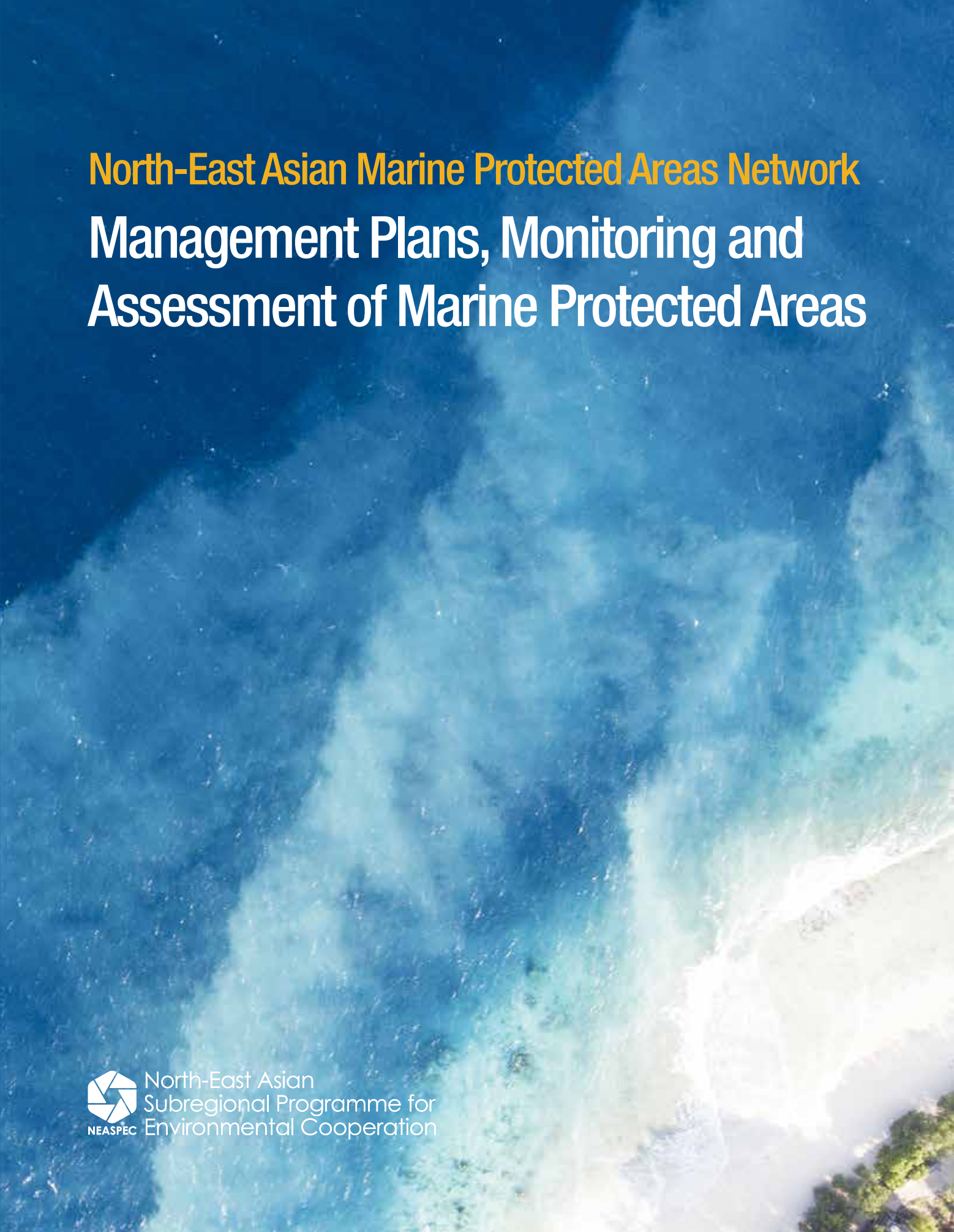

North-East Asian Marine Protected Areas Network

Management Plans, Monitoring and Assessment of Marine Protected Areas

NEASPEC
North-East Asian
Subregional Programme for
Environmental Cooperation

North-East Asian Marine Protected Areas Network

Management Plans, Monitoring and Assessment of Marine Protected Areas

North-East Asian
Subregional Programme for
Environmental Cooperation
NEASPEC

Management Plans, Monitoring and Assessment of Marine Protected Areas

Layout and Design: DocuFriends

CONTENTS

CHAPTER 2. JAPAN

CHAPTER 4. RUSSIAN FEDERATION

FIGURES

TABLES

Annex

Abbreviations

AGRCZ	Aquatic Germplasm Resources Conservation Zone
CHA	Cultural Heritage Administration
COD	Chemical Oxygen Demand
CBD	Convention on Biological Diversity
CY-MSPA	Changyi National Marine Ecology Special Protected Area
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphorus
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
FESMBR/FEMBR	Far-Eastern State Marine Biosphere Reserve
GEF	Global Environment Facility
IUCN	International Union for Conservation of Nature
KOEM	Korea Marine Environment Management Corporation
LA	Local Administration
MA	Metropolitan Administration
MEE	Ministry of Ecology and Environment, China
MEP	Ministry of Environment Protection
MNR	Marine Nature Reserve (in the context of MPA)
MNR	Ministry of Natural Resources, China
MNRE Russia	Ministry of Natural Resources and Environment of the Russian Federation
MOE	Ministry of Environment
MOF	Ministry of Oceans and Fisheries
MPA	Marine Protected Area
MSPA	Marine Special Protected Area
NEAMPAN	North-East Asian Marine Protected Areas Network
NEASPEC	North-East Asian Subregional Programme for Environmental Cooperation
NFGA	National Forest and Grassland Administration, China
NGO	Non-Government Organisation

NJ-MNR	Nanji Islands National Marine Nature Reserve
NMDIC	National Marine Data and Information Center
NMEMC	National Marine Environment Monitoring Center
PA	Protected Areas
ROK	Republic of Korea
ROOF	Regional Office of Oceans and Fisheries
SOA	State Oceanic Administration, China
SOM	Senior Officials Meeting
SPA	Specially Protected Natural Area
TSS	Total Suspended Solids
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WPA	Wetland Protected Area
WWF	World Wildlife Fund

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Under the overall direction and guidance of Ganbold Baasanjav, Head of ESCAP East and North-East Asia Office/ NEASPEC Secretariat and the supervision of Sangmin Nam, Deputy Head (ESCAP ENEA/NEASPEC Secretariat), the report was substantively edited by Nobuko Kajiura (Sustainable Development Officer) and Mi-Jin Lee (Research assistant); and proofread by Alasdair Donald Cameron (Intern).

Overview

This publication is a compilation of studies concerning the marine protected areas of the North-East Asian Marine Protected Areas Network (NEAMPAN) established under the North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC). The network currently consists of 12 marine protected areas (MPAs) in China, Japan, the Republic of Korea (ROK) and the Russian Federation selected by the respective countries (Table 1).

The twelve marine protected areas of NEAMPAN are diverse, with their sizes ranging from less than 30 km^2 (Changyi National Marine Ecology Special Protected Area, China; Suncheon Bay Wetland Protected Area in the Republic of Korea; and marine areas of Sikhote-Alin State Natural Biosphere Reserve in the Russian Federation) to over 600 km^2 (Far-Eastern State Marine Biosphere Reserve (FESMBR) in the Russian Federation), locations covering subarctic (Shiretoko National Park in Japan; and FESMBR in the Russian Federation) to tropical climate zones (e.g., Shankou Mangrove National Marine Nature Reserve and Nanji Islands National Marine Nature Reserve, China). Naturally, there are vast variations among the NEAMPAN MPAs in their biological features, target species, and the anthropocentric impact on the protected areas.

While the institutional set up of MPA sites varies within and across the countries, each MPA has its own management plans and systems to monitor its ecological status and to ensure conservation and appropriate use of the marine protected areas. Thus, the studies compiled here are intended to look into the management plans and monitoring of the MPAs in NEAMPAN and explore their linkages.

Some of these features are highlighted below, although this report is not an attempt to make cross-country comparisons - given the diverse nature of institutional settings and the responsibilities in management of the target MPAs in the respective countries.

Varying Level of Protection within MPAs

Classification of MPAs within the country and the level of restrictions associated with each category vary across countries. NEAMPAN MPAs consist of the types of MPAs which restrict most human activities (including visitors), such as the State Nature Reserves in the Russian Federation and Marine Nature Reserves in China, to those which aim for conservation and sustainable use of natural resources such as the MPA in Japan.

In the Russian Federation, among the various types of Specially Protected Areas (Reserves, National parks, Nature monuments, Zakazniks), the State Nature Reserves (including Sikhote-Alin Reserve and FESMBR) are the most strictly protected category, with permitted activities, if any, are limited to research, rehabilitation activities and educational activities. For instance, for FESMBR, the area is divided into 4 clusters with different levels of permissible activities - from strictly protected areas (Eastern marine cluster) to research zones where research and rehabilitation of natural ecosystems and educational excursions are permitted (Southern and Western marine cluster) with the area (no marine area) open to visitors (Northern cluster).

In China, among the three types of marine protected areas, i.e., Marine Nature Reserves (MNR), Marine Special Protected Areas (MSPA) and Aquatic Germplasm resource Conservation Zones (AGRCA). MNR contain the most restrictive areas, which prohibits human entry to their core areas. All NEAMPAN sites in China except Changyi are MNR category. On the other hand, MSPA such as Changyi represents a combination of conservation objectives and moderate development for sustainable resource development. MSPA is zoned according to the functionality, i.e., protection zone, ecological and resource recovery zone, resources utilisation zone and reserved zone. This defines the permissible activities within the zone.

Restrictions in marine protected areas in Japan and ROK often concern restricted activities within the area, such as construction or extraction of resources.

Shiretoko National Park in Japan is categorized as a protected national park but does not exclude the "sustainable use of marine ecosystem service", given the importance of the area as a commercial fishing ground for the local economy. Thus, certain targets (target species, wildlife, etc.) are protected or controlled following the relevant legislation related to conservation, and fishing activities occurring in the same marine area are in accordance with fishery-related legislation.

All three MPAs of NEAPMAN in ROK are in the category of Coastal Wetland Protected Area - one of the eight categories of marine protected areas. While activities such as the construction of buildings and extraction of resources are restricted in this category of MPAs, local residents' fishery activities for their livelihood are exempted.

Management Plans of MPAs in NEAMPAN

MPA Management plans in China are planning documents for activities and resource use (e.g. human, financial, etc.) within the respective MPA to undertake conservation and management activities, including constructing physical facilities for conservation, ecological monitoring, and scientific research. Preparation of the management plan is part of the obligation of the MPA management agency in both MPA categories (MNR and MSPA) and must be in accordance with the respective technical guidelines ("*Technical regulations for the nature reserve master plan*

for MNR" and "*Technical guidelines for functional zonation and the management plan compiling of MSPA*"). The plan also has to be approved by the central government (National Forestry and Grassland Administration since 2019), which is a prerequisite for the disbursement of the budget to the MPA management office. In addition to the major revision of the management plan every 10 years, the plan is revised every 5 years to reflect changes in the protected targets and the environmental situation of the MPAs.

The management plan of Shiretoko National Park in Japan - "*The management plan for Shiretoko World Natural Heritage Site*" - referred to in the study, was developed through the involvement of multiple national and local government offices, i.e., Ministry of Environment, Forest Agency, Agency for Cultural Affairs and Hokkaido Prefecture. The Management Plan was developed in the context of the inscription of the site on the UNESCO World Natural Heritage list. While the above management plan covers the entire area of the national park, specific management plans for marine areas ("*Multiple use integrated marine management plan*") were developed as the government's response to the concern overfishing activities in the area during the process of the inscription. The document, to be revised every 5 years, highlights an adaptive management and monitoring scheme, which includes stakeholder (fishers, local citizen, tourists, etc.) participation.

In ROK, the Ministry of Oceans and Fisheries (MOF) and the Ministry of Environment develop the "*Wetlands Conservation Basic Plan*" every 5 years based on the Wetland Conservation Act, while MOF, MOE, local administrations and concerned agencies are responsible for the implementation of the basic plan. Each NEAMPAN site studied has its own 5-year conservation plan, outlining its strategies and associated activities in areas such as conservation, management of MPA, capacity development, and stakeholders' participation. The relevant local governments (i.e., Suncheon city for Suncheon tidal flat, Muan county for Muan tidal flat, and Gochang county for Gochang tidal flat) submit their annual management plan to MOF for budget application to implement the plan. The local government independently manages the wetland protected areas and is tasked to implement the management plans through a regional management committee to promote the participation of various stakeholders in wetland conservation and management.

In the Russian Federation, the overall approach and strategic and programmatic directions related to the development and improvement of the SPAs are set out in various policy documents. For instance, "*Concept of the Long-Term Socio-Economic Development of the Russian Federation for the Period by 2020*" highlights environmental protection and rational use and reproduction of natural resources as a key public good for long-term socio-economic development. The management plan of an individual SPA is an operational planning document developed by each SPA. It identifies the activities of management offices of the SPA while also taking into account the economic, social and environmental conditions of the reserve's location. The management plan also includes SPA's plan for activities on monitoring; ensuring reliable protection of natural complexes and objects in the relevant SPA; regulation of limited economic activity and nature use within SPA and its protective zone; scientific

research; and the development of environmental education, etc. The management plan thus justifies the costs for carrying out these activities and provides a basis against which the effectiveness of the SPA management can be assessed.

Monitoring of MPAs

In China, the management agency of each MPA is responsible for conducting ecological monitoring, although the task is often contracted to professional agencies. National guidelines for MPAs specifies standard monitoring parameters such as endangered marine organisms, high-value animals, plants, marine natural landscape, and the marine ecosystem. Each MPA tailors these monitoring parameters depending on the local context. Assessments of monitoring data identify threats and drivers of observed changes, which is reflected in annual work plans and thus in responsive actions.

For instance, the scientific monitoring of Nanji islands identified various threats to biodiversity: overexploitation of marine resources; the rapid development of tourism; infrastructure construction; and mariculture and environmental quality degradation around the area. Those findings prompted the MPA management office to take responsive measures either directly or in cooperation with relevant authorities: extending the no-fishing period; tourists control; ecological restoration; strengthening of the monitoring system, etc. Similarly, monitoring of the water quality, sediment quality and target species in Changyi identified threats to the MPA such as ecosystem degradation, negative impacts of aquaculture, and tourists volume. These findings led MPA management authorities to take responsive measures including the promotion of ecological marine aquaculture and ecotourism planning, etc.

For Shiretoko National Park, the long-term monitoring plan is viewed as a key element for scientific knowledge-based adaptive management. The monitoring plan attached to the management plan for Shiretoko National Park identifies the areas and 42 monitoring parameters aligned with the overall management objectives of the protected area. The monitoring parameters are based mostly on the natural ecosystem and possess very limited coverage on the aspects of human use. Moreover, most of them are existing monitoring activities conducted by relevant offices, thus do not necessarily cater to the purpose of monitoring the MPA site. The monitored data on marine ecosystem related parameters are assessed by the marine working group and scientific council of the Shiretoko WNH sites, although there is a limited link between the assessment results and responsive management measures.

In ROK, monitoring operations are undertaken at the national level by the Ministry of Oceans and Fisheries. The national marine ecosystem monitoring programme and marine environment measurement network are conducted regularly to monitor and assess the marine areas. MOF also operates survey programmes such as

automatic measuring networks for marine water quality and environment monitoring for fishing grounds, etc. Monitoring results provide a scientific base for policies related to MPAs as well as remedial measures. For example, findings of degraded water quality through marine environment measurement network in Muan district and the plan for preventive measures are incorporated into the management plan of the Muan tidal flat WPA.

The marine environment measurement network monitors: seawater, sediments and biotas of port environment, coastal waters, and river influence and semi-enclosed waters. The ecosystem monitoring includes monitoring parameters on the sedimentary environment, macrobenthos, salt plants and sea birds. It is noteworthy that the national marine ecosystem monitoring programme also conducts a survey on residents' awareness and perception of changes in marine protected areas. The results of the residents' awareness survey also provide data for conservation/management policies and the updating of conservation/management policies.

In the Russian Federation, monitoring of the biological system in individual MPAs is mostly conducted in the form of scientific studies on biological diversity and an inventory of the species in the area, rather than periodic monitoring on specific environmental/biological parameters.

For instance, FESMBR carries out scientific research on the biological system, including the inventory of marine and island ecosystems of the Reserve – plants, birds, and aquatic creatures. The decades of research in FEMBR contributed to the understanding of biodiversity in the reserve, where more than 5,000 species are catalogued. The scientific research and monitoring of the marine ecosystem is also conducted in Sikhote-Alin among other research areas such as climate change and the dynamics of the rare species population. Key areas of scientific research on marine ecosystems are marine phytocenosis; marine invertebrates; marine ichthyofauna; seabirds; and marine mammals. The research results are used for: implementing the main activity of the Reserve; for preparing documents for different authorities in order to make a decision on nature protection actions, such as protection of rare species of plants and animals; creation of new nature protected territories; carrying out of ecological expertise; and fulfilment of economic projects.

In the Russian Federation, monitoring of environmental parameters, such as qualities of air, sea water and sediments, are conducted by the Federal level monitoring agency (Roshydromet). The results of the environmental monitoring reveal environmental hot spots in Russian coastal waters near the reserves studied - such as water contamination by the neighbouring industrial and municipal sewage, and contamination from unorganized recreation activities, poaching, etc.

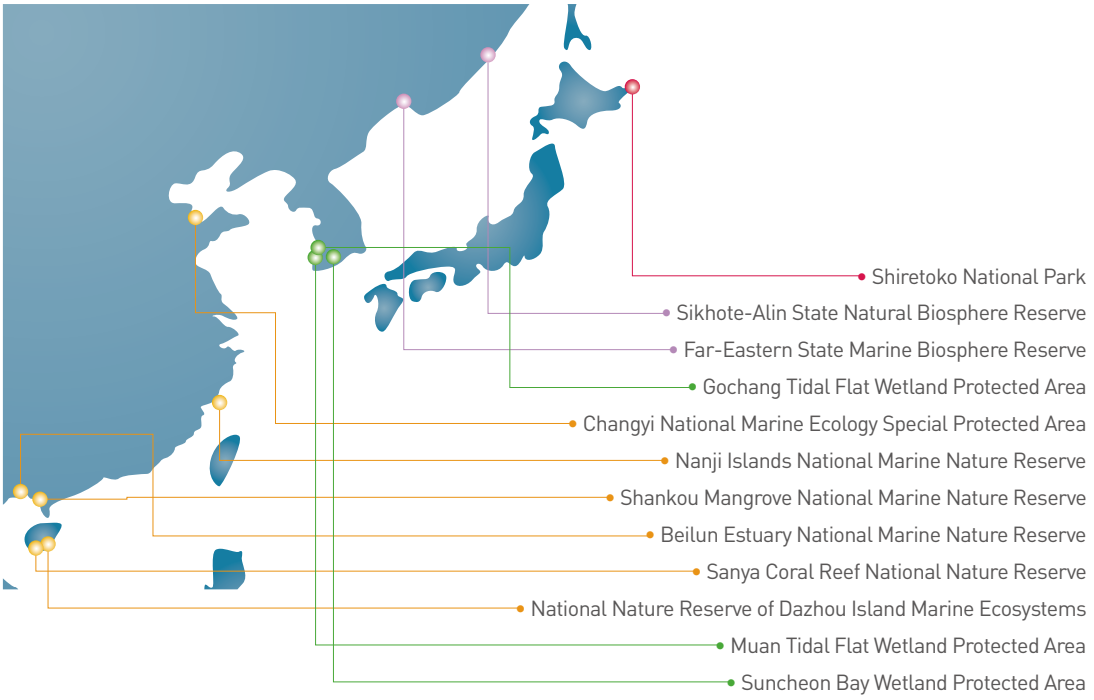
Anthropocentric Impact

While the NEAMPAN MPAs are relatively well protected, they are not insulated from human activities from the surrounding areas, such as pollutants from residential and industrial establishments in neighbouring areas, poaching of marine resources, tourism and fishing activities in adjacent areas, etc. The studies suggested potential benefits in connecting socio-economic information and assessment with the management of MPAs.

Table 1 List of North-East Asian Marine Protected Areas Network Sites

	Name	Location	Area (km^2)	Designation (year)	International network
CHINA	Beilun Estuary National Marine Nature Reserve	Fangchenggang, Guangxi	300	2000	Ramsar site
	Changyi National Marine Ecology Special Protected Area	Changyi, Shandong	29.29	2007	
	Nanji Islands National Marine Nature Reserve	Pingyang, Zhejiang	201.06	1990	UNESCO-MAB Biosphere Reserve
	National Nature Reserve of Dazhou Island Marine Ecosystems	Wanning, Hainan	70	1990	
	Sanya Coral Reef National Nature Reserve	Sanya, Hainan	85 (24.27)*	1990	
	Shankou Mangrove National Marine Nature Reserve	Hepu, Guangxi	80	1990	UNESCO-MAB Biosphere Reserve; and Ramsar site
JAPAN	Shiretoko National Park	Hokkaido	711 (224)*	1964	UNESCO World Natural Heritage Site
REPUBLIC OF KOREA	Muan Tidal Flat Wetland Protected Area	Muan-gun, Jeollanam-do	42	2001	Ramsar site
	Suncheon Bay Wetland Protected Area	Suncheon-si, Jeollanam-do	28	2003	UNESCO-MAB Biosphere Reserve; and Ramsar site
	Gochang Tidal Flat Wetland Protected Area	Gochang-gun, Jeollabuk-do	64.66	2007	UNESCO-MAB Biosphere Reserve; and Ramsar site
RUSSIAN FEDERATION	Far-Eastern State Marine Biosphere Reserve (FESMBR)	Primorsky Krai	641.363	1978	UNESCO-MAB Biosphere Reserve
	Sikhote-Alin State Natural Biosphere Reserve	Primorsky Krai	4,016 (29.0)*	1935	UNESCO-MAB Biosphere Reserve; and UNESCO World Natural Heritage Site

* marine area


Shiretoko National Park
Sikhote-Alin State Natural Biosphere Reserve
Far-Eastern State Marine Biosphere Reserve
Gochang Tidal Flat Wetland Protected Area
Changyi National Marine Ecology Special Protected Area
Nanji Islands National Marine Nature Reserve
Shankou Mangrove National Marine Nature Reserve
Beilun Estuary National Marine Nature Reserve
Sanya Coral Reef National Nature Reserve
National Nature Reserve of Dazhou Island Marine Ecosystems
Muan Tidal Flat Wetland Protected Area
Suncheon Bay Wetland Protected Area

NORTH-EAST ASIAN MARINE PROTECTED AREAS NETWORK

MANAGEMENT PLANS, MONITORING AND ASSESSMENT OF MARINE PROTECTED AREAS

1

China

A. REVIEW OF MANAGEMENT PLANS

B. MONITORING AND ASSESSMENT OF DESIGNATED MPAS

C. FEEDBACK OF ASSESSMENT RESULTS TO MANAGEMENT PLANS AND PRACTICES

D. CASE STUDIES

Chapter 1. China[1]

Preface

Marine protected area (MPA) is a useful measure to protect marine endangered species, biodiversity, ecosystems, natural relics, and other resources. Thus, the Chinese government established the first MPA in Liaoning Province in 1963. Through successive efforts, more than 270 MPAs have been established along the Chinese coast as of 2017, covering around 4.6% of the Chinese coast area.

MPAs in China act mainly in accordance with the "Marine Environment Protection Law", which regulates two types of MPA - Marine Nature Reserve and Marine Special Protected Area. MPAs are divided by national level and local levels in China. National MPA means the protected target is valued and important nationwide, and local MPA means the protected target is only important and represented on the local scale. There are 101 national-level MPAs that are managed by different authorities within the central government.

Due to historical reasons, at least four agencies are involved in MPA management: The Ministry of Environment are responsible for 7 national marine nature reserves; The Bureau of Fishery in Ministry of Agriculture for 3 national marine nature reserve; The State Forest Administration for 10 national marine nature reserve; and The State Oceanic Administration for 14 national marine nature reserve and another 67 national marine special protected areas. However, overlaid obligations frequently cause conflict among the agencies. To strengthen MPA management, the responsibility of MPA management was transferred to National Forest and Grassland Administration during the re-organisation of the central government in 2018. It should be noted that with the restructuring, there may be many more changes in structures and modalities within MPA management for which information is not readily available at the time of writing.

International cooperation is a very useful pathway to enhance the effectiveness of MPAs due to the migratory nature of many protected targets and borderless seawater movements. An MPA network could provide a better shelter for protected marine organisms. That was the purpose of launching the North-East Asian Marine Protected Areas Network (NEAMPAN) in 2013 under the North-East Asian Subregional Programme for Environmental

1 This chapter was prepared by Dr. Zhang Zhaohui, First Institute of Oceanography, Ministry of Natural Resources of China.

