspectives for the Future. EEA Report No 3/2015. European Environment Agency. Copenhagen, Denmark.
- EEA. (European Environmental Agency). (2015b). State of Europe's seas, EEA Report No 2/2015. European Environment Agency. Copenhagen, Denmark.
- Eisma-Osorio, R. L., Amolo, R. C., Maypa, A. P., White, A. T., and Christie, P. (2009). Scaling up local government initiatives toward ecosystem-based fisheries management in Southeast Cebu Island, Philippines. *Coastal Management*, 37(3-4), 291-307.
- Fang, Z., Wang, H., & Qin, C. (2016). Shandong Released the First Regulation on Ecological Compensation in the Nation. Oceanol.com . Retrieved from <http://oceanol.com/shouye/yaowen/2016-02-19/56721.html> (Accessed on March 1, 2016).
- Fisheries and Oceans Canada. (2002). *Canada's Oceans Strategy*. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/documents/cos-soc/cos-soc-eng.pdf> (Accessed on March 27, 2016).
- Fisheries and Oceans Canada. (2005). *Canada's Oceans Action Plan*. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/documents/oap-pao/oap-eng.pdf> (Accessed March 27, 2016).

- Fisheries and Oceans Canada. (2007). *Health of the Oceans Initiatives*. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/publications/healthyoceans-santedesoceans/index-eng.html> (Accessed on March 26, 2016).
- Fisheries and Oceans Canada. (2009). Canadian Science Advisory Secretariat - CSAS. Retrieved from [http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2009/2009\\_056-eng.htm](http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2009/2009_056-eng.htm) (Accessed on March 26, 2016).
- Fisheries and Oceans Canada. (n.d.a) *Canadian Science Advisory Secretariat - CSAS*. Retrieved from <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm> (Accessed on March 27, 2016).
- Fisheries and Oceans Canada (n.d.b). *Guiding Principles*. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/mpa/guiding-principles-eng.html> (Accessed on March 27, 2016).
- Fisheries and Oceans Canada and WWF-Canada. (2009). Guidance and Lessons Learned for Canada's Marine Protected Areas Networks: Proceedings of a national workshop held in Ottawa in January 2008. Retrieved from <http://www.dfo-mpo.gc.ca/index-eng.htm>. (Accessed on March 27, 2016).
- Franklin, M. (2010). Opposition Casts Out a Bait for Miners Who Fish. *The Australian* (July 28). National Parks South Australia. (2014). About Marine Parks. Retrieved from <http://www.environment.sa.gov.au/marineparks/About> (Accessed on April 2, 2016).
- G. K. Lowry, A. T. White and P. Christie (2009) Scaling Up to Networks of Marine Protected Areas in the Philippines: Biophysical, Legal, Institutional, and Social Considerations, *Coastal Management*, 37:3-4, 274-290.
- Gleason, M., McCreary, S., Miller-Henson, M., Ugoretz, J., Fox, E., Merrifield, M., ... and Hoffman, K. (2010). Science-based and stakeholder-driven marine protected area network planning: A successful case study from north central California. *Ocean & Coastal Management*, 53(2), 52-68.
- Govan, H. et al. 2009. Status and potential of locally-managed marine areas in the South Pacific: meeting nature conservation and sustainable livelihood targets through wide-spread implementation of LMMAs. SPREP/WWF/WorldFish-Reefbase/CRISP. 95pp + 5 annexes
- Government of Canada. (2005). *Canada's Federal Marine Protected Areas Strategy*. Ottawa, Ontario: Communications Branch, Fisheries and Oceans Canada. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/documents/fedmpa-zpmfed/mpa-eng.pdf> (Accessed on March 27, 2016).
- Government of Canada. (2010). Spotlight on Marine Protected Areas in Canada. Fisheries and Oceans Canada. Ottawa. 24 pp
- Government of Canada. (2011). National Framework for Canada's Network of Marine Protected Areas. Fisheries and Oceans Canada, Ottawa. 31 pp. Retrieved from <http://www.dfo-mpo.gc.ca/oceans/documents/dmpaf-eczpm/framework-cadre2011-eng.pdf> (Accessed on March 27, 2016)
- Gray, E., and Jones, C. (2012). Eco-Compensation in China: Opportunities for Payments for Watershed Services | World Resources Institute. Wri.org. Retrieved from

- <http://www.wri.org/blog/2012/05/eco-compensation-china-opportunities-payments-watershed-services>(Accessed on February 27, 2016).
- Gulf and Caribbean Fisheries Institute. (2016). CaMPAM Network and Forum. Retrieved from <http://campam.gcfi.org>(Accessed on March 18, 2016).