Cooperation (NEASPEC). China nominated six MPAs for NEAMPAN based on its 5 selection criterianational level MPA; biodiversity or endangered species type; holding an independent management agency; English communication ability; and willingness. As a part of the NEAMPAN research project, this report review will analyse how to improve the management measures through monitoring and assessment for the selected MPAs in China, and share with other NEAMPAN sites how to collectively improve knowledge and practices.

A. Review of Management Plans

1. Basic Information of the NEAMPAN Sites

Of six MPAs selected as the NEAMPAN sites in 2014 from China, 5 MPAs belong to the national natural reserve (MNR) and the other to a marine special protected area (MSPA) (the list is given in Table 2). The following six MPAs were selected as the first batch among the whole 271 MPAs in China based on whether they met the following five pieces of criteria:

1. a national level MPA;
2. an independent management office;
3. with marine biodiversity, rare and endangered species as the protection targets;
4. enough capacity for English communication; and
5. willingness to join the NEAMPAN.

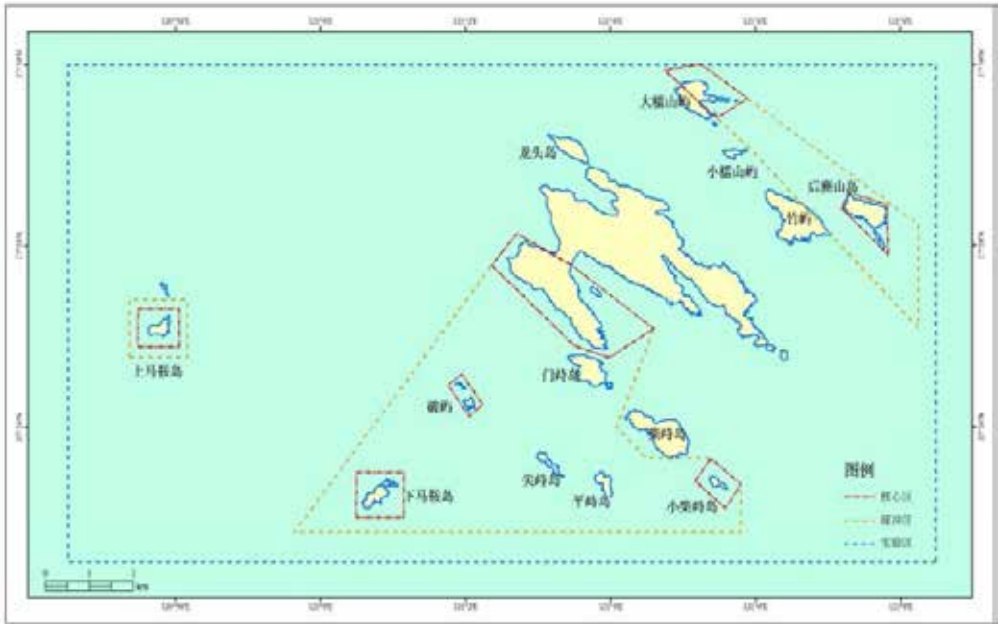
Table 2 **List of MPAs of NEAMPAN Sites in China**

No.	MPA's Name	Location	Area (km^2)	Protected Targets
1	Nanji Islands National Marine Nature Reserve	Pingyang, Zhejing	201.06	Marine shellfish and algae as well as their habitats
2	Shankou Mangrove National Marine Nature Reserve	Hepu, Guangxi	80	Mangrove ecosystem
3	Beilun Estuary National Marine Nature Reserve	Fangchenggang, Guangxi	300	Mangrove ecosystem
4	National Nature Reserve of Dazhou Island Marine Ecosystems	Wanning, Hainan	70	Swiftlet, its habitat and the marine ecological system
5	Sanya Coral Reef National Nature Reserve	Sanya, Hainan	85	Coral reef and the marine ecological system
6	Changyi National Marine Ecology Special Protected Area	Changyi, Shandong	29.29	*Tamarix chinensis*, marine organisms and coastal wetland ecosystems

Nanji Islands National Marine Nature Reserve

The Nanji Islands National Marine Nature Reserve is a marine ecosystem protected area mainly protecting shellfish, algae, marine birds, wild daffodils and their habitats. Located in the southeast sea areas of Pingyang County, Zhejiang Province, it possesses bedrock hilly islands and consists of 52 islands with tens of bare/submerged rocks within the surrounding waters. The total area is 201.06 km^2 with 11.13 km^2 of land area and 189.93 km^2 of sea area. It has been listed as UNESCO's Marine Nature Reserve of World Biosphere Reserves in 1998 and selected as one of the four demonstration sites of GEF-supported project of Biodiversity Management in the Coastal Area of China's South Sea in 2002. In 2005, it was awarded by 23 new media as one of the ten most beautiful islands in China. (Further detail in section D on case studies).

Figure 1 **Map of Nanji Islands National Marine Nature Reserve**



Key features:

- Year designated: 1990
- Conservation status: MNR
- Area: 201.06 km^2, including 189.93 km^2 of sea waters
- Range: 120°56′30″E-121°08′30″E and 27°24′30″N-27°30′00″N
- Location: Pingyang, Zhejing Province
- Protected Targets: marine shellfish and algae, birds and ecosystem
- Management challenges: overexploitation, rapid development of tourism, infrastructure construction, mariculture, and nature environment quality degradation

Shankou Mangrove National Marine Nature Reserve

Shankou Mangrove National Marine Nature Reserve is located in Shankou Town, Beihai, Guangxi Province. The biosphere reserve includes mangroves, salt marshes and seagrass habitats. This combination of three coastal habitats in one single location is rare along China's coast. It is in a tropical monsoon climate zone and tropical rainforest region, with thunderstorms, typhoons and strong tides frequently in spring and summer (annual average temperature: 23.4 ºC; annual average precipitation: 1,700-2,800 mm).

The landform is an alluvial terrace where long and narrow marine-deposition plains are formed among the terraces, shorelines and estuaries. The intertidal mudflat is wide and flat with deep silts. Sixteen mangrove species, 251 macro-benthos species, 5 nekton species, 36 zooplankton species, 20 plant plankton species, 118 bird species and 301 insect species are found here.

Figure 2 Map of Shankou Mangrove National Marine Nature Reserve

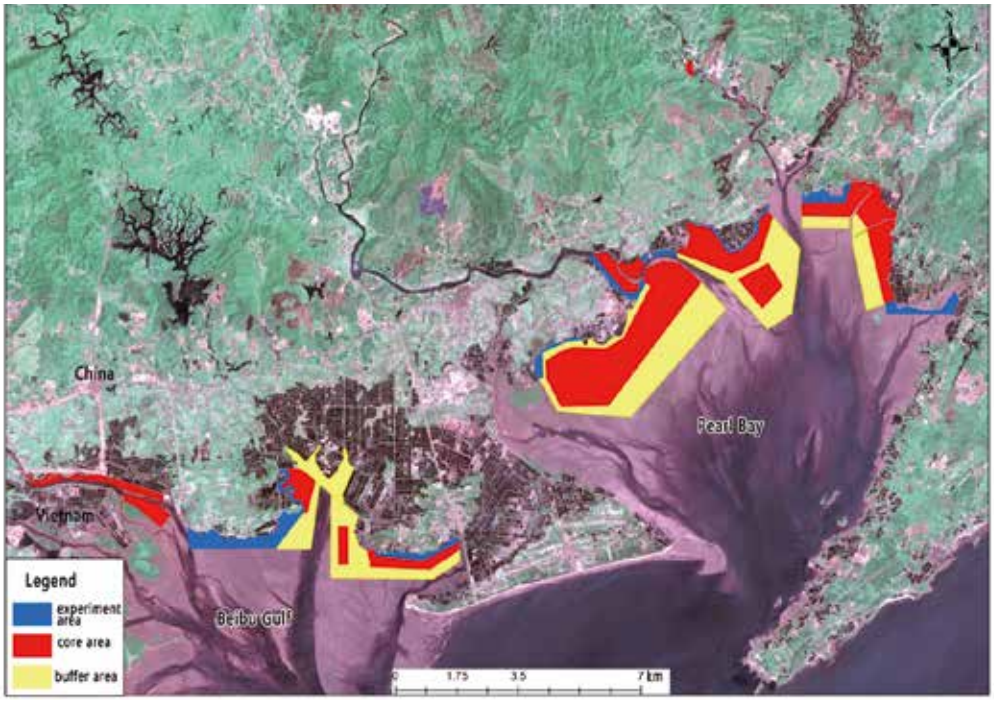
Key features:

- Year designated: 1990
- Conservation status: MNR
- Area: 80 km^2
- Range: 109°37′00″E-109°47′00″E and 21°28′22″N-21°37′00″N
- Location: Beihai, Guangxi Province
- Protected Targets: Mangrove ecosystem
- Management challenges: human activity, invasive species, sea level rise, pollution

Beilun Estuary National Marine Nature Reserve

Guangxi Beilun Estuary National Nature Reserve is located in the north of Beilun River opposite Viet Nam, and 180 km south of Nanning (the capital city of the Guangxi province). It includes 105 km of coastline and covers three towns and 13 villages in Dongxing and the Fangcheng district of Fangchenggang. Mountains, mesa and uplands interlace with one another, and high mountains roll upon the land side bordering upon the reserve, while the seaward side is full of estuaries and bays as well as amplitude tidal flats. Mangroves dominate the reserve and it is the largest contiguous stretch of mangrove forest in the coastal area of China (*https://rsis.ramsar.org/ris/1728*), with a relatively high diversity of halobios and birds.

Figure 3 **Map of Beilun Estuary National Marine Nature Reserve**



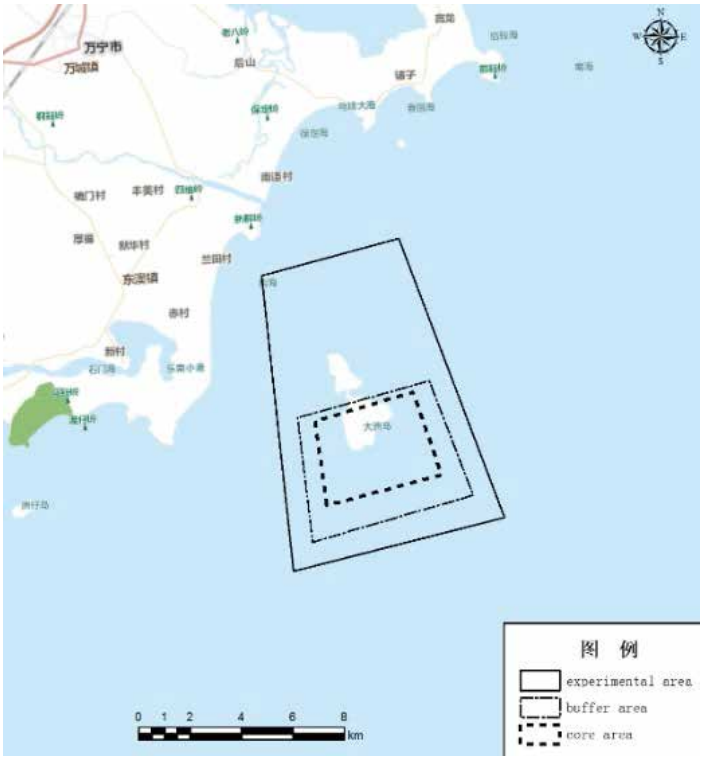
Key features:

- Year designated: 2000
- Conservation status: MNR
- Area: 300 km^2
- Range: 108°00′30″E-108°16′30″E and 21°31′00″N-21°37′30″N
- Location: Fangchenggang, Guangxi Province
- Protected Targets: Mangrove ecosystem, Coastal wetlands ecosystem, and Seagrass beds ecosystem
- Management challenge: pollution, mangrove degradation, overfishing

National Nature Reserve of Dazhou Island Marine Ecosystems

The National Nature Reserve of Dazhou Island Marine Ecosystems is located in Wanning, Hainan. The Hainan Swiftlet and other swifts inhabit and breed in this area without seasonal migration. The island has an abundance of wild animals and plant resources. Natural plants have lush growth with over 95 per cent coverage, including four vegetation types: groundling, grassland, brush and low forest. An abundance of animals also live on the island, such as amphibians, reptiles, birds and mammals. Dazhou MPA is rich in marine living resources possessing high biodiversity.

Figure 4 **Map of National Nature Reserve of Dazhou Island Marine Ecosystems**



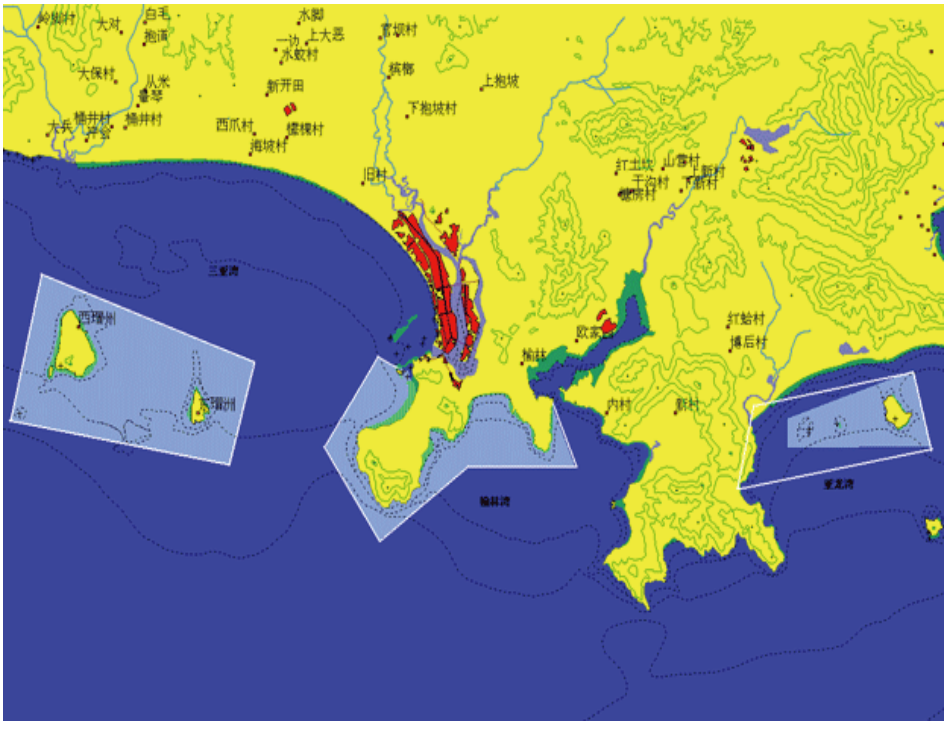
Key features:

- Year designated: 1990
- Conservation status: MNR
- Area: 70 km^2
- Range: 110°26′50″E-110°32′06″E and 18°37′06″N-18°43′54″N
- Location: Wanning, Hainan Province
- Key Protected species: Swiftlet, its habitat and the marine ecological system
- Management challenge: insufficient funds, illegal tourism, overfishing

Sanya Coral Reef National Nature Reserve

Sanya Coral Reef National Nature Reserve in Sanya, Hainan, is a crucial area for protecting the diversity of marine organisms, particularly ones in the coral reef. The geomorphological differences are evident: the eastern and western parts are a typical island and the other is a peninsula with many capes and bays. Human activities severely damaged coral reef in the 1970-80s. Thus, in 1989, scientists proposed this area be protected. In the following year, it was designated as a national nature reserve to protect the coral reef and marine ecological system.

Figure 5 **Map of Sanya Coral Reef National Nature Reserve**



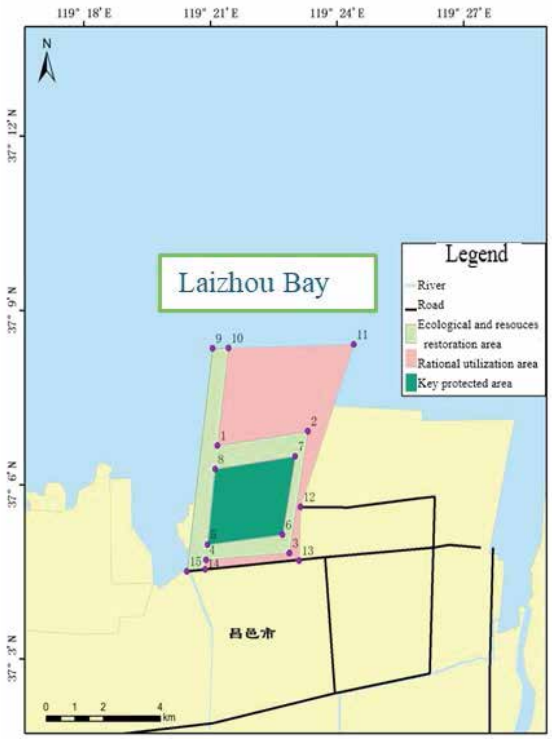
Key features:

- Year designated: 1990
- Conservation status: MNR
- Area: 85 km^2
- Range: 109°20′50″E-109°40′30″E and 18°10′30″N-18°15′30″N
- Location: Sanya, Hainan Province
- Protected Targets: Coral reef and the marine ecological system
- Management challenge: global climate change, environmental pollution, human activity and insufficient funds

Changyi National Marine Ecology Special Protected Area

Located in Changyi, Shandong Province, the Changyi national MPA is the only national MPA that protects mainly tamarisk of coastal wetland in China. The physical features of the MPA are characterised: by flat topography and accumulated coastal plain; irregular and mixed semidiurnal tide; flood current of SW and ebb current of NE; low salinity of 30; five main rivers to the sea including Yu river; Di river; Wei river; Pu river; and Jiaolai river. Tamarisk can be used for cistanche (a Chinese herb) culture, and the coastal area is also attractive to tourists. Thus, Changyi was designated as MSPA for its sustainable use features. (Further detail in section D on case studies).

Figure 6 **Map of Changyi National Marine Ecology Special Protected Area**



Key features:

- Year designated: 2007
- Conservation status: MSPA
- Area: 29.29 km^2
- Range: 119°20′09.30″E-119°24′13.21″E and 37°04′25.74″N-37°08′15.47″N
- Location: Changyi, Shandong Province
- Protected Targets: tamarisk (*Tamarix chinensis*), marine organisms and coastal wetland ecosystems
- Management challenge: insufficient funds, utilisation activity, public awareness

2. Background of MPA Management Plan

The Management Plan is a basic document for the daily management of MPA. It is a plan to use potential resources (human, financial and others) to carry out various activities for protection, management capacity, and resources utilisation to address challenges and threats faced over a certain time period.

MPAs in China are categorised into three groups with varying degrees of restriction on human activities within the area: Marine Nature Reserve (MNR), Marine Special Protected Area (MSPA), and Aquatic Germplasm Resources Conservation Zones (AGRCA) (see Table 3).

Marine Nature Reserves

Based on the "Management Measures for Marine Nature Reserves" issued by the State Oceanic Administration (SOA) in 1995, the management plan of each national MNR should be prepared according to the *Technical regulations for the nature reserve master plan* (GB/T 20399-2006) and approved by SOA, which is authorised by the State Council as the ocean management authority in the central government. However, with the restructuring of the central government in 2019, it is believed that obligation will be transferred to the National Forest and Grassland Administration (NFGA) which is authorised with the management of a variety of protected areas.

The obligations of management agencies of respective national MNR is clearly defined as follows:

- Implementing the law, regulations, guidelines and policies of the State concerning MNR;
- Formulating specific management measures, rules and regulations for MNR, and controlling all activities inside the MNR;
- Drawing up the management plan of MNR;
- Installing boundary markers, landmarks and related protection facilities for MNR;
- Organising and carrying out basic investigations, regular monitoring and surveillance in MNR, as well as the documents and records management;
- Organising the ecological restoration and scientific research in MNR; and
- Carrying out publicity and public education on marine protection.

Table 3 **Brief Introduction of MNR, MSPA and ACRCZ**

	MNR	MSPA	AGRCZ
Key legislation	• Marine Environment Protection Law of PRC, Article 21. • National standard (GB/T17504-1998) • Principles of type and level of classification of marine nature reserves • National Standard (GB / T 19571-2004) • Technical specifications of marine nature reserve management	• Marine Environment Protection Law of PRC, Article 23. • National Standard (GB / T 25054-2010) • Selection technology guidelines of marine special protection areas • Marine industry standards (HY/ T118-2010) • Technical guidelines for the preparation of overall planning, function zoning in marine special protection areas	Fisheries Law of PRC, Article 29.
Nature of the MPAs	Typical ecosystem	Special geographical location, Ocean park	Important habitat for protected aquatic organisms.
Objectives	Protection of nature	Sustainable use of resources	Protection of germplastic resources and their habitat
Restriction of human activities	Human entry to core area is strictly prohibited in core area.	No construction activity in key protected area.	Human disturbance to core area is strictly prohibited. Fishing activity are allowed outside the core area. Fishing activity must obey Fisheries Law.
Target of management	Natural relics and other resources. Ecosystem: mangrove, coral reef, salt marsh, estuary, bay, island, lagoon et al. Endangered species: amphioxus, spotted seals, dolphins, sea turtles and other rare and endangered marine species Others: rare marine natural heritage	Marine resources	Important habitats for: national and local protected aquatic organisms, important endemic aquatic organisms, protospecies for important aquatic organisms and other organisms of high economic values and genetic breeding values.
Administration	National Forestry and Grassland Administration, Ministry of Natural Resources		Ministry of Agriculture and Rural Affairs of the People's Republic of China

Marine Special Protected Area

Similar to MNR, based on the "Management Measures for Marine Special Protected Area" issued by SOA in 2010, the management plan of each national MSPA should be prepared according to the *Technical guidelines for functional zonation and the management plan compiling of MSPA* (HY/T 118-2008) and approved by SOA. The SOA is the ocean management authority in the central government designated by the State Council, however, its obligations will be transferred to NFGA in 2019 with the restructuring of the central government.

The obligations of the management agency of national MSPA includes.

- Implementing national and local laws, regulations and policies on marine ecological protection and resources utilisation;
- Formulating and implementing the management system in MSPA;
- Formulating the management plan and annual work plan for MSPA and implementing targeted management measures;
- Organising and constructing facilities for the protection, monitoring, scientific research, tourism and public education for MSPA;
- Organising the daily patrol and management of MSPA;
- Formulating plans for ecological compensation, protection and restoration of MSPA, and implementing the measures for the above plans;
- Organising, implementing and coordinating various activities concerning the protection, utilisation, rights and interests of MSPA;
- Organising and managing ecotourism activities in MSPA;
- Organising and carrying out monitoring, surveillance, evaluation and scientific research activities in MSPA;
- Organise and carrying out publicity, education, training and international cooperation of MSPA;
- Establishing archives of resources, environment and other information management of MSPA;
- Publishing relevant information on MSPA; and
- Other duties shall be performed by the management agency of MSPA.

There are also some special requirements for MSPA: such as finalising the management plan for approval within 12 months upon the MSPA designation; adherence of the plan to the instructions of "*Technical guidelines for functional zonation and the management plan compiling of MSPA (HY/T 118-2008)*"; as well as adherence of all the activities for protection and utilisation to the management plans.

3. Objective of MPA Management Plan

3.1 Objective of MNR Management Plan

According to the guideline of "*Outline of Management Plan for National Nature Reserves*" issued by MEP in 2002, the general objective of MNR management plans are to conserve the natural status of MNR, and to keep human activities out of the MNR. But for any given MNR, the objective of the management plan is usually specified for a period of 10 years. The objective of natural ecology status, protected target status, human activities/disturbance controlling, working conditions/capacity building, infrastructure building, scientific research, local community development, and public education are often set and described in the management plan. The management plan for each MPA is rewritten every 10 years. They are also revised every 5 years based on the evaluation of the status of protected targets conducted every 5 years. If the targets are undergoing significant change, the revision will reflect this change.

The principles for setting the objective of MNR management plan are; to closely focus on the protection functions of nature reserves; to meet the protection and management needs of the main protected targets; to strictly control all kinds of development and construction activities; to insist that infrastructure construction be as simple and practical as possible and integrated into the local landscape; to insist on community participation in management, and contribute to the local communities sustainability. It is preferable to have measurable objectives in the management plan rather than description-based objectives.

3.2 Objective of MSPA Management Plan

The "*Technical guidelines for functional zonation and the management plan compiling of MSPA (HY/T 118-2008)*" clearly instructs based upon the objectives of MSPA management plans. The designateed MSPA should draw up a management plan according to the status quo; sensitivity, carrying capacity; the dominant ecological functions of the marine ecological environment; the structure and process characteristics of ecosystem types; the present status and trend of the natural environment, and socio-economic development. The MSPA should be divided into key protection zones: ecological and resource recovery zones, resources utilisation zones, and reserved zones with a different objective to marine protection and resource utilisation. Zoning will determine: the main function; provide clarity to the direction of management activities; and form a harmonised spatial development pattern of population, economy, resources and environment. Furthermore, the plan could formulate reasonable and feasible development goals, and provide a basis for policy guidance for the construction of protected areas during the planning period.

The management objectives should include the status of the ecological environment and the main protected

targets, human disturbance control, and the socio-economic development of the neighbouring communities. The objective should be integrated with the overall protection plan of the sea area where the MSPA is located, sensitive to the challenge, and urgent needs of the MSPA management. The management plan can set the general objectives, stage objectives and various construction objectives for a certain time-period such as 10-15 years.

The principles of an MSPA management plan is to promote the sustainable development of marine resources; coordination between marine protection and economic development; coordination with marine functional zoning and other plans; implementation of inner zoning management; and comprehensive benefits for social, economic, resource and environment. That is, the objective is protection-oriented paired with moderate sustainable resource development.

4. Key Content of the Management Plan

There is a common structure across all the MPAs within the same category (MNR or MSPA) as they follow the same respective templates. Usually, individual MPA management authorities would tailor them to reflect the local context of the respective MPAs. In principle, approval of the management plan of each MPA is a precondition for the budget release to the respective MPA management authority which, in turn, implements the management plan.

4.1 Contents of MNR Management Plan

According to the 2002 guideline of "*Outline of Management Plan for National Nature Reserves*", a management plan should contain the following aspects:

Foreword

It should provide a concise description of the management plan of the national nature reserve, including the basic characteristics of the nature reserve, historical evolution, legal status, and the purpose and significance of the preparation and implementation of the management plan.

1. Basic Overview

Based on the basic description and analysis of the scientific research materials and existing information of the reserve. Insufficient information should be supplemented and improved. The evaluation should be based on scientific evidence with objective and reasonable conclusions.

It should contain information on:

- Regional natural ecology/biogeographic characteristics, and humanities and social environment characteristics;
- Location, boundary, area, land ownership and natural resources, ecological environment, and socio-economic status of nature reserves;
- The aim and evaluation of;
    - the protection function and protected targets;
    - the ecosystem services and social services;
    - the inner zoning and adaptive management measures;
- Progress and evaluation of nature reserve management.

2. The Goal of Protection for National Nature Reserve

The goal of protection is a concise description of fundamental purpose for designing the nature reserve, and the expression of the eternal value and ongoing pursuit of this nature reserve.

3. Major Constraints on Protection Objectives

This part provides analysis of the constraints on the protection objectives, usually including:

- Internal natural factors: such as land desertification, decline in biodiversity index, etc.
- Internal human factors: such as over-exploitation, urbanisation tendencies, etc.
- External natural factors: such as regional ecosystem deterioration, islanding effect, etc.
- External human factors: such as road crossing, interception of water, poaching, etc.
- Policy, social factors: if not received enough attention, passive situation.
- Community/economic factors: If the community is resource dependent or polluted.
- Available resource factors: less management operations and lack of training for personnel.

4. Objectives of Planning Period

It is a detailed description of the management plan objectives for the reserve, with a phased goal-orientated plan serving the protection goal. This part should contain the following:

- Planning period: in general for 10 years, with a clear starting and ending time.
- Principles for determining objectives: with a close focus on the protection functions of nature reserves, and the protection and management needs of major protection targets.
- Planning objective considerations: status of natural ecology/protected target, controlling objectives of human activity, improving objectives of working conditions / management facilities, working objectives of scientific research / community development.

5. Main Contents of the Management Plan

This part should detail on:

- Management and construction infrastructure planning;
- Working conditions / patrol work planning;
- Human resources / internal management planning;
- Community work / mission planning;
- Research / monitoring work planning;
- Ecological restoration planning (not planned when unnecessary);
- Rational development and utilisation of resources (such as ecotourism, etc.); and
- Suggestions for pollution control / ecological protection around protected areas.

6. Key Projects Planning

The key projects support the implementation of the plan and objectives during the planning period and will serve as the basis for the preparation of the feasibility study report for the nature reserve capacity building project. For key projects, the construction of infrastructures such as real estate and roads should be as simple as possible, energy-saving, and multi-functional; conditional equipment should be practical and efficient; software construction should be given sufficient attention.

7. Measures for Implementing the Plan

This part describes how to ensure smooth implementation of the management plan, including the requirements on policy/regulation, funding, management organisation, staffing, department coordination, and community co-management, etc.

8. Benefit Analysis

This is the assessment and evaluation of the environmental, economic and social benefits upon completion of the main planning components during the planning period such as the management and protection capabilities, the changes in the protected areas and the impact on the development of the community.

4.2 Contents of MSPA Management Plan

Based on the "*Technical guidelines for functional zonation and the management plan compiling of MSPA (HY/T 118-2008)*", the contents of MSPA management plan should include the following 9 parts.

Foreword

The foreword is a brief description of the management plan of the MSPA, including its basic characteristics, historical evolution, legal status, and the purpose and significance of its compilation and implementation.

1. General Information

1.1 Planning background

1.2 Necessity and significance of district construction

1.3 Planning basis

1.4 Planning scope and duration

2. General Situation of Natural Environment, Marine Resources and Social Economy

2.1 Basic characteristics of the natural environment

2.2 Types and utilisation Status of marine resources

2.3 Socio-economic situation and marine industry distribution

3. Current Situation and Existing Problems of the Construction of MSPA

3.1 Overview of MSPA

3.2 Nature and protection objectives of protected areas

3.3 Ecological and resource characteristics of protected Areas

3.4 Main constraints affecting protection objectives

4. Guidelines, Basic Principles and Development Objectives of Planning

4.1 Guidelines

4.2 Basic principles

4.3 Planning period objectives (overall objectives, short-term objectives, and long-term objectives)

5. Overall Layout and Inner Zoning

5.1 Determination of the major function

5.2 Overview of inner functional zoning

5.3 Management objectives of each inner zones

5.4 Arrangement of protection and development activities and management measures in each zone

6. Key Planning Projects

6.1 Protection management planning

6.2 Infrastructure and capacity building planning

6.3 Planning for rational utilisation of resources

6.4 Scientific research and monitoring planning

6.5 Ecological restoration planning

6.6 publicity and education planning

6.7 Community co-management planning

6.8 Eco-industry development planning

7. Measures Guarantee for Implementation of Planning

7.1 Regulation and policy guarantee

7.2 Organisational guarantee

7.3 Human resources guarantee

7.4 Science and technology guarantee

7.5 Funds guarantee

7.6 Protection and management measures

7.7 Other guarantee

8. Comprehensive Benefit Evaluation

8.1 Resource benefits

8.2 Eco-environmental benefits

8.3 Social benefits

8.4 Economic benefits

9. Planning Compilation, Consultation and Approval

Reference and Appendix

4.3 Revision of the Management Plan

The MPA authorities can update or modify their management plan every 5 years based on the evaluation status of protected targets' status and new threats or new management demands.

The management plan of each MPA is rewritten and re-drafted every 10 years to reflect any significant changes of protected targets, new protection activities, the new status of the environment, and the new developing objective of the MPA.

4.4 Management Plans of the NEAMPAN Sites

As described above, management plans of the NEAMPAN sites follow the common structure across MPAs while there are rules and regulations specifically applicable to each respective MPAs. Reflecting the nature of the MPA, management authorities of the Marine Nature Reserve (MNR) allow no entry to the core area and prohibit any activities which harm the MPA, while the scope of measures of Marine Special Protected Area (MSPA) include the sustainable use of resources within the carrying capacity of the area. Further details are provided in Table 4.

Table 4 **Management Details of Each MPA in NEAMPAN**

	Law/ regulation/ guideline, etc. specific to the site.	Management measures to be taken by MPA management authority	Management Plan	Protection facilities	Monitoring	Scientific research and education
Nanji (MNR)	Management rules of Nanji Islands National Marine Nature Reserve of Zhejiang Province (1996)	No entry into the core area. No human activity in the buffering area. Any activity which is harmful to the MPA is prohibited in the experimental area.	Current management plan: 2014-2024	Management station, Landmark, sign, power & water supply, disaster prevention, transportation & communication supplies.	The monitoring sites may be selected according to historical sites. The location is mainly within the habitats of shellfish and algae, including benthic habitat and tidal flat. Monitoring sites in different cruises should be same. Monitoring time and frequency: conduct monitoring every month if conditions permit.	Training workshop for MPA staff.
Shangkou (MNR)	Management Measures of Shankou Mangrove National Marine Nature Reserve and Beilun Estuary National Marine Nature Reserve in Guangxi Zhuang Autonomous Region (2018)	No entry into the core area. No human activity in the buffering area. Any activity which is harmful to the MPA is prohibited in the experimental area.	Current management plan: 2011-2020	Boundary marker, MPA administration building, administration site, field patrol equipment	Monitoring of the water body, fish and plant species; Environmental impact monitoring of tourism activities.	Investigation of afforestation; Structural and functional stability of mangrove systems;
Beilun (MNR)	Management Measures of Shankou Mangrove National Marine Nature Reserve and Beilun Estuary National Marine Nature Reserve in Guangxi Zhuang Autonomous Region (2018)	No entry into the core area. No human activity in the buffering area. Any activity which is harmful to the MPA is prohibited in the experimental area.	Current management plan: 2011-2020	MPA administration building, administration site, boundary marker , watchtower, field patrol equipment	Mangrove monitoring	Ecological monitoring, bird observation, mangrove insect pests, plant culturing and ecological conservation in technical cooperation with Guangxi Mangrove Research Center, breeding and recovery of rare species living in mangroves and coastal wetlands, sea water chemical analysis and ecological investigation

	Law/ regulation/ guideline, etc. specific to the site.	Management measures to be taken by MPA management authority	Management Plan	Protection facilities	Monitoring	Scientific research and education
Dazhou (MNR)	Announcement on reinforcing the management of national nature reserve of Dazhou Island Marine Ecosystems (1992)	No entry into core area. No human activity in the buffering area. Any activity which is harmful to the MPA is prohibited in the experimental area.	Current management plan: 2011-2020	MPA administration building, boat and communication facility	Swiftlet/marine seawater monitoring	In 2008, a biological resource investigation had been carried out in Dazhou Island protected area.
Sanya (MNR)	Management rules of Hainan Nature Reserves (1991)	No entry into core area. No human activity in the buffering area. Any activity which is harmful to the MPA is prohibited in the experimental area.	No information		Monitoring of coral reef and water quality.	Cooperate with South China Sea Institute of Oceanology, Hainan Tropical Ocean University and the Third Institute of Oceanography. Research on biodiversity of coral reef; Study on the influence to the coral reef after the enhancement of fish; basic research on morphological characters and habits of marine animals.
Changyi (MSPA)	Interim management procedures of MSPA in Shandong Province (2014) No construction activity in the key protected area. Restoration activities that are consistent with protection objectives are allowed in ecological restoration area. Sustainable use of resources within the limit of carrying capacity is allowed in proper utilisation area.		Current management plan: 2016-2025	Management office, boundary marker, fire safety sign, patrol equipment, monitoring equipment, lab equipment	Baseline study conducted every 5 years. Longterm monitoring on protected target and habitat.	The protected area has cooperated with Ocean University of China, the First Institute of Oceanography, Qingdao National Oceanography Laboratory and other scientific research institutes; It has been the demonstration zone of two marine non-profit scientific research; scientific research institute of marine ecology and engineering in Changyi was established by the protected area and the Cold and Arid Regions Environmental and Engineering Research Institute of the Chinese Academy of Sciences.

B. Monitoring and Assessment of Designated MPAs

The aim of monitoring and assessment is to know the status (mainly density, biomass, and numbers etc.), distribution area, change and main factors influencing the protected targets in MNR/MSPA.

1. Monitoring Parameters

1.1 Areas Addressed by the Monitoring Parameters

In China, according to the technical guidelines on marine ecology & environment monitoring protocol (SOA, 2015) for both MNR and MSPA, in all types of protected areasmonitoring focuses on protected targets and the factors influencing them . Water quality must be monitored according to the requirements of functional zoning management. However, not much attention is given to the socio-economic monitoring at this moment and almost no MPA incorporates social-economic data into their monitoring report.

The monitoring frequency should be at least once a year, and the detailed monitoring time should depend on the characteristics of the protected targets, especially for marine organisms, as well as the context of different types of MPAs. Ultimately, the higher the monitoring frequency, the better. In the case of emergencies, there should be an increase in urgent monitoring for the environment and protected targets.

Table 5-9 show the standard monitoring parameters specified in the national guidelines for MPAs, such as endangered marine organisms, high valued animals, plants, marine natural landscape, and marine ecosystem. Each MPA tailors these monitoring parameters depending on the local context. Table 10 summarises the specific monitoring parameters for each target MPA in reference to standard parameters.

Table 5 The Monitoring Parameters for MPAs of Endangered Marine Organism

Protected target	Monitoring parameter	Monitoring parameter of affecting factors *			
		Water quality	Sediment quality	Biological quality	Others
Lancelet *(Amphioxus)*	Density, and biomass	pH, DO, COD, DIP, DIN, petroleum, and heavy metals	Granularity, DOC, petroleum, and heavy metals	—	Biodiversity index, and human factors
Songjiang Perch *(Trachidermus)*	Density, and biomass	pH, DO, COD, DIP, DIN, petroleum, and heavy metals	DOC, petroleum, and heavy metals	Colibacillus. Petroleum, and heavy metals	
Coral *(Anthozoa)*	Coverage of live corals, species, and death rate	pH, TSS, DO, COD, DIP, DIN, petroleum, and heavy metals	DOC, petroleum, and heavy metals	—	
Cowfish *(Neophocaena)*	Quantity, and frequency	—	—	—	
Sea turtle *(Chelonia mydas)*		pH, DO, COD, DIP, DIN, petroleum, and heavy metals	Granularity, DOC, petroleum, and heavy metals	—	
Swiftlet *(Aerodramus)*		—	—	—	
Chinese White Dolphin *(Sousa chinensis)*					

Table 6 The Monitoring Parameters for MPAs of High Valued Animals

Protected target	Monitoring parameter	Monitoring parameter of affecting factors *			
		Water quality	Sediment quality	Biological quality	Others
Surf Clam Shell *(Mactra antiquata)*	Density, and biomass	pH, DO, COD, DIP, DIN, petroleum, and heavy metals	DOC, petroleum, and heavy metals	Colibacillus. Petroleum, and heavy metals	Biodiversity index, and human factors
Clam Worm *(Nereis succinea)*					
Sea Cucumber *(Stichopus japonicus)*					
Shellfish	Species, density, and biomass				
Razor Clam					
Fish					
Birds	Species, and quantity	—	—	—	Biodiversity index, and human factors

Table 7 The Monitoring Parameters for MPAs of Plants

Protected target	Monitoring parameter	Monitoring parameter of affecting factors *			
		Water quality	Sediment quality	Biological quality	Others
Mangrove *(Rhizophora apiculata)*	Species, density and area	—	DOC, petroleum, and heavy metals	—	Climate factors, pests, alien invasive species, and human factors
Chinese Tamarisk *(Tamarix chinensis)*	Density, and area				
Wild Daffodil *(Narcissus tazetta chinensis)*					
Algae *(Sargassum fusiforme)*					

Table 8 The Monitoring Parameters for MPAs of Marine Natural Landscape

Protected target	Monitoring parameter	Monitoring parameter of affecting factors *			
		Water quality	Sediment quality	Biological quality	Others
Chenier	Area, and integrity	—	—	—	Storm tide, ocean dynamic, and human factors
Coastal Dune	Area, and elevation				
Oyster Reef	Area, and integrity				
Submarine Ancient-forest					
Sand Beach					
Land-tied Island Sandbar					
Reef Island					

Table 9 The Monitoring Parameters for MPAs of Marine Ecosystem

Protected target	Monitoring parameter	Monitoring parameter of affecting factors *			
		Water quality	Sediment quality	Biological quality	Others
Bay	Biodiversity, and typical species, density, and biomass	pH, DO, COD, DIP, DIN, petroleum, and heavy metals	DOC, petroleum, and heavy metals	—	Biodiversity index, and human factors
Island					
Estuary					
Coastal Wetland					
Seagrass bed	Species, density, coverage, and area	—	DOC, petroleum, and heavy metals	—	Climate factors, pests, alien invasive species, and human factors

Table 10 **The Monitoring Parameters for Each MPA**

No.	MPA's name	Protected targets	Monitoring parameters
1	Nanji Islands National Marine Nature Reserve	Marine shellfish and algae as well as their habitats	Density, biomass, and area plus water/sediment/ biological/other parameters in Table 6 and 7
2	Shankou Mangrove National Marine Nature Reserve	Mangrove ecosystem	Species, density and area, plus sediment/other parameters in Table 7
3	Beilun Estuary National Marine Nature Reserve	Mangrove ecosystem	Species, density and area, plus sediment/other parameters in Table 7
4	National Nature Reserve of Dazhou Island Marine Ecosystems	Swiftlet, its habitat and the marine ecological system	Quantity, and frequency, plus water/sediment/other parameters in Table 5
5	Sanya Coral Reef National Nature Reserve	Coral reef and the marine ecological system	Coverage of live corals, species, and death rate, plus water/ sediment/other parameters in Table 5
6	Changyi National Marine Ecology Special Protected Area	Tamarix chinensis, marine organisms and coastal wetland ecosystems	Density, and area, plus sediment/ other parameters in Table 7

1.2 Monitoring Bodies and Collection of Data

As requested in the "*Standardised Construction and Management of National Marine Protected Areas*" by SOA in 2014, the management agency of each MPA is the responsible body for conducting the monitoring. However, because of limited staff and expertise, almost all the MPA's monitoring is executed by other professional qualified agencies such as local marine environment monitoring center, related universities, and research institutes. MPA management agencies will pay the monitoring expenditure according to the total area, amount of parameters, and monitoring frequency by services procurement. As they purchase the service, they own all the monitoring data and have the right to decide how to use the monitoring data, for public use or not. However, they must submit all data and an assessment report to the National Marine Information Center and NFGA, the authority of the central government for MPAs, for reference and decision-making.

2. Assessment of Data

2.1 Assessment Criteria and Responsibilities

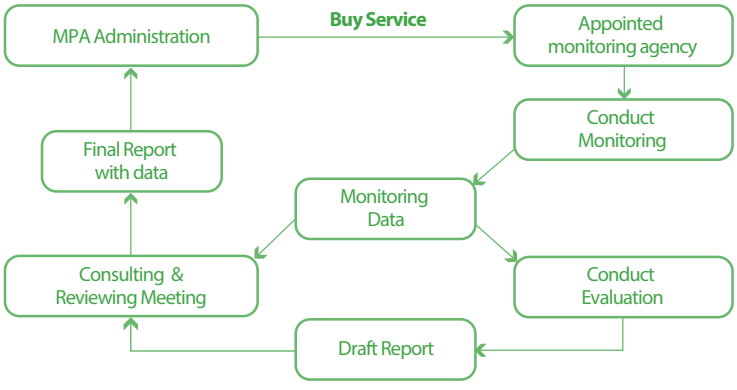
There are two purposes to evaluate the monitored data:
(1) To obtain ecological and environmental information. The status of protected targets could be known by evaluating the monitored data and changing trends.
(2) To know the pressure and threats to the MPA. The intensity of the pressure and main threats will be known, as well as how they affect protected targets.

There is no evaluation criteria for the monitored data of protected targets, such as the density, biomass, death rate, marine mammal frequency, species number, coverage area, integrity, and key species of ecosystem. Biodiversity is usually evaluated by Shannon-Wiener Index. Normally, the monitored data of affecting parameters (Table 5-9) will be evaluated against national standards, i.e., Sea Water Quality Standard (GB 3097-1997) for water quality, Marine Sediment Quality Standard (GB 18668–2002) for sediment quality, and Marine Biological Quality Standard (GB18421-2001) for the biological quality.

As illustrated in Figure 7, the evaluation process is typically carried out by the contracted monitoring agency. Upon the delivery of the monitoring and evaluation report by the agency, the administration of the MPA will organise an expert consultation meeting to review the monitoring methodology and evaluation results. The meeting will consist of independent consultant/experts who are familiar with the study or the area. The frequency of this is generally once a year, dependent on the budget.

The MPA administration must submit the final evaluating report and the monitoring data to the National Marine Information Center for backup.

Figure 7 The Process of the Monitoring and Evaluation of MPA



2.2 Assessment against Goals and Indicators

As shown in section A.4, the management plan should usually detail the status of natural ecology/protected targets, controlling objectives of human activity, improving objectives of working conditions / management facilities, and working objectives of scientific research / community development. Yet the monitoring parameter shown in 2.1 is more focused on the protected targets, the ecology and environment, and the threats. Therefore, the assessment will be against the objective indicators for the status of those parameters. The other objective indicators related to administration and management of the office, such as the working conditions, the capacity building of staff, and the community development, cannot be monitored and evaluated.

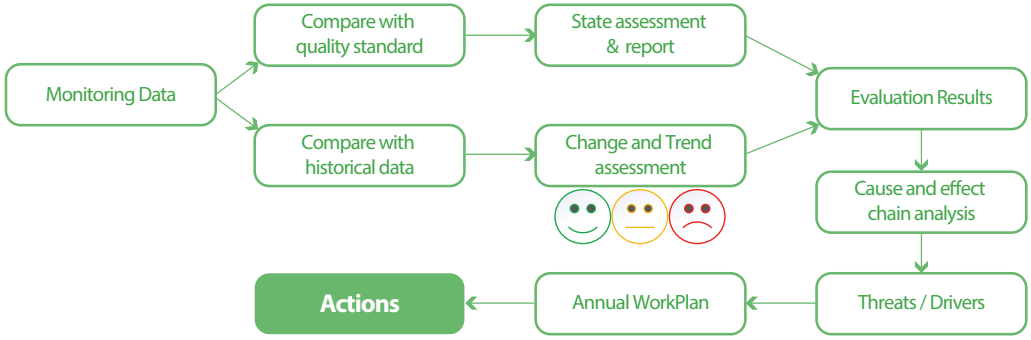
Despite the number of guidelines for the MPA's monitoring, there is a huge gap with the guidance and standards for the MPA's evaluation in China, both for the procedure and the criteria. SOA had appointed NMEMC to draft guideline for protected targets evaluation in 2015, although it is unfinished.

3. Links between Monitoring/Assessment Results and Management

3.1 Use of Monitoring Data

Costly monitoring data generated for the protected targets and ecology statuses are valuable to the MPAs, especially the long-term monitoring data. As illustrated in Figure 8, the monitoring agency (appointed by the MPA administration) will analyse the ecological and environmental data against the quality standards to evaluate the states of ecosystems and compare them with historical data to assess changes of protected targets. For the overall evaluation report, analysis of the cause-and-effect chains, and the threats and drivers are conducted. Based on the results, the annual work plan will be adjusted and some special actions may be implemented by the MPA administration.

Figure 8 **The Use of Monitoring Data**



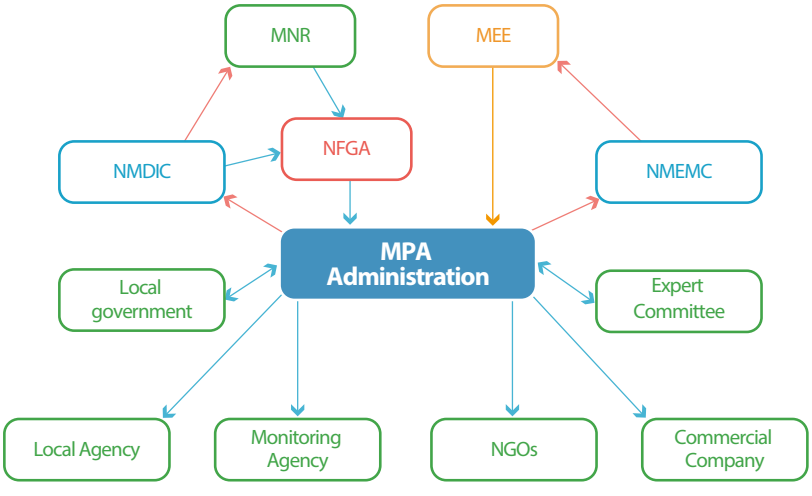
However, it is regrettable that the monitoring data is not accessible to the public and research institutions. The public does not know the states of the MPAs and the protected targets, although such information is especially useful to the neighbouring community, such as fishermen. Further, the long-term monitoring data is very valuable for scientific research, as the scientists could further analyse the data and find insights for the MPA's management. The scientific research team is thus trying to work closely with the MPA administration in order to access monitoring data for research.