- Hennink, M., Hutter, I., and Bailey, A. (2010). *Qualitative Research Methods*. London: SAGE.
- Horigue, V., Aliño, P. M., White, A. T., and Pressey, R. L. (2012). Marine protected area networks in the Philippines: Trends and challenges for establishment and governance. *Ocean & Coastal Management*, 64, 15-26.
- Huang, Z. (1994). Marine Species and its (*sic*) Distribution in China. Beijing: Marine Publishing House [in Chinese].
- Huang N., Yang M.H., Lin Z.L., Yang, D.W., and Huang Y.F. (2012). Landscape pattern changes of Xiamen coastal zone and their impacts on local ecological security. *Chinese Journal of Ecology*, 31(12), 3193-3202 [in Chinese].
- Huang X.Y., Li F., and Chen J.K. (2016). Reserve network planning for fishes in the middle and lower Yangtze River basin by systematic conservation approaches. *Science China Life Science*, 59: in press, doi: 10.1007/s11427-015-4950-0
- IEEP and NRDC (Institute for European Environmental Policy and Natural Resources Defense Council). (2008). Marine Protected Areas in Europe and the United States. <http://www.ieep.eu/projectminisites/t-page/>. 67 pp.
- IMCRA (Interim Marine and Coastal Regionalisation for Australia) Technical Group. (1998). Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments. Version 3.3. Environment Australia, Commonwealth Department of the Environment. Canberra. 102 pp. Retrieved from <https://www.environment.gov.au/resource/interim-marine-and-coastal-regionalisation-australia-version-33>. (Accessed on March 13, 2016).
- IUCN-WCPA (IUCN World Commission on Protected Areas). 2007. Establishing Networks of Marine Protected Areas: A Guide for Developing National and Regional Capacity for Building MPA Networks. Non-technical summary report. Retrieved from [http://www.uicn.fr/IMG/pdf/Etablir\\_des\\_reseaux\\_d\\_AMP.pdf](http://www.uicn.fr/IMG/pdf/Etablir_des_reseaux_d_AMP.pdf) (Accessed on February 27, 2016)
- IUCN-WCPA (IUCN World Commission on Protected Areas). (2008). Establishing Marine Protected Area Networks—Making It Happen. IUCN-WCPA, National Oceanic and Atmospheric Administration and The Nature Conservancy. Washington, D.C., 118 p.
- Jim, C. Y., and Xu, S. S. (2004). Recent protected-area designation in China: an evaluation of administrative and statutory procedures. *The Geographical Journal*, 170(1), 39-50.
- JNCC (Joint Nature Conservation Committee). (2015). EU Marine Strategy Framework Directive. Retrieved from <http://jncc.defra.gov.uk/page-5193>(Accessed on March 17, 2016).
- Laffoley, D. d'A., (ed.) 2008. Towards Networks of Marine Protected Areas. The MPA Plan of Action for IUCN's World Commission on Protected Areas. IUCN WCPA, Gland, Switzerland. 28 pp.

- Leslie, H., Ruckelshaus, M., Ball, I. R., Andelman, S., and Possingham, H. P. (2003). Using siting algorithms in the design of marine reserve networks. *Ecological Applications*, 13(SI), 185-198.
- Liu, J. (2010). China's road to sustainability. *Science*, 328(5974), 50.
- Liu, J.Y. (2013). Status of marine biodiversity of the China Seas. *PLoS One*, 8(1), e50719.
- Liu, L. (2006). The Study of the Theory and Practice on Marine Special Reserves in Our Country. (Doctoral dissertation). Ocean University of China [in Chinese]. 121 pp.
- Liu, L., Yu, Y.F., and Ma, Y.D. (2013). The Development of Marine Protected Areas in Bohai Sea From the Perspective of Ecological Civilization. *Dong Yue Tribune*, 7, 016 [in Chinese].
- Lu, B., and Zhou, S. (2016). China's state-led working model on protection of underwater cultural heritage: Practice, challenges, and possible solutions. *Marine Policy*, 65, 39-47.
- Ma, C., Zhang, X., Chen, W., Zhang, G., Duan, H., Ju, M., ... and Yang, Z. (2013). China's special marine protected area policy: trade-off between economic development and marine conservation. *Ocean & Coastal Management*, 76, 1-11.
- Marine Protected Areas Federal Advisory Committee. (2009). *Evaluating the National System of Marine Protected Area: Considerations and Planning Tool*. Retrieved from [http://marineprotectedareas.noaa.gov/pdf/fac/mpa\\_fac\\_recommendations\\_91109.pdf](http://marineprotectedareas.noaa.gov/pdf/fac/mpa_fac_recommendations_91109.pdf) (Accessed on February 17, 2016).