3.2 Institutional aspects

Major institutions involved in monitoring and evaluation are shown in Figure 9. The MPA administration is the central institution for monitoring, setting management plan objectives, and implementing plans and monitoring. NFGA in the Ministry of Natural Resource (MNR) is the MPA authority within the central government. The Ministry of Ecology and Environment (MEE) is the supervision and inspection authority for all the protected areas (including MPAs), and usually conduct management effectiveness evaluations every two years.

The National Marine Data and Information Center (NMDIC) is the data reservation agency for MNR, while National Marine Environment Monitoring Center (NMEMC) is the monitoring data reservation agency for the MEE. The MPA administration delivers all monitoring data to both agencies, which then provides the data and other related information to respective ministries. Communication channels between the NFGA and the MEE exist, such as meetings, but there are no communication channels between NMDIC and NMEMC. Expert committees are composed of famous experts in this field, regardless of the institution.

Figure 9 The Institutions Involved in Monitoring and Evaluation of MPA



Note: [Blue line] normal operational connection; [Red line] reporting connection; and [Yellow line] supervision and inspection

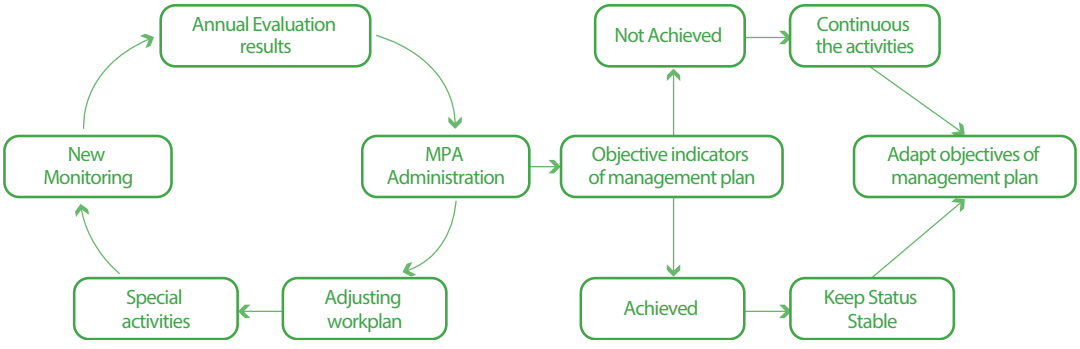
Many objective indicators, such as those related to the administration and management of the office, should be coordinated with the local government. The expert committee provides professional suggestions and technical review for the management plan, the objectives setting, monitoring protocol, evaluation report, and other advice to MPA.

Objectives and the key projects within the management plan can be implemented by the local agency, monitoring agency, NGOs, or commercial companies based on their business scope and expertise.

C. Feedback of Assessment Results to Management Plans and Practices

The adaptive management principle is widely accepted and used in MPA management. MPA administration has responsibility and authority for monitoring and adapting the objectives of the management plan. Therefore, the assessment results can be reflected in the annual workplan and/or management plan of MPA administration (Figure 10).

Figure 10 The Relation between Evaluation Results and Objective Indicators of the Management Plan



The key focus of annual monitoring and evaluation is the status of protected targets, the status of the ecology and environment and threats, in adjusting the annual work plan. For new threats and/or degradation of ecology and environmental quality, some special activities will be carried out to reduce the threat and improve the quality of the environment. New monitoring will be implemented for these special activities.

For long-term evaluation results (at least 5 years), the MPA administration and the expert committee will review the objective indicators of the management plan to determine whether those indicators need to be adapted. As the management plan is normally for a 10-year period and is to be approved by the MPA authority, it is not so frequently modified. If the evaluation results show a continuous degradation (at least 5 years) of protected targets and/or ecology, i.e., lasting threats on MPA, the objective indicators will be adapted. If the evaluation shows stable

results of the indicators, the new objectives within the new management plan will usually be to maintain the status quo.

D. Case Studies

1. Nanji Islands National Marine Nature Reserve

1.1 Brief Introduction

As described in section A, Nanji Islands National Marine Nature Reserve (NJ-MNR) in Zhejiang Province belongs to the marine ecosystems protected area with protected targets of shellfishes, algae, marine birds, wild daffodils and their habitats. It consists of 52 islands, tens of bare/submerged rocks and the surrounding waters and has been listed as UNESCO's Marine Nature Reserve of World Biosphere Reserves.

The NJ-MNR is located in the transitional zone of temperate and tropical zones. The site has islands and rocks with tortuous coastlines and numerous capes and baysand, as well as various types of beaches including the sandy beach, mudflat, boulder beach and rocks. Because it is at the junction of the Taiwan Warm Current and Jiangsu/Zhejiang Longshore Current, it has a unique ecological environment, diverse species set and complex flora and fauna, providing a perfect habitat for marine life. The MPA has identified 427 species of shellfishes, 178 species of macro-benthic algae (the species of shellfishes and algae together account for 20% of the country's total number and 80% of Zhejiang Province), 459 species of microalgae, 397 species of fish, 257 species of crustaceans and 158 species of other marine lives. 36 species of the shellfish are only found in Nanji Islands, among which 22 are listed as rare species. Three algae species, *Sargassum nigrifoloides sp.nov*. *Sargassum capitatum* and *Hincksia zhejiangensis* were also first discovered globally on the islands.

The algae species are abundant, with the features from both temperate and tropical zones, demonstrating characteristics of regional "Faults Distribution". It is like a living natural history museum and gene bank of the main marine algae in China. Consequently, it has been dubbed the "Shellfishes and Algae Kingdom". It also provides the resource pool of the marine project "Southern species transfer to the north and northern species transfer to the south".

The scenery of NJ-MNR is praised as "Bihaixianshan", meaning blue sea and fairy mountains, for having beautiful mountains, distinctive rocks, charming beaches, green grassland, blue waters and far-reaching sky.

The biggest island in NJ-MNR is Nanji Island. Dalei Island and Zhu Island are known as "the Islands of Daffodil" for their abundance of daffodils.

As the first island ecosystem nature reserve established in China, NJ-MNR possesses the premier scientific and ecological value whilst also attracting an increasing number of tourists.

1.2 Monitoring Plan

The rapid growth of the population and economy in the southern coastal region has led to the degradation of coastal habitats. Despite measures such as the establishment of MPAs and implementation of integrated coastal management (ICM), threats to biodiversity remain. To protect the biodiversity and habitats of NJ-MNR and sustain the carrying capacity of the site, long-term monitoring is indispensable.

The objective of the monitoring plan of NJ-MNR is to provide supporting information to protect the shellfish and algae resources and their habitats, maintain the balance of the ecosystem, prevent the damage to shellfish and algae resources, promote the virtuous cycle of the ecosystem, and establish a harmonious development between humans and nature.

The monitoring location is mainly the habitats of the shellfish and algae, including benthic habitat and tidal flats. The main ecological types of Nanji shellfish and algae habitat should be covered, including rock, sandy beach and muddy flat. Table 11 shows the monitoring parameters of NJ-MNR.

Table 11 **Monitoring Parameters of NJ-MNR**

Items	Parameters	Sites
Habitats diversity	Sediment particle size	Sandy, muddy ecotypes
	Habitat	All
	Habitat water quality	Species with weak or no migration ability
	Geographic and geomorphic conditions	All
Biodiversity	Species diversity	All
	Biodiversity index	All
Community structure	Biomass and abundance	All
	Species composition	All
	Species with public attention	All

1.3 Monitoring Results and Threats Identified

Comprehensive scientific surveys were conducted in the 1970's, 1990's and 2003. Table 12 shows the results of these surveys. It shows that number of shellfish and algae species obtained in these 3 surveys differ significantly, which might be due to the passage of time, site and transections numbers surveyed.

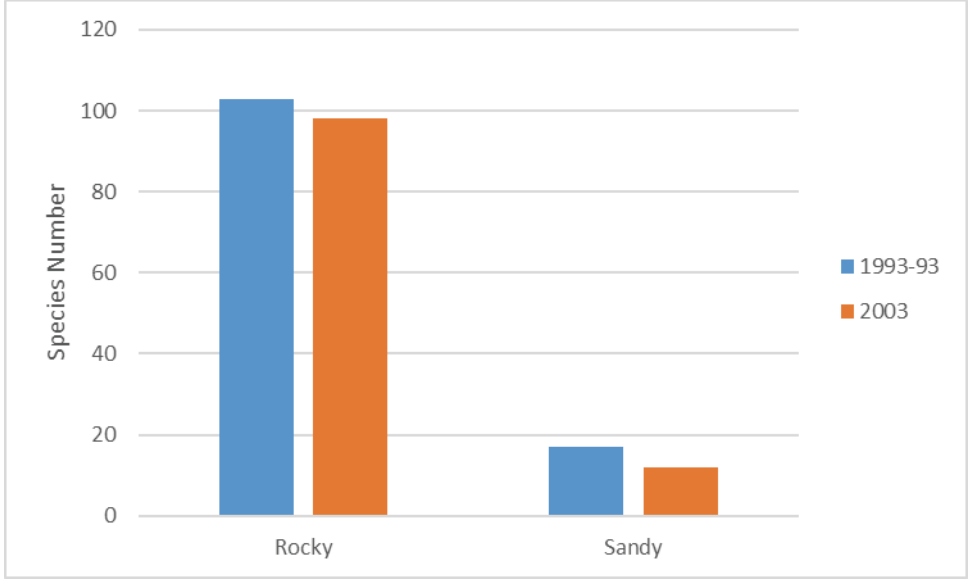
Table 12 **Shellfish and Algae Species Number in Three Surveys**

Year	Shellfish species number	Algae species number	Transection
1974-1976	122	94	4
1992-1993	143	121	14
2003-2004	105	85	10

Shellfish Abundance & Biomass

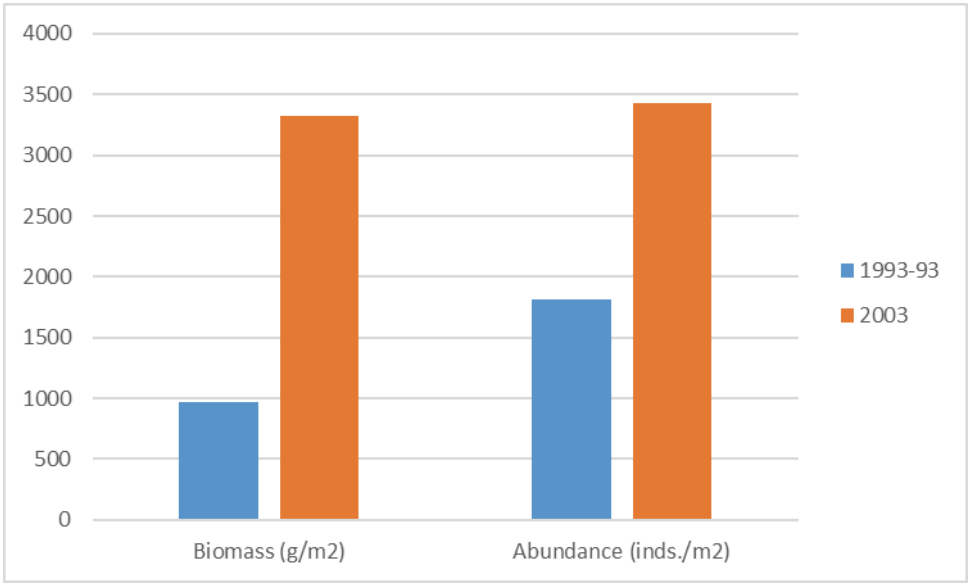
As shown in Figure 11, the rocky transection had 103 species in 1992-1993, compared to 98 in 2003. In the sandy beach transection, the species number dropped from 17 (1992-93) to 12 (2003).

Figure 11 **Shellfish Species Number between Years and Transections in NJ-MNR**



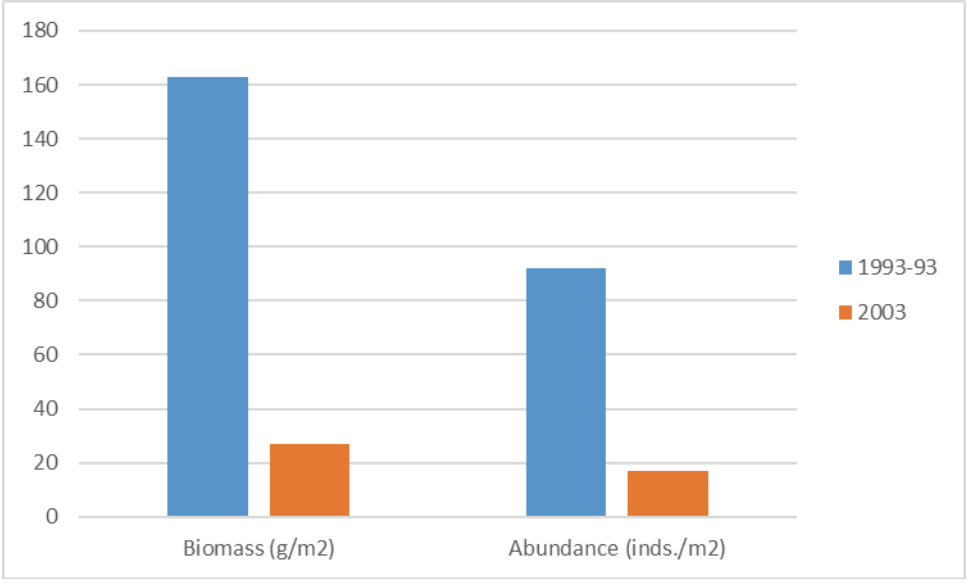
As shown in Figure 12, in 2003 the rocky transection, shellfish biomass (3,324.29 g/m^2) and abundance (3,428 inds./m^2) was higher than 1992-93 (970.63 g/m^2 and 1,812 inds./m^2, respectively).

Figure 12 **Shellfish Biomass and Abundance in Rocky Transection of NJ-MNR**



In the sandy transection, shellfish biomass and abundance in 2003 was lower than 1992-93. The biomass dropped from 162.95 g/m^2 to 26.78 g/m^2 and the abundance dropped from 92 inds./ m^2 to 17 inds./ m^{2,}, as shown in Figure 13.

Figure 13 **Shellfish Biomass and Abundance in Sandy Transection of NJ-MNR**



Algae Species Diversity

The south cape of Mazuao in NJ-MNR has a history of monitoring algae. Forty years of monitoring found a decreasing trend in algae species diversity, as shown in Table 13. Half of the constructive species have lost their ability to construct the community. For instance, *Ulothrix flacca* and *Pachydictyon coriaceum* are now degraded from constructive species to dominant species. *Lynghya semiplena* and *Grateloupia ramosissima* are degraded to common species.

Table 13 **Long-term Variations in Species Number of Algae in NJ-MNR**

Year	Total species	Constructive species		Dominant species		Common species	
		No. of species	%	No. of species	%	No. of species	%
1959-1965	84	8	9.5	14	16.6	34	40.7
1980-1985	73	8	11.0	12	16.4	22	30.1
2000-2007	49	4	8.2	4	8.2	13	26.5

Threats Identified

Several threats have been identified regarding the decline in biodiversity in NJ-MNR.

- *Overexploitation* - NJ-MNR area is historically used by local fishermen for fishing and algae collection. Fisheries are the main source of income for local fishermen, with capture fisheries in coastal waters being the most valuable. Aquaculture accounts for smaller parts of their fishery resources acquisition. The production, lifestyle and culture are relatively less developed compared with other coastal parts of China. The less-developed fishery style poses pressure on the environmental protection of MPA. For example, due to the oversampling of *Sargassum fusiforme*, the population of this species has been degraded.

- *The rapid development of tourism* - There is a conflict between tourism development and MPA management. Since the establishment of MPA, tourism has developed rapidly, with increasing visits of tourists to NJ-MNR, which could be over 1,000 visitors/day. The number was as high as 60,000 visitors/year in 2007. Tourists' preference to eat economical shellfish increases the pressure of overexploitation of shellfish resources. The decrease of shellfish species diversity, number and size in Dashaao beach is an example of this. The demand for shellfish promotes the formation of the harvesting-selling chain, a big threat to the shellfish diversity conservation. Furthermore, the increase in tourists adds pressure to water & electricity supply and increases water/solid waste disposal. Without proper management of such pressures, environmental pollution could be aggravated.

- *Infrastructure construction* - Although NJ-MNR is far from the mainland, there are some coastal engineering activities for existing villages and islands, such as the construction of an island belt road and dock. Detritus, sand and mud generated during the construction will impact the local biological resources and environment. Particularly, the artificial coastal lines will influence the surrounding fishery grounds and habitats. For example, due to the Nanji Islands belt road construction, a large volume of soil and stones sink into the sea, leading to the degradation of Mazuao habitats. *Sargassum horneri* bed is largely degraded in this area. Generally, this algae species lives between the low-tide line and 3-4 meter shallow water areas, thus the road construction damages not only its habitats but also hampers its growth by changing the pH and increasing the turbidity of seawater. Anthropogenic development activities in NJ-MNR also influences the biodiversity to some extent.

- *Mariculture* - In recent years, cage farming is developing rapidly in and around NJ-MNR. The introduction of non-native species might lead to species invasion. Mariculture may also result in environmental pollution. About 0.04 km^2 sea area in NJ-MNR used for deep-water cage farming poses threats to shellfish and algae biodiversity inside the MPA. A high volume of residual feeds, faeces, and death of cultured organisms will influence the water environment. Medicines applied in mariculture will also suppress the growth of plankton. Medicine residuals will accumulate within low trophic organisms and gradually be transferred to high trophic level organisms and may eventually even influence human health.

- *Natural environment quality degradation* - NJ-MNR area is rich in nutrients. Against the Redfield ratio[2]: N/P=16, the ratio in the NJ-MNR area is much higher. According to survey in 1992, the ratio is N/P=36.94. In the survey of year 2003, the ratio was 31.68 in spring, and 28.33 in summer. The ecosystem here is sensitive to the variation in nutrients, and the possibility of harmful algae bloom does exist.

1.4 Improved Management Measures

Based on the identified threats, the management agency of NJ-MNR drafted the special management plans for reducing the threats to MPA and applied for additional funding for the activities. Two main pathways are: (1) the activities implemented by the agency directly, such as the ecological restoration and the real-time monitoring of network building; (2) activities in cooperation with local government, such as extending the fishing-off period, controlling tourist arrivals, and developing the eco-mariculture.

2 N for nitrate and P for phosphate

Extended Fishing-off Period in MPA

Since 1995, China has fully implemented the summer fishing ban policy. For over 20 years, the fishing ban duration was gradually extended, from 2.5 months at its inception, to 3.5 months. The annual fishing ban is currently 4.5 month in NJ-MNR, from May to the middle of September. This policy can help fishing resources recover from fishing pressure and protect the fish larva by controlling the fishing gear. The fishing ban is an important measure to sustain the healthy development of marine organisms and improve the ecological environment. It possesses ecological, social and economic benefits: the abundance and size of the fish larva are increasing, and the marine biological community composition is improved. At the same time, bottom trawling is entirely forbidden to reduce the threats to the benthic habitat in NJ-MNR.

Tourists Control and Updated Management Facilities

Tourism can bring a considerable income to local fishermen. However, the over-development of tourism can also add pressure to the ecosystem. To promote the healthy development of tourism and reduce the costs of management, the carrying capacity of tourism was calculated in order to control the number of tourists. The "one-ticket system" was proposed in 2007 to control tourist quantities. At the same time, the boundary and area of management were signalled with bright warning signs and fences to keep away tourists from the core area of the MPA. The old facilities were updated with tools such as communication devices, cars, and law-enforcement boats.

Ecological Restoration

Sargassum horneri can function as a shelter, spawning and feeding habitats for many marine organisms. These macroalgae can absorb nutrients from ambient seawater to prevent eutrophication. However, the *S. horneri* bed has been degraded due to many reasons, such as construction. Thus, the restoration of *S.horneri* population is an important task for NJ-MNR, which involves 1) studying the life circle of *S.horneri*, 2) artificial breeding in a lab, and 3) cultivation of seedlings. After a recent restoration, two seaweed fields with an area of 100 hm^2 have been formulated, a positive direction in efforts for the restoration.

Marine Ranching and Eco-mariculture

Selecting the appropriate sea area, such as the out circle of NJ-MNR, or setting up artificial fish reefs to create suitable habitats and environment for marine organism growth. This activity will promote the productivity of NJ-MNR and reduce fishing pressure. Reasonable development of mariculture is encouraged, although the development must consider the protection of the marine environment and biodiversity. Several measures were carried out to ensure the sustainable development of mariculture, such as reasonable design of mariculture area, promotion of eco-mariculture mode, control on pollution and alien species culture, and control on culture scale based on the environmental carrying capacity.

Real Time Monitoring Network

A comprehensive monitoring system has been set up, including satellite, unmanned aerial vehicle, shore-based radar and law-enforcement boat to better manage the dynamics of the environment and protected organisms. Long-term monitoring sites have been set up to obtain continuous monitoring data. Water quality is monitored by conducting supervision, control, and management on wastewater discharge and pollution status in the mariculture area. The ecosystem assessment indicator system has been set up, including environmental indicators, biological indicators, biodiversity indicators and environmental quality indicators. Better analysis and prediction of NJ-MNR biological resources and ecological environmental quality could be achieved by setting up such a comprehensive monitoring system.

2. Changyi National Marine Ecology Special Protected Area

2.1 Brief Introduction

Changyi National Marine Ecology Special Protected Area (CY-MSPA) is the only MPA with tamarisk (*Tamarix chinensis* and *Tamarix austromongolica*) as the protected target in China and also the first National level MSPA in Shandong Province. It was designated and approved by the SOA in October of 2007 and located in the mudflat area on the eastern coastline of Changyi.

CY-MSPA maintains various ecotypes, ranging from shallow waters and mudflat to the saltmarsh and tamarisk wetlands. Inside the MPA, there is a diverse number of plants and animals, including plant species of the Chinese tamarisk, reed (*Phragmites communis*), seepweed (*Suaeda heteroptera*), silvergrass (*Miscanthus sacchariflorus*) and *Limonium bicolor*, bird species of the white swan, wild goose, wild duck, and pheasant, mammal species of the hare, badger, fox, yellow weasel, palm civet, macro-benthic communities in the intertidal zone of the *Mactra veneriformis, Moerella irideseens,* and *Solen gouldi* and *Bullacta exarata*. The natural tamarisk forests cover an area of 2,070 ha, accounting for 71% of the total MPA. The scale and density of its forests are rarely seen on China's coast, making it extremely valuable for scientific research and tourism development. Together with the mangrove planting, marine scientists call it "Southern Mangrove and Northern Tamarisk". The tamarisk blooms three times between May-September, creating a 'flower sea' in the MPA.

The CY-MSPA is divided into three zones according to their different functions: *the key protected zone*, *the ecological and resource restoration zone* and *the moderate utilisation zone*. *The key protected zone* is in the central part of the MPA, with the densest tamarisk forests, diverse animal/plant species and natural resources for scientific, economic and social value. The ecological and resource restoration zone surrounds the key protected zone, which now has sparse tamarisk covering. The moderate utilisation zone is outside of the ecological and

resource restoration zone and has sufficient sources of marine multiplication and cultivation and saline chemical industries.

The establishment of the CY-MSPA contributes immensely to the conservation of the coastal wetland's ecosystem and biodiversity and the provision of ecosystem goods and services for purification of air, wind sheltering, sand fixation, and erosion prevention.

Figure 14 Protected Targets of CY-MSPA

2.2 Monitoring Plan

The monitoring objective is to provide information for the effective management of the MPA and to increase the knowledge of protected targets. In particular;

- To comprehensively understand the basic situation of CY-MSPA and its surrounding areas, the growth of Tamarisk, the living habits and wildlife, the natural environment condition, and the relationship among various systems;
- To protect the coastal wetland ecosystem and marine living resources dominated by *Tamarix chinensis*, with an improved understanding of the natural law of evolution of wetlands through monitoring and scientific research; and
- To provide a scientific basis for the ecological restoration of *Tamarix chinensis* and wildlife through monitoring and research and provide the information on rational utilisation, such as ecotourism and vegetation resources in CY-MSPA.

The monitoring focus is on the protected targets, i.e., Tamarisk and wetland, and habitat quality. Monitoring was conducted once a year on the parameters shown in Table 14.

Table 14 **Monitoring Parameters of CY-MSPA**

Items	Parameters	Sites
Protected targets	Coverage of Tamarisk, biomass	intertidal
Habitat quality	Oil concentration in soil	intertidal
	Organic carbon in soil	intertidal
	Sulfide in soil	intertidal
	COD in seawater	intertidal
	Phosphate in seawater	intertidal
	Dissolved inorganic nitrogen in seawater	intertidal
	Oil concentration in seawater	intertidal

2.3 Monitoring Results and Threats Identified

Seawater Quality

The monitoring results of seawater quality are summarised in Table 15. The COD was stable in the seawater from 2011-2015, the Phosphate was at various levels during the first 2 years and stabilised between 2012-2015. Oil concentration changed with a similar variation. However, the DIN showed a very high concentration in the first 4 years and has since dropped in the past 2 years. Compared with the seawater standard, only DIN was exceeding the criteria (0.3 mg/L), with all other monitoring parameters within the boundaries of the criteria.

Table 15 **Monitoring Results of Seawater Quality in CY-MSPA**

	COD (mg/L)	PO_4-P (mg/L)	DIN (mg/L)	Oil (mg/L)
2010	1.65 ~ 2.88	0.00744 ~ 0.0174	0.503 ~ 0.811	0.0240 ~ 0.0379
2011	1.83 ~ 3.00	0.0360 ~ 1.01	0.146 ~ 0.280	0.0285 ~ 0.0490
2012	1.37 ~ 1.90	0.002 ~ 0.003	0.698 ~ 0.772	0.0196 ~ 0.0258
2013	0.760 ~ 1.37	0.00500 ~ 0.0220	0.696 ~ 1.76	0.00406 ~ 0.287
2014	1.14 ~ 2.21	0.00500 ~ 0.0390	0.371 ~ 1.12	0.00911 ~ 0.0236
2015	1.37 ~ 2.21	0.00200 ~ 0.00500	0.345 ~ 1.32	0.0193 ~ 0.0388
Criteria	**3.0**	**0.030**	**0.3**	**0.05**

Sediment Quality

For sediment quality monitoring, the results show a positive situation for the soil. All the monitoring sites were much lower than the criteria (Table 16).

Table 16 **Monitoring Results of Sediment Quality in CY-MSPA**

	Oil (mg/kg)	Organic carbon	Sulfide (mg/kg)
2010	28.0 ~ 67.3	0.0672 ~ 0.0398	0.00 ~ 6.63
2011	32.3 ~ 38.6	0.0523 ~ 0.0945	0.672 ~ 1.56
2012	---	0.015 ~ 0.027	0.00 ~ 0.384
2013	0.00 ~ 7.40	0.0852 ~ 0.10	0.469 ~ 4.07
2014	0.00 ~ 58.4	0.0578 ~ 0.282	1.10 ~ 5.08
2015	7.12 ~ 17.70	0.0281 ~ 0.392	6.80 ~ 48.10
Criteria	**500**	**2.0**	**300**

Protected Targets

The tamarisk forest consists of various age trees, the density is 4.50~40/km^2 with crown width of 0.6m*0.6m~4m*4m. The height and diameter of tamarisk are shown in Table 17 in the fixed monitoring sites of CY-MSPA.

Table 17 **Monitoring Results of Tamarisk in CY-MSPA**

	Height (cm)	Diameter (cm)
2013	290-310	3.9-4.8
2014	340-380	4.2-4.9
2015	350-390	4.3-5.0

The coverage of tamarisk is monitored by the satellite imaging (Figure 15 for 2013 and Figure 16 for 2015). There are significant changes for the tamarisk and other botany coverages as shown in Table 18 and Figure 17. Over 4.7 km^2 the tamarisk forest was transformed into grassland (3.32 km^2), water pond for aquaculture (1.02 km^2), and land (0.4 km^2).

Figure 15 The Coverage of CY-MSPA in 2013

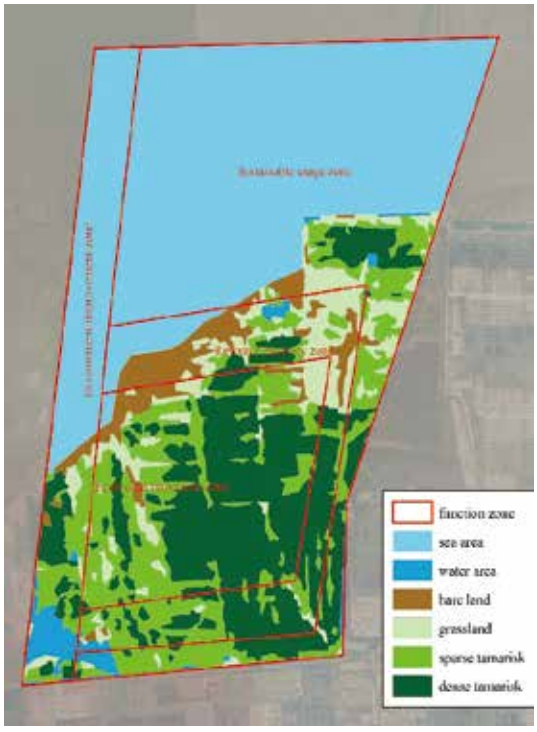


Figure 16 The Coverage of CY-MSPA in 2015

Table 18 Monitoring Results of Land Coverage in CY-MSPA

	2013		2015	
	Patches	Area (ha)	Patches	Area (ha)
Grassland	60	131	236.82	569.05
Tamarisk	100	25	1156.36	685.71
Land	16	107	137.07	177.12
Water	15	16	1395.88	1497.95

Figure 17 **The Change of Land Coverage of CY-MSPA from 2013 to 2015**

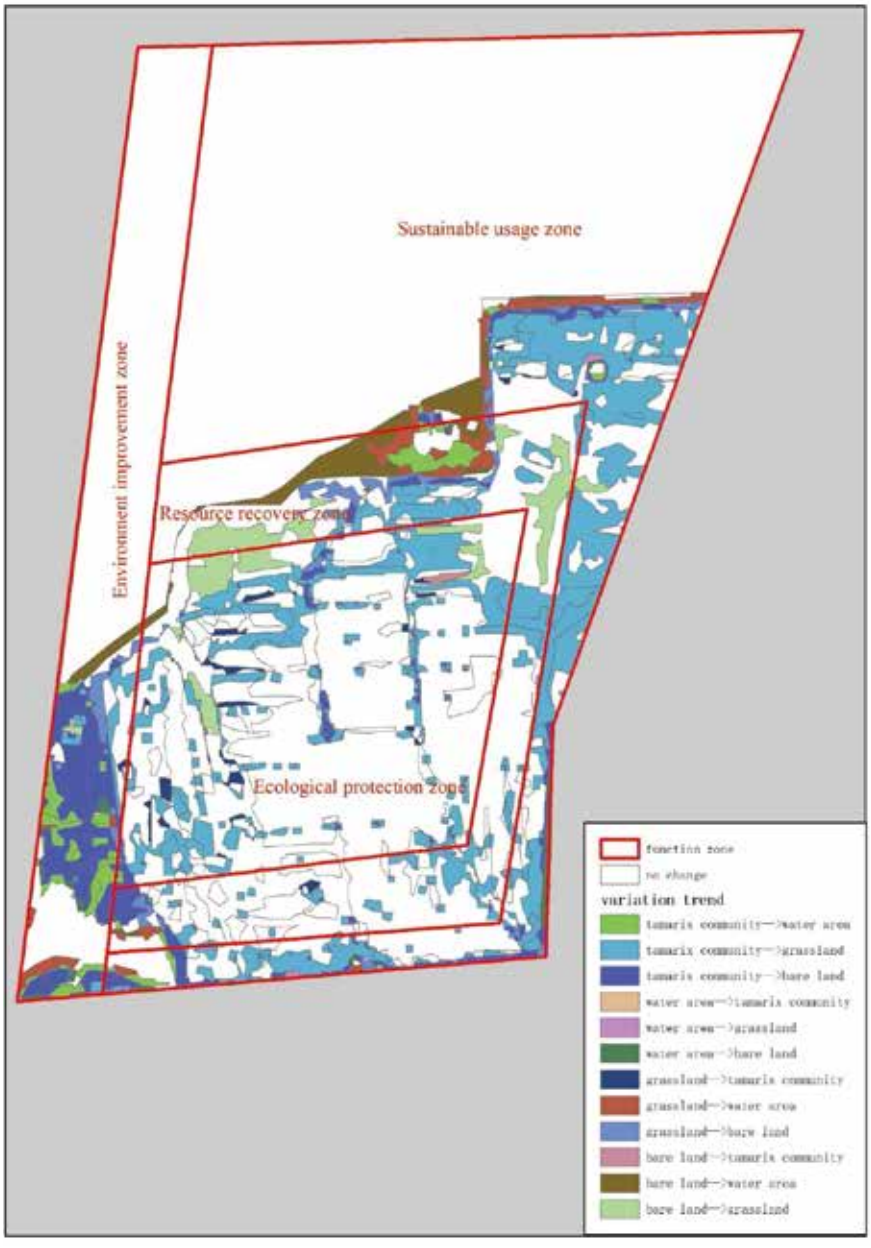
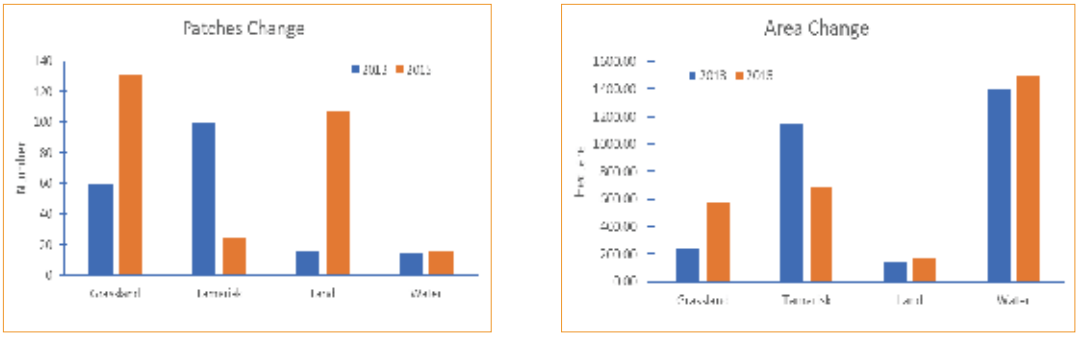


Figure 18 **The Change of Botany Coverage of CY-MSPA**



Threats Identified

Based on the monitoring results, the major threats identified for the CY-MSPA are below:

- *Natural ecosystem degradation* - With the completion of the dam outside the CY-MSPA in 2011, the character of the habitat changed from a coastal wetland to dry land with a decreased seawater soaking period. The ecological succession is experiencing rapid change from saltine species to freshwater species, from tamarisk to grassland, although the dominant species is still the tamarisk. With global climate change, the CY-MSPA will increasingly show characteristics of freshwater wetland with the increase in rainfall if the dam still separates CY-MSPA from saltwater.

- *Aquaculture* - More than 500 thousand people live around the CY-MSPA, with most of the population living on the aquaculture industry. Aquaculture is a significant threat to the MPA, both for habitat occupation and wastewater discharge. The monitoring results show a huge transformation of the habitat surrounding the CY-MSPA, from the tamarisk forest to the aquaculture pond. Further, DIN pollution is mainly from aquaculture wastewater discharge.

- *Tourism* - With the rapid development of coastal tourism in China and increased tourism to the CY-MSPA, some of the vegetation habitats have been damaged down to the bare land by trampling and walking. CY-MSPA does not currently have a tourism management plan and gives unlimited access to all visitors. An increase in tourists will bring more litter into the MPA, as well as an increased risk of a forest fire.

2.4 Management Improved

Based on the monitoring results, the management agency of CY-MSPA conducted several special activities to address the issues above.

Ecological Marine Aquaculture

The DIN exceeded the criteria of seawater inside CY-MSPA, which was mostly from the discharged water of the neighbouring marine aquaculture pond. To reduce the impact on the habitat, special law enforcement action was taken, and an online monitoring system is planned to be built on the outlets of the aquaculture pond. At the same time, traditional aquaculture will be upgraded into ecological aquaculture to prevent DIN pollution.

Ecological Restoration

The monitoring result showed many original tamarisk forests were transformed and/or degraded into grassland, marine aquaculture pond, and land. With a restoration project funded by both the central and local government, 0.7 km^2 of tamarisk forest was recovered in 2017, with more grassland and land to be rehabilitated by the tamarisk trees in the future.

Ecotourism Planning

The increase in tourists poses a high-level threat of waste discharge, vegetation damage, fire risk, and ecosystem degradation. The management agency is aware of all those threats and has started ecotourism planning to make a sustainable tourist visit routine in the MPA, reduce the risks of ecosystem degradation, and build an emergency response system for the fireproofing, accidents, and potential rescuing of tourists. It aims to provide more ecological goods and services for the people in future.

3. Conclusion & Recommendation

A number of important pieces of information and conclusions can be drawn from the above studies as a reference for other NEAMPAN MPA sites, as well as provide recommendations for future improvements in other Chinese MPAs.

The MPAs are in Good Status although Facing Some Threats

The monitoring results and evaluation of the above two MPAs indicate that the protected targets are stable with a fair ecological environment status, although not without threats around/within the MPA, which are mostly anthropocentric.

Threats from human activities could be well controlled with prudent action from the MPA agency, although the harmony between conservation and development is a long-term conflict for all the MPAs in China. Because the coastal area is extensively developed, intensive human activities and disturbances put pressure on MPAs located along the coast. However, with the progress in implementation of "eco-civilisation" strategy, new policies and regulations will likely be announced for controlling the human activities in MPAs in China.

Threats from the natural environment and large-scale threats, such as climate change and global plastic pollution, are very difficult to remove or reduce by a single MPA, requiring worldwide cooperation. Coordinated international action are crucial for the protected targets and MPAs, not only China but globally.

The MPAs should Develop a Tailor-made Monitoring Plan for Protected Targets

Although there are some national guidelines for MPA/PA monitoring in China, the protected targets are unique to each habitat or ecosystem sensitive to the various ecological environments and threats within each respective MPA. It is paramount to develop a tailor-made monitoring plan to reflect the changes of protected targets, the status of the ecological environment, and the pressure of the threats (especially the human activities).

For the MPA management agency, initial monitoring could start within the framework of the national guideline for 2-3 years. Once monitoring data has been collected and evaluations are conducted, the MPA will possess an improved understanding of the status of MPAs and protected targets, and a tailor-made monitoring plan should be developed for the specific concerns in the long term. For example, tourist numbers become a monitoring indicator if the tourism is identified as one of the threats in NJ-MNR.

The Monitoring Data could be Used by MPA Agencies to Improve the Management, but Not Good Enough

Monitoring normally produces an abundance of data, information, and results. However, a big issue for the MPAs in China is the intelligent use of monitoring data. Managers of MPAs normally lack background expertise on the protected targets, and there is an absence of college-level educated staff in the MPA in China, leading to a lack of expert knowledge within all the MPAs in China. Managers lack the knowledge to apply monitoring data into management actions and improve management effectiveness. Further, the lack of clear guidance or directives in the application of monitoring data to management actions leaves most MPAs underutilising monitoring data. Presently, the MPA managers mostly depend on suggestions from experts or scientists who conduct the monitoring survey or scientific research, while experts or scientists lack practical management experience.

Adaptive Management should be More Emphasised in MPA Monitoring

The most important and fundamental principles within MPA, adaptive management, is not well recognised in solving uncertain and complex issues of MPA. Although China published the *Technical Specification for the Management of MPAs* (GB/T 19571-2004), adaptive management is not recommended. As the marine ecosystem is complex and is affected by many factors, impacts of policies or actions aiming for controlling the influence of human activities on MPA are also uncertain. An adaptive path is needed to modify the management actions based on scientific results of the MPA monitoring. This is a critical step for MPA's effectiveness.

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Annex 1. Sea Water and Marine Sediment Quality Criteria

Sea Water Quality Criteria of China and Other Institutions

Agent (mg/l)	Sea water quality standard of P.R. of China (Class 2)	ASEAN (Proposed marine water quality criteria)	U.S. EPA quality criteria for seawater for regulatory purposes	
			Acute criteria	Chronic criteria
Nitrate	0.30	0.06		
Phosphate	0.030	0.015-0.045 (coastal-estuaries)		
DO	>5	4		
COD	3			
Fecal coliform (individual/l)	2,000			
TSS	Man-caused increment≤10	50 (Malaysia)		
Copper	0.010	8.0 μg/l	2.9 μg/l	2.9 μg/l
Mercury	0.0002	0.16 μg/l	2.1 μg/l	0.025 μg/l
Lead	0.005	8.5 μg/l	140 μg/l	5.6 μg/l
Cadmium	0.005	10 μg/l	43 μg/l	9.3 μg/l
DDT (dichloro-diphenyl-trichloro ethane)	0.0001		0.13 μg/l	0.001 μg/l
666 (benzene hexachloride)	0.002			
Oil/grease	0.05	0.14 (Water soluble fraction)	0.09	0.004
PAH			300	

Marine Sediment Quality Criteria of China (Class 1, GB 18668-2002)

Agent	Sediment quality standard ($\times 10^{-6}$ dry weight)
Mercury	0.2
Copper	35
Lead	60
Cadmium	0.5
Arsenic	20
DDT (Dichloro-diphenyl-trichloro ethane)	0.02
Oil/grease	500
666	0.50
Organic carbon	2.0
Sulfide	300

2

Japan

A. REVIEW OF MANAGEMENT PLANS AND STRATEGIES OF THE SELECTED NEAMPAN SITE

B. MONITORING AND ASSESSMENT OF DESIGNATED MPAS

C. FEEDBACK OF ASSESSMENT RESULTS TO MANAGEMENT PLANS AND PRACTICES

D. ISSUES AND CHALLENGES IN THE MPA: A CASE OF THE SHIRETOKO WORLD NATURAL HERITAGE

Chapter 2. Japan[3]

A. Review of Management Plans and Strategies of the Selected NEAMPAN Site

1. Basic Information of the National MPA Policy in Japan

The Japanese national-level policy document on marine biodiversity conservation is the "Marine Biodiversity Conservation Strategy" (see Supp. 1 in the reference list). It was formulated by the Ministry of Environment in 2011 based on the "Basic Act on Biodiversity" enacted in 2008 (Supp. 2), in line with the "Basic Act on Ocean Policy" enacted in 2007 (Supp. 4). The author was a member of the Drafting Committee for the Marine Biodiversity Conservation Strategy. Its objectives are as follows:

> *"The Strategy aims to protect the biodiversity to support the sound structure and function of marine ecosystems, and to use ecological services of the ocean, or its blessings, in a sustainable manner. The Strategy provides a basic view and direction of measures for conservation and sustainable use of the marine biodiversity."*

This Strategy includes the Japanese definition of Marine Protected Areas (MPAs) described as follows:

> *"Marine areas designated and managed by law or other effective means, in consideration of use modalities, aimed at the conservation of marine biodiversity supporting the sound structure and function of marine ecosystems and ensuring the sustainable use of marine ecosystem services."*

Therefore, in Japan, harmony between biodiversity conservation and sustainable usage of marine ecosystem services is the prerequisite of the marine environmental policies. To be more specific to the MPA discussion, no-take sanctuaries are only one of many important types of MPAs following the same definition of marine protected areas introduced by the Convention on Biological Diversity (CBD) or International Union for Conservation of Nature and Natural Resources (IUCN).

3 This chapter was prepared by Dr. Makino Mitsutaku, Atmosphere and Ocean Research Institute, University of Tokyo.

As the Attachment to this Strategy, the Government of Japan officially published the list of "Existing Systems in Japan that may correspond with Marine Protected Areas", the so-called, "Japanese MPA system".[4]

In the following list, the Japanese MPA system will be shown to be comprised of three categories, differentiated by three respective objectives; 1) Protection of natural scenery (implemented by Ministry of Environment), 2) Protection of natural environment or habitats and growing areas for organisms, (implemented by Ministry of Environment), and 3) Protection, cultivation etc. of aquatic animals and plants (implemented by Ministry of Agriculture, Forestry and Fisheries). Table 19 shows these 3 types of MPAs, although they can coincide within the same geographic areas with differing protection targets as in Shiretoko MPA. With this definition of MPA, 8.3% of the Japanese Exclusive Economic Zone (EEZ) is covered by the MPAs.

Table 19 Japanese MPA System

(1) Protection of natural scenery (administered by the Ministry of Environment)		
Area (System)	Purpose of designation	Description of major regulations
Natural Park (Natural Parks Act)	Protection of outstanding natural scenery and promotion of its use	Mainly regulation on developments, such as landfills (Ordinary Zone: notification system; Marine Park Zone: license system or harvest control in some zones). A Special Area (license system) may be set in brackish water zones.
Natural Coastal Protected Zone (Act on Special Measures Concerning Conservation of the Environment of the Seto Inland Sea)	To maintain the state of nature so that seashores and ponds could be used for bathing, shellfish gathering and so forth in the future.	Regulation on developments, such as the construction of new structures, the transformation of land properties, the mining of minerals, and earth and rock quarrying (the prefecture concerned must be notified).
(2) Protection of natural environment or habitats and growing areas for organisms (administered by the Ministry of Environment)		
Area (System)	Purpose of designation	Description of major regulations
Nature Conservation Area (Nature Conservation Law)	Conservation of the outstanding natural environment requiring particular conservation.	Developments, such as land transformation, are mainly controlled (Ordinary Zone: notification system; Marine Special Zone: license system or harvest control is adopted in some zones)
Wildlife Protection Area (Wildlife Protection and Proper Hunting Act)	Protection of wildlife.	Hunting is controlled. Developments, such as the construction of structures, are also controlled in Special Protection Zones, and the use of power-driven vessels is additionally controlled in Special Protection Designated Zones.

4 Available at *https://www.env.go.jp/nature/biodic/kaiyo-hozen/other/pdf.html*

Natural Habitat Conservation Area, etc. (Act on Conservation of Endangered Species of Wild Fauna and Flora)	Conservation of national endangered species of wild fauna and flora.	Development is controlled in Monitored Zones (by notification system). In Controlled Zones, the harvest of designated species and the use of power-driven vessels are regulated in addition to development control (license system). Additionally, access is restricted for Restricted Entry Zones
Natural Monument (Act on Protection of Cultural Properties)	Protection of animals, plants, geographic features and minerals of high scientific value.	License systems on acts that change the current state or adversely affect its conservation.
(3) Protection, cultivation etc. of aquatic animals and plants (administered by the Ministry of Agriculture, Forestry and Fisheries)		
Area (System)	Purpose of designation	Description of major regulations
Protected Water Surface (Act on the Protection of Fishery Resources)	Protection and cultivation of aquatic animals and plants.	Development, such as landfill and dredging (license system), and the harvest of designated aquatic animals and plants are controlled for water surfaces suitable for egg laying and the growth of juvenile fish
Coastline Marine Resource Development Area, designated sea area (Marine Resources Development Promotion Act)	To promote the streamlining of the development and use of marine fishery resources through measures to promote the multiplication and aquaculture of aquatic animals and plants systematically.	Development, such as seabed transformation and digging, is controlled (it must be notified to the governor or the Minister of Agriculture, Forestry and Fisheries). Prefectures must formulate a "Coastline Marine Resource Development Plan".
Area designated by prefecture, fishery operator group, etc.	To protect and cultivate aquatic animals and plants, and to secure their sustainable use.	Control over harvest of specified aquatic animals and plants, etc.
(Underlying systems) Harvest Control Zone (Fishery Act and Act on the Protection of Fishery Resources), water surfaces covered by the Resource Management Regulations and voluntary efforts by fishery cooperatives (Fishery Cooperative Act)		
Common fishery right area (Fishery Act)	To enhance fisheries productivity (protecting and cultivating aquatic animals and plants, and ensuring their sustainable use), etc.	The harvest of aquatic animals and plants (area, period, fishing method, number of vessels, etc.) is controlled by the Rules about the Exercise of Fishery Rights (approved by the governor). A right to petition based on real rights, a right to claim compensation or damages, and, at the same time, a charge of the infringement on fishery rights will apply to infringement by any third party.

Source: *https://www.env.go.jp/nature/biodic/kaiyo-hozen/pdf/pdf_eng_shiryo.pdf*

This, however, is not enough to protect Japanese marine ecosystems. For instance, the Nature conservation area (in the second category above) comprises less than 0.01% of Exclusive Economic Zones (EEZ) in Japan. The majority of MPA in Japan is fisheries-related MPAs (the third category in Table 19). Also, these existing MPAs mostly target coastal shallow waters. Additional institutional frameworks specific to the protection of the offshore deep-water

areas are needed such as sea mountains, hydrothermal vents, trenches, etc. The amendment of the "Nature Conservation Law" has been submitted to the Parliament on March 1st of 2019, passed by the Lower House on April 9th, and passed by the Upper House on 24th (the author was in the drafting committee). Based on this amendment, additional MPAs will be set at offshore areas and will achieve the Aichi Biodiversity Target (10% of EEZ).[5]

Other Relevant Acts Relating to Marine Protected Areas

In Japan, two Acts are important from the viewpoint of MPAs, i.e., the **Basic Act on Ocean Policy** (2007) (Supp. 4) and the **Basic Act on Biodiversity (**2008) (Supp. 2).