- Ministry of Agriculture. China. (2011). Interim Measures for the Administration of Aquatic Germplasm Resources Conservation Zones. Retrieved from <http://en.pkulaw.cn/display.aspx?cgid=144847&lib=law> (Accessed on May 9, 2016).
- Ministry for the Environment. China. (2016). A New Marine Protected Areas Act: Consultation Document. Wellington: Ministry for the Environment. 47 pp.
- Ministry of Environmental Protection. China. (2013). Nature Reserves Inventory. Sts.mep.gov.cn. [in Chinese]. Retrieved from <http://sts.mep.gov.cn/zrbhq/zrbhq/> (Accessed on February 21, 2016).
- Ministry of Fisheries and Department of Conservation, New Zealand. (2008). Marine Protected Areas: Classification, Protection Standard and Implementation Guidelines. Ministry of Fisheries and Department of Conservation, Wellington, New Zealand. 54 pp.
- Ministry of Primary Industries. New Zealand. (2014). Marine Protected Areas. Retrieved from <http://www.fish.govt.nz/en/nz/Environmental/Seabed+Protection+and+Research/MPA/default.htm> (Accessed on April 6, 2016).
- National Academy of Economic Strategy. China (2014, Jan. 8). Tourism Green Paper. [in Chinese]. Retrieved from [http://news.china.com.cn/2014-01/08/content\\_31125749.htm](http://news.china.com.cn/2014-01/08/content_31125749.htm) (Accessed on January 5, 2016).
- NBS (National Bureau of Statistics) China. (2014). China statistical yearbook 2014. Beijing.
- National Marine Protected Areas Center. United States. (2003). *Social Science Research Strategy for Marine Protected Areas*. Retrieved from [http://marineprotectedareas.noaa.gov/pdf/publications/ssr\\_strategy.pdf](http://marineprotectedareas.noaa.gov/pdf/publications/ssr_strategy.pdf) (Accessed on February 27, 2016).

- National Marine Protected Areas Center. United States. (2013). *North American Marine Protected Areas Network*. Retrieved from <http://marineprotectedareas.noaa.gov/nationalsystem/international/nampan/> (Accessed on March 18, 2016).
- National Marine Protected Areas Center. United States. (2014). *MPA Federal Advisory Committee*. Retrieved from <http://marineprotectedareas.noaa.gov/fac/> (Accessed on March 19, 2016).
- National Marine Protected Areas Center. United States. (2015). *Identifying National System Conservation Gaps*. Retrieved from <http://marineprotectedareas.noaa.gov/nationalsystem/conservationgaps/> (Accessed on March 19, 2016).
- National Marine Protected Areas Center. United States. (2015). The Marine Protected Areas Inventory. Retrieved from <http://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/> (Accessed on April 29, 2016).
- NEAMPAN (North East Asia Marine Protected Areas Network). (2014). First Steering Committee of NEAMPAN. Presentation. Retrieved from [http://neaspec.org/sites/default/files/Background%20Presentation%20\(NEAMPAN\).pdf](http://neaspec.org/sites/default/files/Background%20Presentation%20(NEAMPAN).pdf) (Accessed on February 26, 2016).
- NPC and NSTC (National Planning Committee and National Science and Technology Committee). (1994) *China Agenda 21: White Paper on Population, Environment and Development in the 21st Century*. Beijing, China: China Environmental Science Press [in Chinese].
- Neindorf, B., Pittaway, I., & Worthington, B. (2015). *Fishermen affected by SA marine park sanctuary zones in minority*. ABC Rural. Retrieved from <http://www.abc.net.au/news/2015-10-01/one-year-on-for-sa-sanctuary-zone-marine-parks/6819384> (Accessed on April 4, 2016).
- NOAA National Marine Sanctuaries. United States. (2016). *Advisory Councils. Sanctuaries.noaa.gov*. Retrieved from <http://sanctuaries.noaa.gov/management/ac/> (Accessed on March 18, 2016).
- Ocean Development Strategy Research Study Group. (2010). *China's Ocean Development Report*. State Oceanic Administration. Beijing, China :China Ocean Press. [in Chinese].
- Partnership for Interdisciplinary Studies of Coastal Oceans. (2007). *The Science of Marine Reserves* (2nd Edition, International Version). www.piscoweb.org. 22 pages.