The Basic Act on Ocean Policy (2007) was legislated with the following motivation: marine policies must deal with many cross-sectoral issues but vertical segmentation by ministries is a serious problem. Therefore, the main objective of this act is the integration/coordination of marine-related policies. There are six basic principles: 1) harmonization of the development and use of the oceans in ways that conserve the marine environment, 2) securing safety and security on the oceans, 3) improvement of scientific knowledge of the oceans, 4) sound development of ocean industries, 5) comprehensive governance of the oceans, and 6) international partnership with regard to the oceans. The Headquarters for Ocean Policy, headed by the Prime Minister of Japan, was established in the Cabinet, and the Basic Plan on Ocean Policy was formulated in 2008. Revised in 2013 and 2018 (Supp. 5). This Basic Plan prescribes in more detail the direction of ocean policy in Japan, including the Marine Protected Areas. This document is the legal base of the Japanese MPA system.

National Biodiversity Strategies have been published in 1995, 2002, 2007, and 2010. However, they possessed no strong legal basis until the legislation on the **Basic Act on Biodiversity** in 2008. Further, the biodiversity conservation policy measures are implemented in Japan based on specific acts to each issue, such as the "**Species Protection Act**", or "**Invasive Alien Species Act**", etc. This is the first act to integrate them and conserve ecosystems and biodiversity as a whole. The basic concepts in this Act are the Harmony of use and conservation, Precautionary Principle, Adaptive Approach, Long-term perspective, coordination with the climate change policies.

2. Basic Information of the Shiretoko World Natural Heritage

The Shiretoko National Park is the only site in Japan included in the NEAMPAN (Figure 19). As shown in Table

5 *https://www.cbd.int/sp/targets/rationale/target-11/*

20, it is one type of natural parks defined under the **Natural Parks Law** (1957), administered by the national government.

Table 20 **Classification of Natural Parks**

	Designated by	Administered by
National Parks	National Government	National Government
Quasi-national Parks	National Government	Prefectural Government
Prefectural Natural Parks	Prefectural Government	Prefectural Government

Reference: *Natural Parks Law; Ministry of Environment and Hokkaido Prefectural Government (2007), The Multiple Use Integrated Marine Management Plan and Explanatory Material for Shiretoko World Natural Heritage Site*

Because many endangered and rare species live in this pristine natural ecosystem (Figure 20), it was inscribed to the UNESCO World Natural Heritage list in 2005. Since then, a very rigid science-based management system was introduced, as explained below.

The marine area of the heritage site is in the southernmost region of the seasonal sea ice that is found in the northern hemisphere and is affected by the East Sakhalin cold current and the Soya warm current. This area has a complicated marine character created by these two currents and the intermediate cold water which is derived from the Sea of Okhotsk, forming the marine ecosystem where a welter of organisms migrates and lives. (Figure 20)

The heritage site is an outstanding example of the interaction between marine and terrestrial ecosystems. In early spring, when sea ice melts earlier than in other areas, blooms of ice algae and other phytoplankton occur in the Shiretoko. As shown in Figure 22, diverse marine life, including a wide variety of fish such as salmonids and walleye pollock, live in the waters surrounding Shiretoko based on a food web that starts from phytoplankton, seaweeds and seagrass, and detritus.

A lot of anadromous salmonids return to rivers in Shiretoko for spawning. Wild salmonids (including hatchery-derived chum and pink salmon that reproduce naturally in the rivers) running upstream serve as an important source of food for terrestrial mammals (e.g., brown bear) and birds of prey (e.g., Blakiston's fish-owl), and contribute to the biodiversity and material circulations from the marine ecosystems to the terrestrial ecosystems. Salmonids are also important as marine living resources in the region, where the hatchery programs of chum and pink salmon are carried out (Ministry of Environment and Hokkaido Prefectural Government 2007).

Figure 19 Location of the Shiretoko National Park

Source: *modified from Makino et al. 2009*

Figure 20 Endangered and Rare Species in the Shiretoko National Park

From top left, clockwise, Shiretoko Cape, Sealions (Eumetopias jubatus), killer whale (orcinus orca), sesame seal (phoca largha), and sperm whale (Physeter microcephalus)

This area is also a productive fisheries ground. A myriad of commercial fisheries operations are conducted and produce a variety of seafood for local markets and other major domestic markets (Figure 21). In 2016, the total fish landing was 44 thousand tonnes (22 million yen), which corresponds to 1.4% of the national total fisheries production. Figure 22 shows that human beings (fisheries) are a part of the Shiretoko ecosystem and located at the top of the food web. As the figure shows, local fisheries are utilizing almost all of the functional groups of this food web, including whales, salmon, pollock, Atka mackerel, squid, kelp, sea urchin, etc. Therefore, utilizing wide-

ranging species sustainably is very close to the conservation of ecosystem structure and functions in this area. In other words, the local coastal fishery is a "keystone species".

Another distinguished feature of this ecosystem is that the sea ice from Russia (Amur River) brings rich nutrients to the Shiretoko coastal areas (Figure 23) and they become one of the most important bases of the high productivities in the area. It is important to note that, the Amur River is flowing from the Eastern part of China. Therefore, the Shiretoko ecosystem is closely linked to the Russian and Chinese ecosystems.

Figure 21 **Fisheries Operations and Products in the Shiretoko National Park**

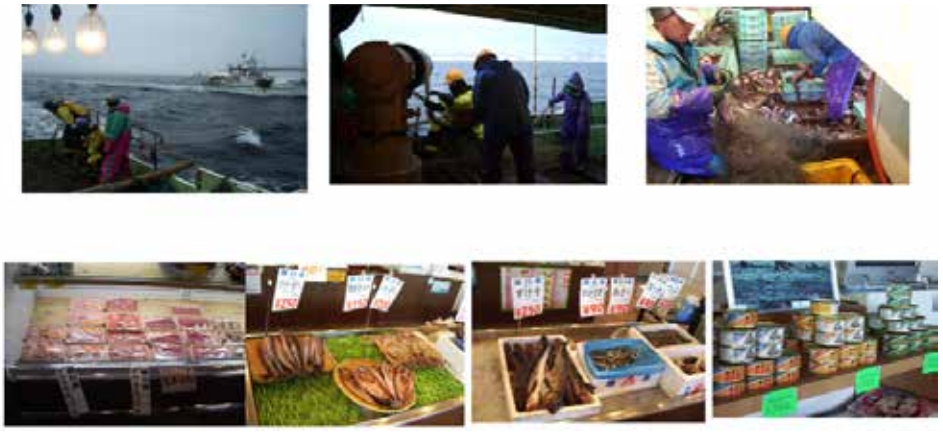

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Figure 22 **Food Web in the Marine Area of the Shiretoko National Park**

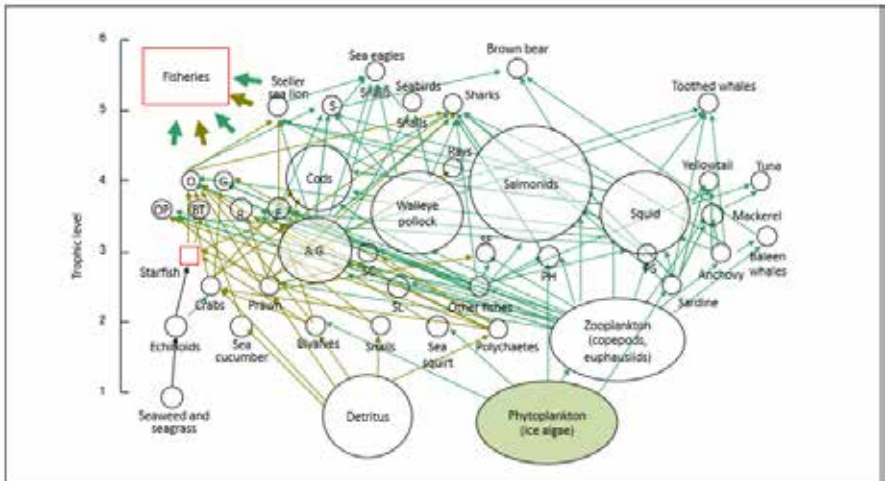


FIGURE 1. Food web in the Shiretoko World Natural Heritage (WNH) area (as depicted by the Shiretoko WNH Site Scientific Council). AG: arabesque greenling; BT: bighand thornyhead; F: flatfishes; G: greenlings; O: octopus; OP: ocean perch; PH: Pacific herring; PS: Pacific saury; R: rockfish; S: seals; SC: saffron cod; SF: sandfish; SL: sand-lance.

Source: *modified from Makino et al. 2011*

Figure 23 **Sea Ice from the Amur River, Russian Federation**

©Mitsutaku Makino

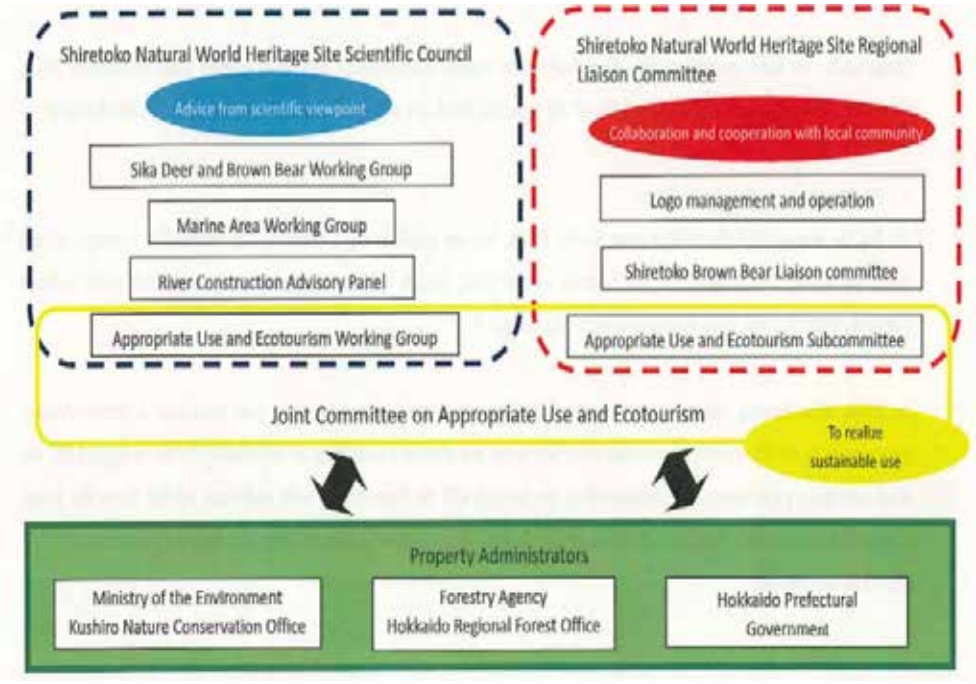
Given the importance of the marine area of the Shiretoko National Park from the perspectives of both biodiversity conservation and as a fishing ground for local fishers, the development of a Marine Management Plan for the site was part of the conditions for its inscription to the UNESCO World Natural Heritage List. Thus, the development of the Plan, reporting on the implementation, as well as a review of the Plan was a part of the commitment made by the Government of Japan,[6] and a strict management system has been implemented since then. The management structure of the Shiretoko World Heritage site consists of 3 major groups, i.e., administrators (Ministry of Environment, Forestry Agency and Hokkaido prefecture government), Regional Liaison Committee and Scientific Council. The Scientific Council is the scientific advisory body of the management with four expert groups as of 2018. (Figure 24). The Marine Area Working Group is in charge of the marine aspects. The author is a member of the Scientific Council and the Marine Working Group.

In addition to the Scientific Council, the Shiretoko Natural World Heritage Site Regional Liaison Committee and the Joint Committee on Appropriate Use and Ecotourism has been formulated to coordinate various issues and management measures across administrative organizations and interest groups, including national and local governments, local townships, fishery cooperatives, and local community organizations.[7]

6 *http://whc.unesco.org/en/list/1193*

7 Reference: *http://www.neaspec.org/sites/default/files/%EF%BC%88160615NEAMPAN%EF%BC%89Shiretoko_Maeda_E.pdf*

Figure 24 Institutional Framework for the Management of the Shiretoko World Natural Heritage



source: *modified from Miyazawa and Makino 2012*

Many laws and administrative bodies are related to the management of the Shiretoko World Natural Heritage, as summarized in Table 21. For the marine component: the Fisheries Agency, Coast Guard, Ministry of Environment, are in charge of laws and policy measures for the management. It should be noted, however, that varying elements of the ecosystem of the Shiretoko site fall under varying legislation. For instance, both the Fisheries Law and Wildlife Protection and Appropriate Hunting Law apply in the park area in the view of protection of marine mammals and controlling their population to minimize damage to local fisheries.

Table 21 Legal Basis and Administrative Authorities for the Management

Public services	Legal basis	Administrative authority
Management of Shiretoko National Park, Natural landscape	Natural Parks Law (Multiple Use Integrated Marine Management Plan)	- Forestry Agency (Hokkaido Regional Forestry Office) [8] - Min. of Environment (Kushiro Nature Conservation Office) - Hokkaido Prefecture - Local townships (Rausu and Shari)
Marine protected area	Basic Act on Biodiversity (2008) Basic Act on Ocean Policy (2007/2018)	- Ministry of Environment - Cabinet Office
Fisheries management	Fisheries Law (1949/2006) Fisheries Resources Protection Law (1951/2006) The Law Concerning the Conservation and Management of Marine Life Resources (1995/2001) Fisheries Basic Act (2001) Regulations of Sea Fisheries Adjustment in Hokkaido (1964/2006)	- Fisheries Agency (Ministry of Agriculture, Forestry and Fisheries) Hokkaido prefecture
Pollution control	Law Relating to Prevention of Marine and Air Pollution from Ships and Maritime Disaster (1970/2007) Waste management and Public Cleansing law (1970/2006) Water Pollution Control Law (1970/2006)	- Japan Coast Guard (Ministry of Land, Infrastructure, Transport and Tourism affiliate) - Ministry of Environment - Ministry of Land, Infrastructure, Transport and Tourism
Landscape conservation and material circulation	Law on the Administration and management of Natural Forest (1951) Natural Parks Law (1957/2006) Nature Conservation Law (1972)	- Ministry of Environment - Forestry Agency (Ministry of Agriculture, Forestry and Fisheries)
Species protection	Law for the Protection of Cultural Properties (1950/2006) The Law for Conservation of Endangered Species of Wild Fauna and Flora ("the Species Conservation Law") (1992) Species Protection Act Invasive Alien Species Act The Wildlife Protection and Appropriate Hunting Law (2002/2006)	- Ministry of Environment, - Ministry of Education, Culture, Sports, Science and Technology (MEXT)

source: *modified from Makino et al. 2009*

In addition to these official management measures implemented by the governmental bodies based on the Act, many autonomous management measures are implemented, especially relating to fisheries management. Table 22 shows the cascade structure of the fisheries management coordinating bodies at various scales in Japan. At the national level, the Fisheries Policy Council discuss the national level issues and provide advice to the Fisheries Agency of MAFF (national government). At the prefecture-level, the Area Fisheries Coordinating Committees (AFCCs) introduces broad regulations to be applied to all the relevant fishers in the prefecture. The most detailed and specialized measures are designed and introduced at the local level. The local Fisheries Cooperative Associations (FCAs), and the Fisheries Management Organizations (FMOs) organized within or across the FCAs, are the main body for such autonomous regulations.

Table 22 Fisheries Coordinating Organizations at Various Spatial Scales

Level	Organization	Function
National level	Fishery Policy Council	The advisory body to the government for national level fishery coordination, design of national fishery policy, etc.
Multijurisdictional level	Wide-Area Fisheries Coordinating Committees (WFCCs)	Coordination of resource use and management of highly migratory species. Also addresses resource restoration plans.
Prefectural level	Area Fishery Coordinating Committees (AFCCs)	Mainly composed of democratically elected fishermen. Coordination through the fishery ground plan, Prefectural Fishery Coordinating Regulations, and Committee Directions.
Local level	Local Fisheries Cooperative Associations (local FCAs)	Composed of local fishermen. They establish operational regulations (FCA regulations) that stipulate gear restrictions, seasonal/area closures of fishing grounds, etc.
More specialized purpose	Fishery Management Organizations (FMOs)	Autonomous body of fishermen. FMO rules are more detailed and more strict than the FCA regulations.

3. Preliminary Review of the Management Plan of the Shiretoko World Natural Heritage Area

Management Plans for the Shiretoko World Natural Heritage Area

There is a long history of conservation of the Shiretoko peninsula, which was designated as a National Park in 1964 and inscribed to UNESCO World Natural Heritage in 2005 (Table 23).

Table 23 **Chronology of the Conservation Activities in the Shiretoko Peninsula**

Year	Event
1953	The first scientific field investigation in Shiretoko area
1960	A movie about Shiretoko released (commercial success)
1964	Designated as **the National Park**
1971	A song about Shiretoko released (commerical success)
1977	The Japanese **National Trust** (100 Square-meter Forest Movement Trust) started
1978	The Shiretoko Museum open
1982	Designation to the Wildlife Protection Area
1988	Establishment of the **Shiretoko Foundation**
1994	**Start of the activities for the nomination to the World Heritage List**
2004	Submission of the nomination list to UNESCO, UNESCO/IUCN monitoring mission
2005	**Inscription** to the UNESCO World Natural Heritage List
2007	Issuing **Shiretoko WNH Multiple Use Integrated Marine Management Plan**
2009	Issuing **Management Plan for the Shiretoko World Natural Heritage Site**

The latest management plan for the Shiretoko WNH area is "The Management Plan for the Shiretoko World Natural Heritage Site of 2009" (Supp. 6. Hereafter, the Management Plan). This document, prepared by the Ministry of Environment, Forestry Agency, Agency for Cultural Affairs (of MEXT) and Hokkaido Prefecture, is for the management of the entire Heritage site, including the land and marine areas. The main text of the Management Plan is included in the Supplemental Materials attached to the end of this report. In this plan, the objective of the management is stated as follows:

> *"In preserving the value of the heritage site in good form for future generations, the Management Plan for the Shiretoko World Natural Heritage Site was developed to appropriately conserve and manage the extremely diverse, unique, and valuable natural environment of the heritage site."*

Besides the Management Plan, a specific plan for the marine areas has been developed, named "The Multiple

Use Integrated Marine Management Plan and Explanatory Material for Shiretoko World Natural Heritage Site" ("the Marine Management Plan" (Supp. 7)). Its objective is stated as follows:

> *"The objective of this plan is to satisfy both of conservation of the marine ecosystem and stable fisheries through the sustainable use of marine living resources in the marine area of the heritage site."*

As briefly described above, the Marine Management Plan was part of the government's commitment to respond to the concerns on fishing activities in the area at the time of inscription to UNESCO WNH, thus it was developed before the Management Plan for the entire Shiretoko Park. The Marine Management Plan emphasizes that fisheries are an element of sustainable food webs (as shown in Table 22 above) and do not jeopardize the ecosystem. The relationships between the Marine Management Plan and the Shiretoko Park Management Plan, and the timeline of their revisions are summarized in Table 24. Note that, the Marine Management Plan was revised last year (Supp. 8), and the Long-term Monitoring Plan is now under revision, and the Marine monitoring scheme will be integrated into the new Long-term Monitoring Plan.

Table 24 Relationship and Timeline of the Management Plan for the Shiretoko World Natural Heritage Site and the Multiple Use Integrated Marine Management Plan

Area	Management plan	Issued by
World Heritage Area as a whole (All the Heritage areas: terrestrial, river, and marine)	Management Plan for the Shiretoko World Natural Heritage Site (2009) + The Long-term Monitoring Plan (2012) **Now under the mid-term assessment and the revising process. The revised Long-term Monitoring Plan (more simple) and the assessment results of 8 Evaluation Items (I-VIII) will be released in late 2019 or early 2020.**	- Ministry of Environment - Forestry Agency - Agency for Cultural Affairs - Hokkaido Prefecture
Marine areas only	Multiple Use Integrated Marine Management Plan (revised about every 5 years: 2007, 2013 and 2018) ➜ Explanatory material for the Multiple Use Integrated Marine Management Plan (2007) provides a list of Monitoring Parameters, responsible bodies, etc. ➜ **Revised in 2018**	- Ministry of Environment - Hokkaido Prefecture

As indicated in Table 23, the Marine Management Plan and the Monitoring Parameters for Marine management Plan was revised in 2018. (Attached as Supp. 8) The changes to the new plan can be summarized as follows. At the beginning of the new plan, the summary of 10-year monitoring results since 2007 is inserted. Then, a strong emphasis was made on the importance of Adaptive Management and declared that management measures

would be changed adaptively within the duration of this plan (2018-2022). As for the monitoring scheme, the importance of stakeholder participation (fishers, local citizen, tourists, etc.) and outreach to the public were emphasized. Also, new monitoring items were added, i.e., theiconic marine mammal: the killer whale, and an additional important fisheries resource: the Common squid.

Importance of the Management Objective

The management objective of the Shiretoko World Natural Heritage is NOT to go back to the original "wilderness" of centuries ago but to achieve a balance between conservation and human uses. Therefore, utilizing a wide-range of species in a sustainable manner is very close to the conservation of ecosystem structures and functions in this area. In other words, the local coastal fishery is a "keystone species" (Makino et al. 2009, Matsuda et al. 2009, and Miyazawa and Makino 2012).

For example, Figures 25(a) and 25(b) are woodblock prints (*Ukiyo-e),* works of the 19th-century artist, Hiroshige Utagawa. They depict the Japanese concept of harmony between people's lives and the coastal ecosystems and suggest a desired relationship between people and the sea. Unless the objective of ecosystem conservation is to return to the original wilderness of hundreds of years ago, local peoples lives are not something to be eliminated from the "original" ecosystems, but an indispensable component of the local ecosystem (Makino et al. 2011).

Figure 25 (a) and (b). Ukiyoe of People's Life and Coastal Ecosystems in the Edo Era

(a) (b)

With such a conceptual framework of harmony between human life and coastal ecosystems, the following three unique features of the inscription process to the WNH List can be pointed out, i.e., stakeholder participation, science-based consensus-building approach, and mutual trust between leading scientists and the local stakeholders.

Firstly, stakeholder participation: Local fishers (local Fisheries Cooperative Associations: FCAs) and the tourism industry have been co-participating in discussions and planning from the very beginning. Also, via this process, communications between fisheries and tourism have been facilitated. Next is the science-based consensus-building approach: There was a strong emphasis on scientific information to bridge the differences or gaps amongst stakeholders, Ministries, and UNESCO/IUCN. It was especially important for controversial issues relating to sea lions and River construction, etc. Finally, mutual trust between leading scientists and local stakeholders: Professor Sakurai, a fisheries scientist was the key actor in achieving smooth communications and unanimous decisions among the parties. Professor Sakurai is now the Chair of the WNH Scientific Council.

B. Monitoring and Assessment of Designated MPAs

1. Basic Information of the Monitoring Plan in the Shiretoko World Natural Heritage

The monitoring activities in the Shiretoko World Natural Heritage are prescribed within "The Long-Term Monitoring Plan for the Shiretoko World Natural Heritage Site", hereafter called "the Monitoring Plan". The outline of this plan is included in the Supplemental Materials at the end of this report (Supp. 9). In the monitoring plan, the objective of monitoring activities is stated as follows:

> *"Long-term monitoring is implemented for adaptive management of the heritage site based on scientific knowledge, within the scope of the management measures stipulated in the Management Plan for the Shiretoko World Natural Heritage Site. This Plan was formulated in order to define the monitoring items and contents required for "effective and efficient" implementation of adaptive management."*

The point here is that all the monitoring activities are conducted for implementation of the adaptive management of the heritage site. Monitoring is an integral part, as adaptive management requires review and adjustment of management and use of the site, based on the prediction and monitoring of the changes in the ecosystem along with the feedback function and involvement of relevant parties. As for the marine area, fisheries sector supposedly introduced adaptive management, as seen in the Total Allowable Catch system for walleye pollock and autonomous closure of some fishing areas to protect spawning fish.[8] It will be further discussed in Section C of the report.

8 The Multiple Use Integrated Marine Management Plan for Shiretoko World Natural Heritage Site, Ministry of Environment (2007)

2. Monitoring Parameters (Items) in the Shiretoko World Natural Heritage

According to the prescriptions within the Monitoring Plan, there are 42 monitoring items for terrestrial and marine ecosystems. These 42 items can be categorized into the following 3 types defined by the monitoring bodies/organizations:

i. 25 Monitoring items implemented by relevant government agencies: "Relevant government agencies" refers to three main government agencies in charge of the management of the heritage site, i.e., the Ministry of the Environment, the Forestry Agency, and the Hokkaido Prefecture Government.

ii. 12 Monitoring items implemented in cooperation with local governments, related bodies, experts, and other government agencies besides those aforementioned in i).

iii. 5 other monitoring items implemented through surveys and research: Surveys and research comprises monitoring items that do not fit within the above two classifications.

The following Table shows the total 42 monitoring items grouped into the three types as described above:

Table 25 The List of 42 Monitoring Items Categorized by 3 Types in the Monitoring Plan

(i) Monitoring items implemented by relevant government agencies	
1	Observation of water temperature and chlorophyll-a using satellite remote sensing
2	Fixed-point observation of water temperature using marine observation buoys
3	Seal habitation survey
4	Marine flora and fauna and habitation survey (periodic shallow-sea survey)
5	Shellfish quantitative survey in shallow seas
6	Survey of spectacled guillemot, black-tailed gull, slaty-backed gull, and Japanese cormorant populations, nesting site distribution, and number of nests
7	Survey of recovery of vegetation from sika deer impact (Forestry Agency 1ha enclosure)
8	Survey of recovery of vegetation from sika deer impact (Ministry of the Environment enclosure at Shiretoko Cape)
9	Survey of sika deer browsing pressure in experimental density manipulation zones
10	Wide-area vegetation survey to gauge sika deer feeding pressure
11	Periodic growth and distribution surveys of *Viola kitamiana*
12	Wide-area aerial count of wintering sika deer populations
13	Survey of habitation of terrestrial invertebrates (primarily insects) (including survey of alien species)
14	Survey of habitation of land birds
15	Survey of habitation of large, medium-sized and small mammals (including survey of alien species)
16	Preparation of wide-area vegetation map
17	Monitoring of number of salmon running upstream, spawning grounds, and number of spawning beds in rivers

18	Survey of habitation of freshwater fish, in particular the Dolly Varden (*Salvelinus malma*) that characterizes the freshwater fish fauna in Shiretoko (including survey of alien species)
19	Site utilization survey
20	Survey of sighting and encounters with brown bears, including any damage incurred
21	Meteorological observation
22	Survey of wintering population of sea eagles
23	Survey of population, breeding status, reproductive rate and number of fledglings, and food sources of Blakiston's fish-owl. Tracking of migration and distribution through tagging and attachment of transmitters. Number of dead, sick and injured and investigation of causes
24	Tracking of project implementation status through preparation of annual reports
25	Tracking of social environment through preparation of annual reports
(ii) Monitoring items implemented in cooperation with local governments, related bodies, experts, and other government agencies besides those ministries	
①	Aerial observation of sea ice distribution
②	Biological survey of ice algae
③	Tracking of changes in fish catches compared to Hokkaido Suisan Gensei [Statistics on Fisheries in Hokkaido]
④	Ascertainment and assessment of walleye pollock stock (survey used to set total allowable catch [TAC])
⑤	Walleye pollock spawning survey
⑥	Survey of number of Steller sealions migrating to Japan seacoast, number killed due to human actions (by gender), characteristics
⑦	Survey of damage caused by Steller sealions
⑧	Status of reproduction at white-tailed eagle nesting sites and monitoring of fledglings
⑨	Survey of total wintering population of sea eagles throughout Hokkaido
⑩	Analysis of oil, cadmium, mercury, etc. in seawater
⑪	Ground population count survey at major sika deer wintering grounds (including habitation surveys of other mammals)
⑫	Qualitative survey of sika deer population through observation of body weight, pregnancy rate etc. among culled and naturally deceased sika deer
(iii) Other surveys and research	
(1)	Observation and prediction of changes in sea ice volume
(2)	Capture, reproduction, population estimates, migration and distribution patterns, and damage caused by brown bears
(3)	Survey on current status and changes to genetic diversity of salmonid species
(4)	Survey of seasonal migration of wintering sea eagle populations and consumption of human-provided and naturally occurring food resources
(5)	Survey of damage caused by seals

The monitoring parameters listed above correspond to eight cross-sectoral evaluation criteria (I through VIII in Table 26 and 27) set out in the Long-term monitoring plan associated with the Management Plan. Among the 42 monitoring parameters for the national park in Table 25, 20 monitoring parameters are closely related to the marine ecosystems, as listed in Table 26 (please see the next section and Table 27 for detail).

Monitoring of these parameters is conducted by various entities as described above, while evaluation of the monitoring results falls under the responsibility of relevant working groups or councils formed for the management of Shiretoko WNH (see Figure 24 above). Table 26 below describes marine-related monitoring items and their relationships with the eight evaluation criteria (termed "Evaluation Items"), their monitoring bodies, and monitoring frequencies. For instance, Fixed-point observation of water temperature (item 2) is conducted by the national agency (Ministry of Environment) in connection with the three evaluation criteria (I, IV, and VIII), evaluated by the Marine Area Working Group.

Table 26 Details of 20 Monitoring Items Closely Relating to Marine Ecosystems

Working group responsible for evaluation		Monitoring item	Evaluation Item				
			I	II	III	IV	V
			Productivity	Interaction between marine and terrestrial ecosystems	Biodiversity	Balance of conservation and sustainable fisheries	Less impacts from river constructions (e.g. dams) to salmonid species
Marine area working group	1	Observation of water temperature and chlorophyll-a using satellite remote sensing	X			X	
Marine area working group	2	Fixed-point observation of water temperature using marine observation buoys	X			X	
Marine area working group	3	Seal habitation survey	X		X	X	
Marine area working group	4	Marine flora and fauna and habitation survey (periodic shallow-sea survey)	X	X	X		
Marine area working group	5	Shellfish quantative survey in shallow seas	X	X			
Marine area working group	①	Aerial observation of sea ice distribution	X			X	
Marine area working group	②	Biological survey of ice algae	X			X	
Marine area working group	③	Tracking of changes in fish catches compared to Hokkaido Suisan Gensei [Statistics on Fisheries in Hokkaido] Common Squid will be added	X		X	X	
Marine area working group	④	Ascertainment and assessment of walleye pollock stock (survey used to set total allowable catch [TAC])	X			X	
Marine area working group	⑤	Walleye pollock spawning survey	X			X	
Marine area working group	⑥	Survey of number of Steller sealions migrating to Japan seacoast, number killed due to human actions (by gender), characteristics	X		X	X	
Marine area working group	⑦	Survey of damage caused by Steller sealions				X	
Marine area working group	⑩	Analysis of oil, cadmium, mercury, etc. in seawater				X	
Marine area working group	(Addition to the revised plan)	Orca survey	Not yet decided				
Appropriate use and ecotourism working group	19	Site utilization survey					
Scientific Council	21	Meteorological observation					
Scientific Council	22	Survey of wintering population of sea eagles		X			
Scientific Council	24	Tracking of project implementation status through preparation of annual reports			X		
Scientific Council	25	Tracking of social environment through preparation of annual reports			X		
Scientific Council	⑨	Survey of total wintering population of sea eagles throughout Hokkaido		X			

source: *NEAMPAN secretariat, modified by the author*

						Frequency
	VI	VII	VIII	Monitoring	Monitoring body	
	Sika deer *(cervus nippon yesoensis)*	Balance of conservation and recreation uses	Impacts / potential impacts of climate change	A. Monitoring by relevant government agencies B. Monitoring in cooperation with local governments, related bodies, experts, and other government agencies		
			X	A	To be decided	TBD
			X	A	Ministry of Environment	Every week from May to Oct.
			X	A	Hokkaido Prefecture	Every year (from a vessel and a helycopter)
				A	Ministry of Environment	Not every year
				A	Ministry of Environment	Not every year
			X	B	Coast Guard	Every year (about 15-50 days observation from Coast Guard airplane)
				B	Tokai Univ. and Hokkaido Univ.	TBD (Not yet monitored)
				B	Hokkaido Prefecture	Every year
				B	Fisheries Agency	Every Year
				B	Rausu Fisheries Cooperative Association and Hokkaido Prefecture	Every Year
			X	B	Japan Fisheries Research and Education Agency	Every Year
				B	Rausu Fisheries Cooperative Association and Hokkaido Prefecture	Every Year
				B	Coast Guard	EveryYear
					(maybe Hokkaido Univ. and tourism sector)	TBD (new item)
		X		A	Ministry of Environment	Every Year
			X	A	Forestry Agency, and Ministry of Environment	TBD (Not yet monitored)
				A	Ministry of Environment	Every Year
		X		A	Ministry of Environment	Every Year (but to be deleted in the new plan)
		X		A	Ministry of Environment	Every Year (but to be deleted in the new plan)
				B	Joint research team	Every Year

As can be seen, most of the monitoring activities concern natural ecosystems. Human use aspects are only covered in a few items, such as the survey of visitors (item 19. site utilization survey) and general socio-economic statistics such as demographics and industrial activities (item 25, tracking of social environment). More monitoring items relating to the human dimensions should be included. Also, climate change is the most emerging issue for the heritage site. Monitoring items relating to adaptation to climate change could be strengthened in the future (Makino and Sakurai 2012).

Also, most monitoring activities are not catered to the management of the World Heritage site. They are the combination of existing monitoring activities conducted by relevant offices (this is the source of a big challenge to be discussed later). One reason as to why is the budget. There are several large ad-hoc and non-regular budgets for the research activities /monitoring for Shiretoko WNH, but no large regular budget specific to the WNH. This also presents a problem. Finally, the most concerning issue is that they have not fully utilized the monitoring results for the adaptive management (to be discussed later).

3. Assessment of the Data in the Shiretoko World Natural Heritage

Under the Monitoring Plan, there are eight "Evaluation Items" to be assessed (Table 27) based on the various Monitoring Items described in the previous section (full list of monitoring item in Table 26). In the process of developing the Monitoring Plan, the Evaluation Items Task Team was organized under the Scientific Council in 2007, to discuss appropriate Evaluation Items. Local stakeholders (e.g., fishers) were also unofficially interviewed by this Task Team (the author was not a member at that time).

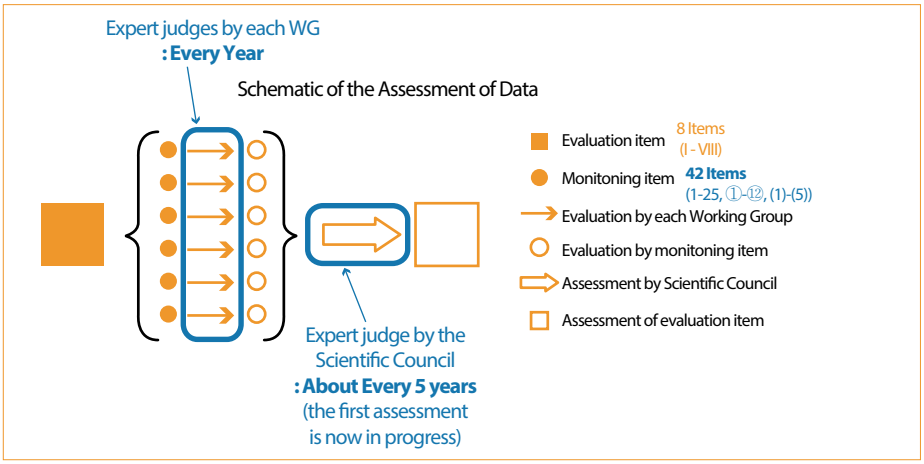
The relationships between Monitoring Items and Evaluation Items are shown in Table 25. For instance, to evaluate criteria "II. The interaction between marine and terrestrial ecosystems is being maintained", monitoring results of marine flora and fauna and habitation survey (item 4), shellfish quantitative survey in shallow seas (item 5), survey of the wintering population of sea eagles (item 22) and survey of total the wintering population of sea eagles throughout Hokkaido (⑨) should be reviewed.

Table 27 **Eight Evaluation Items and Their Justifications**

	Evaluation items	Justification	Reference
I	Extraordinary ecosystem productivity is maintained	Criteria for inscription in UNESCO Natural World Heritage	Criterion (ix) on ecosystem
II	The interaction of marine and terrestrial ecosystems is maintained		
III	Biodiversity at the time of inscription is maintained		Criterion (x) on biodiversity
IV	Marine biodiversity and stable fisheries by sustainable use of marine resources are achieved within the marine area of the WNH site	Recommendation in UNESCO/IUCN Report of the monitoring mission in 2005	Recommendation 4 and 6
V	River ecosystem is maintained which enables reproduction of salmonid, through such measures as reducing the impact of structures on the river		Recommendation 7 and 9
VI	Biodiversity in the site is not excessively impacted due to a high population density of sika dear		Recommendation 10
VII	Human activities such as recreational use and conservation of environment are well balanced	Mention in the Management Plan	4. Basic policies of management, (2) Viewpoints required for management, f. Recreational use and conservation of the natural environment
VIII	Climate change impact or estimation of impact are understood at an early stage		4. (2). g/ Management from a broad perspective

The procedure for the evaluation is shown in Figure 26. Each Working Group (in the case of the marine ecosystem, the Marine WG) assess its assigned monitoring items every year. Then, based on these results, the Scientific Council judge the 8 Evaluation Items every 5 years. At the time of writing, the first judgement by the Scientific Council is ongoing.

Figure 26 **The Schematic Diagram of Evaluation Procedure**



4. Links between Monitoring/Assessment Results and Management in the Shiretoko World Natural Heritage

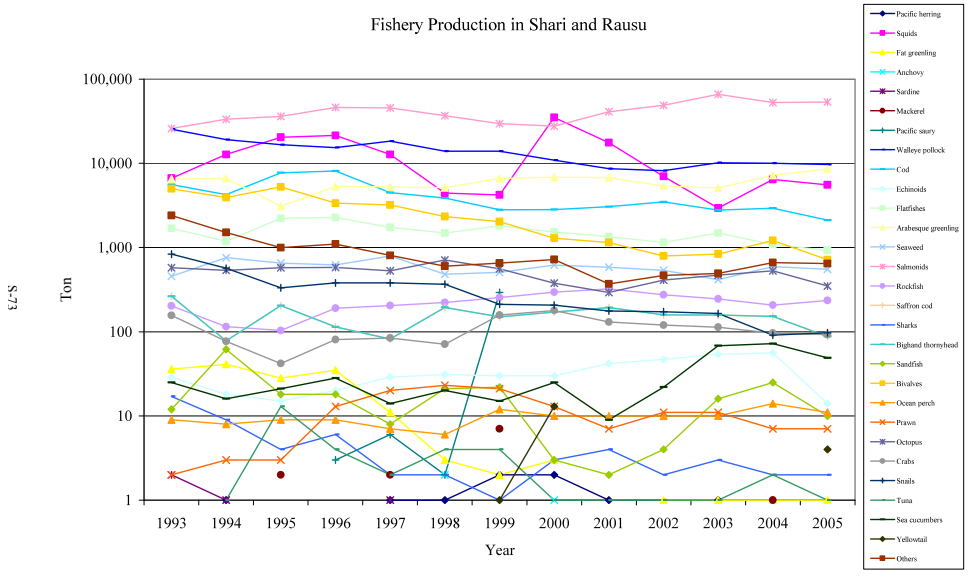
How are Assessment Results Used for Future Management?

For the moment, as far as the author understands, these Monitoring Items and Evaluation Items are used only for reporting the current status to UNESCO and the general public. The author is of the opinion that this is insufficient, and the results should be utilized to adaptively modify the management measures for the conservation of the heritage area.

What is the Institutional Framework / Stakeholder Engagement in the Monitoring and Assessment of the Site, and Utilization of the Assessment Results?

As summarized in Table 26, many monitoring items are monitored by the Ministry of Environment, Forestry Agency and the Hokkaido Prefecture (local government). The sea ice is monitored by the Meteorological Agency and the Coast Guard. These are all public organizations. On the other hand, fisheries data is collected by the Fisheries Cooperative Associations (Local organization of small-scale coastal fishers) and the local government. These monitoring items are used for assessing the Evaluation Item IV (Fisheries). This is one good example of stakeholder engagement in the monitoring activities. Indeed, the fisheries production statistics (tons) at Shiretoko WNH, compiled by Fisheries Cooperative Associations, is a very informative time-series dataset to understand the current situation and expected changes of Shiretoko marine ecosystems.

Figure 27 **Time-series Data of Fish Landing Collected by Local Small-scale Fishers Fishery Production in Shari and Rausu**



Source: *Ministry of Environment 2007, The multiple use integrated marine management plan and explanatory material for Shiretoko World Natural Heritage site*

C. Feedback of Assessment Results to Management Plans and Practices

For the moment, there is no clear feedback mechanism between ecosystem monitoring to the management measures. This is one of the most concerning and fundamental issues to be tackled to allow for the better management of the Shiretoko WNH area and will be discussed in detail in the next section.

D. Issues and Challenges in the MPA: A Case of the Shiretoko World Natural Heritage

1. Monitoring Items and Budgets

The existing monitoring items (Table 25 and 26) are insufficient for tackling the emerging issues in Shiretoko WNH. For example, more monitoring items relating to the human dimensions, such as fisheries and marine tourism sectors, their interactions, influences from land activities, etc., would be needed to understand sustainable relationships between human uses and healthy marine ecosystems. Closely related to that, the cumulative human impact on the ecosystem (fishery, tourism, shipping, water discharge, etc.) is not scientifically clear enough. With climate change, monitoring items relating to the resilience of coastal communities to ecosystem changes is also important. In sum, further monitoring items concerning these human dimensions should be added.

Appropriate budgets should be prepared to ensure the sustainability of the monitoring. For example, monitoring of chlorophyll (monitoring item number 1 in Table 25) and ice algae (monitoring number ② in Table 25) have not yet been conducted because of the lack of appropriate budgets and responsible bodies. This is a serious oversight in understanding the effects of climate change on the Shiretoko marine ecosystems. Similarly, the marine flora and fauna and habitation survey (monitoring item 4 in Table 25) was conducted only once in ten years, which will be inadequate to track the changes in marine ecosystem structures and the effects of climate change. The budget could be supported by the government, as well as the private sector or crowdfunding. For some monitoring items, tourists or local people can participate in monitoring (civil science), which will decrease monitoring costs.

2. Links to the Management Actions

As mentioned in Section C, there is no clear feedback mechanism from the monitoring results to the management measures. The author believes there are at least two root causes to explain why. Firstly, the monitoring activities in Shiretoko are, mainly, the combination of existing monitoring activities of vertically independent authorities serving varying purposes. Data and information gathered do not cater to the evaluation and management of the World Heritage site. Therefore, by nature, integratingand linking such monitoring results

to management measures implemented by differing authorities is difficult. The lesson from this is that benefits need to be shown from the synergy effects of policy integration by multiple authorities (multiple ministries, multiple agencies, etc.). Perhaps appropriate pressures by politics, science, UN, NGO, civil society, etc., will be needed to facilitate such integration and create the desired synergy effects.

The second root cause is that, because of the intrinsic fluctuations/uncertainties of the marine ecosystem, the monitoring results are not so apparent and clear-cut. In other words, one cannot easily distinguish whether it is a sign of problems or the simple noise. For example, it is not necessarily clear whether the decline of the catch of certain species seen in fishery data implies overfishing, long-term fluctuation of the fish population, or the degradation of fish habitats. Consequently, stakeholders cannot clearly understand the benefit of changing the existing measures and introducing new actions, as usually, it is costly to do so. The benefits need to be exhibited. Ultimately, the lesson learnt is that both scientific logic and stakeholder participation are needed to conduct adaptive management when contending with large uncertainties/fluctuations. The basic "precautionary approach" is not enough in practice.

3. Criteria for the Assessments

There is no natural-scientific theory to identify a "good ecosystem" or "healthy ocean", etc. It is a "societal choice" (CBD Ecosystem Approach Principle 1). In other words, the criteria used in the assessment process (Figure 26) should not be based solely on "expert judgement by the working groups/Scientific Council" but based on the consultation with a wide range of stakeholders. *In order to select stakeholders in a fair and equitable manner, monitoring human dimensions again is important.*

Of course, empirical scientific facts should be fully utilised for stakeholder consultations, however, final judgements made are not about natural science but in fact about value systems. Each society/country has its own culture and value system, and that should be respected. Here, more human dimension orientated studies clarifying the differences of value systems amongst countries/societies would be valuable (Hori and Makino 2018).

4. Cross-scale Connections with Other Ecosystems

Finally, just as all other marine ecosystems, the Shiretoko marine ecosystem structures, functions, and services are linked to Russia, China, and Korea. Therefore, international cooperation and the network of MPAs are very important. The ecological, economic and social benefits from international data sharing should be shown, as well as exchanges of lessons learnt, joint declarations, and organizing international symposiums, etc. In this respect, activities such as NEAMPAN's should be highly appreciated, and more resource/efforts should be dedicated to it.

Annex 2. Monitoring Parameters and Data Collection

Individual indicators	Subjects	Monitoring target	Methodologies / remarks	Key data source
Marine environment and low trophic level production	Sea ice	Sea ice distribution and long-term trend	Aerial and satellite monitoring of the sea ice distribution [Mostly utilization of existing monitoring information on sea ice collected for navigation safety (Coast guard) and sea ice observation (Meteorological Agency)]	Japan Coast Guard Japan Meteorological Agency
	Water temperature, water quality, Chlorophyll a, plankton, etc.	Water temperature, Chlorophyll a, plankton, etc.[9]	Monitoring with fixed-point observation buoys [Monitoring associated with Shiretoko marine area management]	Ministry of Environment
	Biota	Shellfish	Survey of shellfish in shallow waters [Monitoring associated with Shiretoko marine area management]	Ministry of Environment (Commission to Shiretoko Nature Foundation)
Coastal environment	Hazardous substances	Petroleum oil, cadmium, mercury concentration	Analysis of surface water and sediments of seabed in the sea of Okhotsk [Utilization of existing monitoring information on marine pollution issued by the Coast Guard – one chapter in the annual report dedicated to the survey in the sea of Okhotsk]	Japan Coast Guard
Fishes	Salmonids	Salmon catch	Monitoring of salmonids catch [Utilization of survey on fisheries by Hokkaido prefecture]	Hokkaido Prefecture
		Salmon run upstream and spawning	Quantitative monitoring of salmon run and the spawning in the river beds [Monitoring activity in compliance with management plan (monitoring plan)]	Hokkaido Prefecture (Forestry management)
		Effect of river structures	Study on the effect of river structures improvement on salmon run [Monitoring associated with Shiretoko marine area management]	Hokkaido Prefecture

9 Monitoring data not available online

Individual indicators	Subjects	Monitoring target	Methodologies / remarks	Key data source
Fishes	Walleye pollock	Stock and trend of walleye pollock (for setting TAC)	Stock assessment [Stock assessment conducted by Fishery Agency in connection with TAC]	Fishery Agency
		Survey of spawning	Assessment of distribution of eggs	Rausu Fisheries Cooperative Association
		Catch of walleye pollock	Survey on total catch of walleye [Utilization of survey on fisheries by Hokkaido prefecture]	Hokkaido Prefecture
Marine mammals	Steller sea lions	Fisheries damage associated with Steller sea lions	Monitoring of the migrating condition of and assessment of damage to fisheries [Use of monitoring information associated with fisheries and fishery damage]	Fishery Agency Hokkaido Prefecture
		Population and characteristics of migrating Steller sea lions	Survey of population, sex, age, size, and maturity; stomach contents of dead individuals [Use of existing information as well as some additional survey by the specialized agency of Shiretoko]	Fishery Agency Hokkaido Prefecture Shiretoko Nature Foundation
	Seals	Population of seals and fishery damages	Monitoring population of seals (observation and aerial survey) [special survey for Shiretoko marine area management]	Hokkaido Prefecture
		Population and culled seals in Rausu area	Survey on migration and analysis of culled seals on feed, DNA, breeding conditions etc [special survey for Shiretoko marine area management]	Rausu township

Individual indicators	Subjects	Monitoring target	Methodologies / remarks	Key data source
Seabirds and sea eagles	Sea birds (spectaded guillemot, black-tailed gull, slaty-backed gull, Japanese cormorant)	Population and breeding pairs on the Shiretoko peninsula	Survey on nesting location, number, and population [special survey for Shiretoko marine area management]	Ministry of Environment
	Sea eagles	population of white-tailed eagles and population of wintering eagles	Survey on nesting location, number, and population of white-tailed eagle, survey on population, species etc of sea eagles (observation?) [special survey for Shiretoko marine area management]	Ministry of Environment; White-tailed eagle monitoring survey group (Shiretoko Nature Foundation, Shiretoko Museum, Rausu township, etc)
Socio economic environment	Natural resource status, food supply, industry, culture, local community	Socio economic situation associated with natural resource extraction and use of Shiretoko park	Catch and income from fisheries, population engaged in fisheries, tourists' arrivals, etc. [Utilization of survey on fisheries by Hokkaido prefecture]	Hokkaido prefecture

Source: *NEAMPAN secretariat, based on the Shiretoko Marine Management Plan*[10] *and Marine Area Working Group reports*[11]

10 Government_of_Japan (2007). The Multiple Use Integrated Marine Management Plan and Explanatory Material for Shiretoko World Natural Heritage Site. Ministry_of_Environment and Hokkaido_Prefectural_Government.