- Pittaway, I., and Neindorf, B. (2015). Marine parks sanctuary zone bill to be reintroduced in South Australian parliament. ABC Rural. Retrieved from <http://www.abc.net.au/news/2015-10-02/sach-marine-parks-bill-to-be-reintroduced/6822880> (Accessed on April 4, 2016).
- PISCO (Partnership for Interdisciplinary Studies of Coastal Oceans). (2007). *The Science of Marine Reserves* (2nd Edition, International Version). www.piscoweb.org. 22 pp.
- Pomeroy, R., and Douvère, F. (2008). The engagement of stakeholders in the marine spatial planning process. *Marine Policy*, 32(5), 816-822.
- Pressey, B. (2012). IUCN - Australia creates world's largest network of marine reserves. Iucn.org. Retrieved from [https://iucn.org/news\\_homepage/news\\_by\\_date/2012/?11659/Australia-creates-worlds-largest-network-of-marine-reserves](https://iucn.org/news_homepage/news_by_date/2012/?11659/Australia-creates-worlds-largest-network-of-marine-reserves) (Accessed on April 4, 2016).

- Qiu, J. and Li, M.J. (2005). Major problems of Marine Nature Reserves in China and Solutions. *Chinese Journal of Ocean Development and Management*, 22(4), 30-35 [in Chinese].
- Qiu, W., Wang, B., Jones, P. J., and Axmacher, J. C. (2009). Challenges in developing China's marine protected area system. *Marine Policy*, 33(4), 599-605.
- Qiu, W. (2010). Governing Marine Protected Areas (MPAs) in China: towards the repositioning of the Central State and the empowerment of local communities (Doctoral dissertation, UCL (University College London) UK. 388 pp.
- SBQTS. (2011). Technical Directives for the Designation of Special Marine Protected Area. Beijing, China. [in Chinese].
- SEPA (State Environmental Protection Administration). (2005) China's Third National Report on Implementation of the Convention on Biological Diversity. Beijing.
- SOA (The State Oceanic Administration of China). (1995). Management Measures for the Marine Nature Reserves. Beijing, China. 12pp. [in Chinese].
- SOA (The State Oceanic Administration of China). (1997). Technical Directives for the Division of Marine Functional Zoning. Beijing, China. 20 pp. [in Chinese].
- SOA (The State Oceanic Administration of China). 1998. Principles for Classification of Marine Nature Reserves. Beijing, China. 8 pp. [in Chinese].
- SOA (The State Oceanic Administration of China). (2010a). Management Measure for the Special Marine Protected Areas. Beijing, China. 22 pp. [in Chinese].
- SOA (The State Oceanic Administration of China). (2010b). Standard for the Classification and Categorization of Special Marine Protected Area. Beijing, China. 17 pp. [in Chinese].
- SOA (The State Oceanic Administration of China). (2012, April 18). National Marine Functional Zoning 2011-2020. [in Chinese]. Retrieved from [http://www.soa.gov.cn/zwgk/fwjgwywj/gwyfgwj/201211/t20121105\\_5255.html](http://www.soa.gov.cn/zwgk/fwjgwywj/gwyfgwj/201211/t20121105_5255.html) (Accessed on February 5, 2016).
- SOA (The State Oceanic Administration of China). (2013). The 12th Five-year Planning of Marine Industries. [in Chinese]. Retrieved from [http://www.soa.gov.cn/zwgk/fwjgwywj/shxzfz/201304/t20130411\\_24765.html](http://www.soa.gov.cn/zwgk/fwjgwywj/shxzfz/201304/t20130411_24765.html) (Accessed on February 23, 2016).
- SOA (The State Oceanic Administration of China). (2014). Summary report on marine economic statistics of China 2014. [in Chinese]. Retrieved from [http://www.soa.gov.cn/zwgk/hygb/zghyjjtjgb/201503/t20150318\\_36402.html](http://www.soa.gov.cn/zwgk/hygb/zghyjjtjgb/201503/t20150318_36402.html) (Accessed on January 26, 2016).
- SOA (The State Oceanic Administration of China). (2015). Adding Three National Marine Protected Areas. [in Chinese]. Retrieved from [http://ocean.china.com.cn/2015-05/12/content\\_35548958.htm](http://ocean.china.com.cn/2015-05/12/content_35548958.htm) (Accessed on February 2, 2016).
- Sun, Y. (2002). The State Oceanic Administration Releases the National Marine Functional Zoning Scheme. People.com.cn. [in Chinese]. Retrieved from

- <http://www.people.com.cn/GB/shizheng/3586/20020910/819506.html> (Accessed on February 29, 2016).
- The Philippine Environmental Governance Project (ECOGOV). (2011). Environmental Governance Phase 2 Project Evaluation. Retrieved from [http://pdf.usaid.gov/pdf\\_docs/Pdacr988.pdf](http://pdf.usaid.gov/pdf_docs/Pdacr988.pdf) (Accessed on April 26, 2016).
- The State Council. (1992). The Issue of Administration Plans on Special Marine Protected Areas. [in Chinese] Retrieved from <http://law1.law-star.com/law?fn=chl516s844.txt&truetag=809&titles=&contents=&dbt=chl> (Accessed on February 26, 2016)
- The State Council. (2015). Adding the Coverage of MPAs to 5%. Retrieved from <http://env.people.com.cn/n/2015/0821/c1010-27494361.html> (Accessed on March 1 2016)
- UNEP-WCMC (United Nations Environment Programme - World Conservation Monitoring Centre). (2008). National and Regional Networks of Marine Protected Areas: A Review of Progress. UNEP-WCMC, Cambridge.
- Vince, J. (2014). Oceans governance and marine spatial planning in Australia. *Australian Journal of Maritime & Ocean Affairs*, 6(1), 5-17.
- Vince, J., Smith, A. D., Sainsbury, K. J., Cresswell, I. D., Smith, D. C., and Haward, M. (2015). Australia' s Oceans Policy: Past, present and future. *Marine Policy*, 57, 1-8.
- Vu, H. (2014). Marine Protected Areas Network in the South China Sea. Leiden: Martinus Nijhoff Publishers.
- Wang, P.L. and Han, J.B. (2007). Present status of distribution and protection of Chinese dolphins *Sousa Chinensis* population in Chinese waters. *Marine Environmental Science*, 26(5), 484-487. [in Chinese].
- Weeks, R., Russ, G. R., Alcala, A. C., and White, A. T. (2010). Effectiveness of marine protected areas in the Philippines for biodiversity conservation. *Conservation Biology*, 24(2), 531-540.
- Wenzel, L. (2015). *Framework for the National System of Marine Protected Areas of the United States of America*. Retrieved from <http://marineprotectedareas.noaa.gov/nationalsystem/framework/final-mpa-framework-0315.pdf> (Accessed on March 12, 2016).
- White, A. T., Courtney, C. A., and Salamanca, A. (2002). Experience with marine protected area planning and management in the Philippines. *Coastal Management*, 30(1), 1-26.
- White, A. T., Aliño, P. M., and Meneses, A. B. T. (2006). Creating and managing marine protected areas in the Philippines. Fisheries Improved for Sustainable Harvest Project, Coastal Conservation and Education Foundation, Inc. and University of the Philippines Marine Science Institute, Cebu City, Philippines. 83pp.
- Xu, G.D. (2015). Marine Ecological Civilization and the Establishment of Marine Parks. Presentation, Shantou, Guangdong. [in Chinese].
- Yao, Y.R. (2014). Research on Legal System of the Network Construction of the Marine Protected Areas (Master's Thesis, Ocean University of China). [in Chinese].

- Ye, Y.H., Peng, S.L., Hou, Y.P., Yu, Y.N., Liu, K.H., Chen, B.M., ... and Li, Y. (2008). An analysis of development and distribution characteristics of Marine Nature Reserves in China. *Journal of Tropical Oceanography*, 27(2), 70-75. [in Chinese].
- Yueqing Bureau of Ocean and Fishery. (2015). General Information of Ximen Island Special Marine Protected Area. [in Chinese]. Retrieved from <http://www.yqhy.gov.cn/?thread-1685-1.html> (Accessed on February 10, 2016).
- Zhang, C. (2015, Sep. 30) China's New Blueprint for an "Ecological Civilization". Retrieved from <http://thediplomat.com/2015/09/chinas-new-blueprint-for-an-ecological-civilization/> (Accessed on February 10, 2016).
- Zhang, J.W., Yang, Z.F., and Huang, X.Y. (2009). The Research on Ecological Compensation for Marine Reserves Based on Environmental Risk Analysis. *Ecological Environment*, (4), 177-181. [in Chinese].
- Zhao, M.L., Wang, P., Xie, J., and Shi, P. (2012). The Exploration of Integrated Coastal Management Mechanism in the Pearl River Delta Region. *Ocean Development and Management*. 25-29 pp. [in Chinese]
- Zhu, Y. (2009). Research on Establishment and Management of Marine Protected Areas in China (Master's Thesis). Xiamen University. 86 pp. [in Chinese].
- Zou, K.Y. (2003). Management of marine nature reserves in China: A legal perspective. *Journal of International Wildlife Law and Policy*, 6(3), 173-204.