11 Marine Area Working Group reports (in Japanese), available at *http://dc.shiretoko-whc.com/meeting/kaiiki_wg_index.html*

Annex 3. Key Legislation, Regulations, etc. on Marine Areas of Shiretoko National Park

Areas concerned	Laws and regulations	Purpose of the laws and regulations	Remarks
Natural landscapes	The Natural Parks Law (1957)	Protecting the places of natural scenic beauty while promoting their use for people's health, recreation, and culture.[12]	
Marine pollution	Water Pollution Control Law, Law Relating to the Prevention of Marine Pollution and Maritime Disaster, Regulations of Sea Fisheries Adjustment in Hokkaido	Regulation on the drainage of harmful substances into the waters from factories, businesses, ships, etc.	
	[plans and guidelines] Oil Spill Accident Disaster Control Manual (Hokkaido) Plan for Cleaning of Spilled Oil (and Hazardous and Noxious Substances) in Hokkaido Coastal Sea Area (Japan Coast Guard) Japanese National Contingency Plan for Oil and HNS Pollution Preparedness and Response as amended in 2006 (Cabinet decision)	Emergency response to oil spills	
Fishes	Fisheries Law Fisheries Resource Protection Law Law Concerning Conservation and management of Marine Life Resources Autonomous management of local fishery organizations	Proper resource management and sustainable use of salmonids and walleye pollock Sustainable use of marine living resources	Salmonids and walleye pollock as indicator species

12 Explanatory note 2007

Areas concerned	Laws and regulations	Purpose of the laws and regulations	Remarks
Marine mammals **Steller sealion** **Seals**	Fisheries Law Classification as endangered species (VU) by Ministry of Environment and IUCN	Population control for conservation and minimizing damage to fisheries	Steller sealion as indicator species
	Wildlife Protection and Appropriate Hunting Law (2003)	Restriction on the capture (damage to fisheries)	Seals as indicator species Survey on the status of seals' migration and damage to the fishing industry
Seabirds and sea eagles **Sea birds***	Wildlife Protection and Appropriate Hunting Law (2003) The red list of endangered species* (both MOE and IUCN)	Protection of endangered species *Japanese night heron, red-crowed crane, Blakiston's fish-owl, Steller's sea eagle, Japanese yellow bunting, white-tailed eagle, yellow-breasted bunting, long-billed murrelet, spectacled guillemot.	Spectacled Guillemot, Slaty-backed gull and Japanese cormorant selected as indicator species
Sea eagles	[for white-tailed eagles and Steller's sea eagles] Designation as Domestic Endangered Species under the Law for Conservation of Endangered Species of Wild Fauna and Flora Designation as Natural Monument under the Law for the Protection of Cultural Properties Hokkaido Prefecture Notification No. 754 [Programmes] Programme for Rehabilitation of Natural Habitats and Maintenance of Viable Population [for both Steller's sea eagles and white-tailed eagles] (under the Species Law)	Protection of endangered species Ban on the use of lead bullets in the hunting of large mammals to prevent lead poisoning of the eagles	white-tailed eagles and Steller's sea eagles selected as indicator species. [monitoring]

Areas concerned	Laws and regulations	Purpose of the laws and regulations	Remarks
Marine recreation	Basic Plan on the Proper Use of the Apical region of the Peninsula Zone of Shiretoko National Park	Minimizing the negative impact of pleasure boats and leisure fishing boats on sea birds and marine mammals	
	Agreement on the instructions for usage restrictions of the Shiretoko Cape area (based on the Basic Plan)	Request for compliance on the routes of recreational boats, Request operators' attention to the potential negative impacts of tourism activities	

Source: *NEAMPAN secretariat based on "The multiple use integrated marine management plan and explanatory material for Shiretoko World Natural Heritage site", Ministry of Environment, 2007, and Makino et al. 2009*

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Supplemental Materials

Supp. 1: Marine Biodiversity Conservation Strategy (*https://www.env.go.jp/nature/biodic/kaiyo-hozen/other/pdf.html*)

Supp. 2: Basic Act on Biodiversity (*http://www.japaneselawtranslation.go.jp/law/detail/?id=1950&vm=04&re=02*)

Supp. 3: Outline of the National Biodiversity Strategy of Japan 2012-2020 (*http://www.biodic.go.jp/biodiversity/about/library/files/nbsap2012-2020/nbsap2012-2020_cop11ver_EN.pdf*)

Supp. 4: Basic Act on Ocean Policy (*https://www8.cao.go.jp/ocean/english/index_e.html*)

Supp. 5: Outline of the Third Basic Plan of Ocean Policy 2018 (*https://www8.cao.go.jp/ocean/english/plan/pdf/plan03_gaiyou_e.pdf*)

Supp. 6: The Management Plan for the Shiretoko WNH Site 2009 (the Management Plan) (*http://dc.shiretoko-whc.com/data/management/kanri/chiki_kanrikeikaku_eng.pdf*)

Supp. 7: The Multiple Use Integrated Marine Management Plan and Explanatory Material for Shiretoko World Natural Heritage Site of 2007 (the Marine Management Plan) (*http://dc.shiretoko-whc.com/data/management/kanri/seawg_kanri_en.pdf*)

Supp. 8: The 3rd Revised Multiple Use Integrated Marine Management Plan and Explanatory Material for Shiretoko World Natural Heritage Site of 2018 (the Marine Management Plan) (*http://shiretoko-whc.com/data/management/kanri/seawg_kanri_3rdterm_en.pdf*)

Supp. 9: Outline of the Long-Term Monitoring Plan for the Shiretoko World Natural Heritage Site (*http://dc.shiretoko-whc.com/data/management/kanri/longterm_monitoring_en.pdf*)

3

Republic of Korea

A. REVIEW OF MANAGEMENT PLANS AND STRATEGIES FOR MARINE PROTECTED AREAS IN THE REPUBLIC OF KOREA

B. MONITORING AND ASSESSMENT OF MARINE PROTECTED AREAS

C. FEEDBACK OF ASSESSMENT RESULTS TO MANAGEMENT PLANS AND PRACTICES

D. CASE STUDIES

3. Republic of Korea[13]

A. Review of Management Plans and Strategies for Marine Protected Areas in the Republic of Korea

1. Basic Information of Marine Protected Areas in the Republic of Korea

The Republic of Korea (ROK) has different kinds of marine protected areas, designated by individual acts of three Ministries. The Ministry of Oceans and Fisheries (MOF) has designated four different types of protected areas while the Ministry of Environment (MOE) and the Cultural Heritage Administration each have designated two types of protected areas, respectively. NEAMPAN sites in the ROK are categorized under "Coastal Wetland Protected Areas (WPA)", which are designated and managed under the Wetlands Conservation Act. Both MOF and MOE have joint jurisdiction under Wetlands Conservation Act, while MOF has jurisdiction over coastal wetlands and MOE has jurisdiction over inland wetlands. Table 28 shows the status of the marine protected areas in the ROK.

13 This chapter was prepared by Mr. Taecheol Jang and Dr. Young Nam Kim, Korea Marine Environment Management Corporation.

Table 28 Status of the Marine Protected Areas in the Republic of Korea

Ministry	Category of protected areas		Legislation	Number	PA (㎢)
Ministry of Oceans and Fisheries	Coastal Wetland Protected Area (tidal flat)		Wetlands Conservation Act	13	1,421.65
	Marine Protected Area	Marine Ecosystem	Conservation and Management of Marine Ecosystems Act	13	259.33
		Marine Scenery		1	5.23
		Marine Species		1	91.24
	Environmental Preservation Sea Areas		Marine Environment Management Act	4	949.12
	Fishery Resources Protection Zone		Fishery Resources Management Act	9	2,526.0
Ministry of Environment	Natural Parks	National Parks	Natural Parks Act	4	2,753.71
		Provincial Parks		4	407.52
		County Parks		1	3.77
	Wildlife Protection Districts (Local Administration)		Wildlife Protection and Management Act	166	3.93
Cultural Heritage Administration	Natural Monument		Cultural Heritage Protection Act	3	960.19
	Scenic Area			6	0.09

** Updated as of 31 Dec 2018*

Coastal WPA can be designated when more than one of the following are satisfied according to Article 8 Paragraph 1 of Wetlands Conservation Act. In addition, MOF has politicized designation standards and announced the detailed (coastal) WPA designation standards in 2018 as follows to clarify a conformance status to the designation requirements. Grounds of WPA designation and detailed designation guidelines of WPA are shown in Tables 29 and 30.

Table 29 Grounds of WPA Designation in Wetlands Conservation Act

Article 8 (Designation of a Wetland Area)

① Minister of Environment, Minister of Oceans and Fisheries or Governor of Metropolitan/Province could designate one of the following areas as a wetland protected area for its high conservation value, and also designate its surrounding area as a wetland surrounding management area.

1. An area that has native continuity or rich biodiversity
2. An area inhabited or visited by a rare or endangered wild animal or plant
3. An area that has extraordinary scenic, topographic, or geologic value

Table 30 **Guidelines for Wetland Protected Areas Designation**

1. Uniqueness of Topographical and Geologic Features

a. Site which displays extremely standard or unique topographical and geological features, and is deemed worthy of preservation due to excellent scientific and aesthetic values

b. Site which preserves the continuity of untouched coastal sand dunes or wetlands, or which shows remarkable development of primitive seascapes such as shore cliffs or sea stacks at the dorsality of coastal wetlands

c. Site with environmental or human landscapes of outstanding aesthetic value which is deemed to contribute to the elevation of emotion and enhancement of welfare through aesthetic pleasure and recreation

2. Large Benthic Species

a. Site habited by more than 100 species or legally protected species in a single unit tidal flat

b. Site habited by a large colony of species found only in Korea, rare species, or species with high ecological significance

c. Site known to display higher ecological indices including species diversity compared to other unit tidal flats

3. Coastal Vegetation and Flora

a. Site habited by legally protected species

b. Site in which the area of habitation of coastal vegetation exceeds 0.01km^2, or in which vegetation habits in an exceptionally extensive manner

c. Site with excellent preservation of Grade 10 vegetation (Sand dune/salty terrain vegetation) as per the Nature Map drawn by the Minister of Environment in accordance with Article 27 of the 「Enforcement Decree of the Natural Environment Conservation Act」

4. Seabirds

a. Site deemed worthy of preservation as the habitat or stopover of legally protected species

b. Site with the appearance of 20,000 individual seabirds

c. Sites habited or utilized by more than 1% of the total population of a single seabird species

5. Other Taxa

a. Site habited by legally protected fish, amphibians, reptiles or mammals, among which the coastal wetland poses a significant impact on the life history of the species

As shown in Table 31, the MPA designation procedure follows three steps. First, based on the results of the National Marine Ecosystem Monitoring Program, regional stakeholders select a candidate site and request its designation as an MPA. In the case that the candidate site does not have sufficient survey results, further precise surveys may be conducted to additionally review conformance status to the designation requirements. By reflecting the survey results and consultations with regional stakeholders, a designation plan for the MPA is prepared, for which sufficient number of opinions from regional stakeholders are gathered through discussions and briefings. When the sufficient discussions on designation have been conducted, relevant departments and local administrations jointly consult and develop the designation plan, followed by an announcement of the designation. MOF or metropolitan city/provincial governments have authority in designating a coastal/marine MPA.

Table 31 MPA Designation Procedure

Preparation	• Recommendation of MPA candidate sites	• Reflecting the results of marine ecosystem research • Designation request from a local administration
	• Detailed site investigation	• Evaluation on the appropriateness of grounds of designation
Designation Arrangement	• Preparation of draft designation plan	• Grounds of designation plan
	• Briefing session for residentss	• Explanation/feedback collection
	• Consultation between relevant organizations	• Corresponding local administration and relevant government institutes
Designation	• Notification on designation of MPA	• Notification on Official Gazette
	• Notification on Official Gazette/Information System	• MOF notifies on MPA website

As shown in Table 32, 13 sites covering 1,421.65km^2 have been designated as WPAs in accordance with the Wetland Conservation Act. Among them, the ROK has designated Suncheon Bay tidal flat WPA, Muan tidal flat WPA, and Gochang tidal flat WPA as NEAMPAN sites.

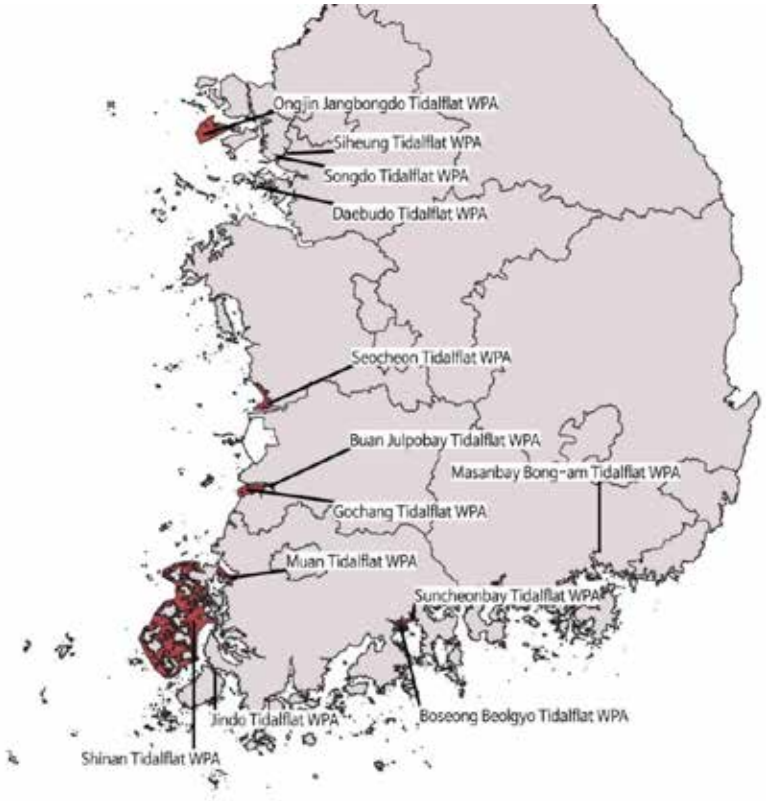
Table 32 **Status of Coastal Wetland Protected Areas**

	Coastal WPA name	Designation date	Area (km^2)	Location	Note
1	**Muan tidal flat**	2001.12.28.	42	Jeollanam-do Muan County	Ramsar site ('08)
2	Jindo tidal flat	2002.12.28.	1.44	Jeollanam-do Jindo County	-
3	**Suncheon bay tidal flat**	2003.12.31.	28	Jeollanam-do Suncheon City	Ramsar site ('06) UNESCO MAB('18)
4	Boseong bulgyo tidal flat	2018.09.03.	31.85	Jeollanam-do Boseong Province	Ramsar site ('06)
5	Ongjin jangbong-do tidal flat	2003.12.31.	68.4	Incheon metropolitan City Ongjin County	-
6	Buan Julpo bay tidal flat	2006.12.05.	4.9	Jeollabuk-do Buan County	Ramsar site ('10) UNESCO MAB('13)
7	**Gochang tidal flat**	2018.09.03.	64.66	Jeollabuk-do Gochang County	
8	Seocheon tidal flat	2018.09.03.	68.09	Chungcheongnam-do Seocheon Province	Ramsar site ('09) EAAF site('12)
9	Songdo tidal flat	2009.12.31.	6.11	Incheon metropolitan City Yeonsu-gu	Ramsar site ('14) EAAF site('19)
10	Masan bay bongam tidal flat	2011.12.16.	0.1	Gyeongsangnam-do Changwon City	-
11	Siheung tidal flat	2012.02.17.	0.71	Gyeonggi-do Siheung City	-
12	Daebudo tidal flat	2017.03.22.	4.53	Gyeonggi-do Ansan City	Ramsar site ('18) EAAF site('09)
13	Sinan tidal flat	2018.09.03.	1,100.86	Jeollanam-do Sinan County	Ramsar site ('11) UNESCO MAB('09)
	Total		1,421.65	-	-

Suncheon Bay Tidal flat WPA was designated on the 31st December 2003. Covering 28km^2, it is located in Suncheon-si, Jeollanam-do, Republic of Korea, and its marine components are intertidal (sand and tidal flat). Yeosu Regional Office of Oceans and Fisheries is the management authority. The conservation plan for 2019-2023 was prepared in 2018 and has been implemented by Suncheon City. The site was listed as a Ramsar Site in 2006 and subsequently a Ramsar wetland city in 2018. It was also designated as the "Scenic Site 41" in June 2008 and has been managed as a state-designated national heritage. It also has been listed as UNESCO MAB in 2018.

Muan Tidal flat WPA, covering 42km^2, was designated on the 28th December 2001. It is located in Muan-gun, Jeollanam-do, Republic of Korea, and its marine components are intertidal (sand and tidal flat). Mokpo Regional Office of Oceans and Fisheries is the authority responsible for its management. The conservation plan for 2017-2021 was updated in 2016 and has been implemented by Muan County. It is a Ramsar site, listed in 2008.

Figure 28 **Map of Coastal Wetland Protected Areas in the Republic of Korea**



Gochang Tidal flat WPA was first designated in 2007 but expanded in 2018 with a total area of 64.66km^2. Located in Gochang-gun, Jeollabuk-do, Republic of Korea, Gunsan Regional Office of Oceans and Fisheries is the management authority. The conservation plan was updated in 2019 and is being implemented from 2020-2024 by Gochang County. It has been listed as a Ramsar Site in 2010 and UNESCO MAB in 2013, respectively.

For all three NEAMPAN sites, annual monitoring has been conducted under the National Marine Ecosystem Monitoring Program since 2015.

2. Background of Strategic and Management Plan of MPA

MOF and MOE have outlined the Wetland Conservation Basic Plan every 5 years since 2007 as required by Article 5 of the Wetlands Conservation Act. MOF, MOE, local administrations, and concerned organizations are responsible for implementing the Basic Plan. The 3rd Wetland Conservation Basic Plan was established in 2018 and has been implemented by national/provincial governments and local administrations.

Table 33 Key Contents of the Wetland Conservation Basic Plan

1. Policy directions concerning wetland conservation
2. Items concerning wetland survey
3. Items concerning status of distribution, area and life diversity of wetland
4. Items concerning adjustment with other national basic plans related to wetland
5. Items concerning international cooperation for wetland conservation
6. Other items determined by presidential decree as the items required for wetland conservation
   - Analysis of causes for damages to wetland and reclamation of damaged wetland
   - Cooperation items for related central administration institutions and local administrations concerning wetland conservation
   - Cultivation of specialized manpower and specialized institutions for wetland conservation
   - Education and publicity for wetland conservation
   - Required financial resources and procurement plans of financial resources for enforcement of basic plans for wetland conservation according to the regulations of Article 5 of the Act

Furthermore, for the systematic conservation and management of WPAs, MOF and MOE establish a conservation plan for regional wetland protected areas every 5 years as stipulated by Article 11 of the Wetlands Conservation Act. The conservation plan should include the items listed in Table 34.

Table 34 Key Contents of the Conservation Plan for a Regional Wetland Protected Area

1. Basic items concerning wetland conservation
2. Items concerning conservation and utility facilities of wetland
3. Items concerning conservation, management and utilization of wetland
   - Projects concerning quality improvement of stakeholders' life
   - Maintenance of biodiversity
   - Wetland restoration projects and wetland conservation projects

The purpose of the Wetland Conservation Act is to identify matters for efficient wetland conservation and management, as well as to preserve wetlands and their biodiversity. Activities listed in Table 35, thus, are restricted to ensure sustainable use and systematic conservation of marine resources, except fishery for the livelihood of local residents. For instance, the Wetland Conservation Act permits sustainable fisheries and the wise use of protected areas and marine resources by stakeholders. Under the Natural Parks Act, which classifies 4 types of zones, namely, (i) park nature conservation zone, (ii) park nature environment zone, (iii) park village zone, and (iv) park culture heritage zone, fisheries are permitted for (ii) and (iii).

Table 35 **Restricted Actions in Wetland Protected Areas**

Wetland Conservation Act

Article 13

① Construction or extension of buildings or other artificial structures (only applicable when such extension increases the floor area of the building or other artificial structure by two times the previous floor area) and change in soil characteristics

② Activities increasing or decreasing the water level or water amount of wetland

③ Activities collecting soil, sand, gravel or stone, etc.

④ Activities mining minerals

⑤ Activities artificially importing, cultivating, capturing or collecting plant or animals (except when local residents continuously cultivate, capture or collect during the period set by joint ordinance for a means of living or leisure activity)

Category of protected areas	Legislation concerned	Restricted activities (reference. Table 35)	Exemption
Coastal Wetland Protected Area	Wetlands Conservation Act	①②③④⑤	Fishery for the livelihood of local residents who have had fishery authority for more than one year
Natural Parks (i) park nature conservation zone (ii) park nature environment zone (iii) park village zone (iv) park culture heritage zone	Natural Parks Act	①②③④⑤, Fisheries	Fisheries permitted in (ii) park nature environment zone and (iii) park village zone only
Marine Protected Area	Conservation and Management of Marine Ecosystems Act	①②③④⑤	Fishery for livelihood by local residents
Environmental Management Sea Areas	Marine Environment Management Act	①	-
Fishery Resources Protection Zone	Fishery Resources Management Act	①⑤	-

Management of Coastal WPA is overseen by MOF, with a system where the authority and tasks are mandated and consigned to regional offices of oceans and fisheries and Provincial/local administrations. Korea Marine Environment Management Corporation (KOEM) is responsible for integrated management, raising awareness, international cooperation and provision of subsidies, upon "Regulations on management, etc. of marine protected areas". More information on the management system is provided in Table 36.

Table 36 Management System of Wetland Protected Areas

- (MOF·KOEM) Integrated Management, International Cooperation, Raising Awareness (National level), Monitoring, Subsidization (Subsidization Rate: Government Expenditure 70% / Local Expenditure 30%)
  - Monitoring: National marine ecosystem monitoring Program, MPA citizen monitoring Program, etc.
  - Awareness-raising: World Wetland day Ceremony, National Marine Protected Area Congress, etc.
  - International cooperation: Ramsar Convention (Ramsar Site Designation, Wetland City Accreditation), Cooperation with International Organizations, Response to International agreements, etc.
- (Regional Office of MOF) Establishment of Basic Management Plan, Provision of Subsidies, and Assessment of Subsidies
- (Provincial/Local Government) Creation and operation of regional commission, Implementation of Management Plan, Inspection on restrictions, Awareness raising at a local level

Offices	Key responsibilities	Remarks
Ministry of Oceans and Fisheries and KOEM	Integrated Management	MPA Management Regulations
	Monitoring	• National marine ecosystem monitoring Program • MPA citizen monitoring Program
	Awareness raising (national level)	• World Wetland day Ceremony • National Marine Protected Area Congress • MPA Manager Capacity Building Program • MPA Visitor Center Network Meeting
	International Cooperation	• Ramsar Convention (Ramsar Site Designation, Wetland City Accreditation) • Cooperation with International Organizations • Response to International agreements.
	Provision of subsidies	• Subsidization Rate: Government Expenditure 70% + Local Expenditure 30%
Regional Offices of Ministry of Oceans and Fisheries	Management authority of the NEAMPAN sites	• Establishment of Basic Management Plan • Provision of Subsidies • Assessment of Subsidies
Yeosu Mokpo Gunsan	Tidal flat WPA: Suncheon bay Muan Gochang	• (Conservation plans) 2019-2023 2017-2021 2020-2024
Provincial/Local Government	Site management and Implementation of the annual management plans	• Creation and operation of regional commission • Implementation of Management Plan • Inspection on restrictions • Raising Awareness (local level)

3. Objective and Key Contents of Conservation Plans for NEAMPAN Sites

3.1 Suncheon Bay Tidal Flat Wetland Protected Area Conservation Plan

Suncheon Bay Tidal Flat was designated as a wetland protected area in 2003 (28 km^2). As shown in Figure 29, it is largely muddy with shallow salt marshes supporting a wide range of species, e.g. Black-faced Spoonbill (*Platalea minor*), Nordmann's Greenshank (*Tringa Guttifer*), Spoonbill Sandpiper (*Calidris Pygmaea*), and Relict Gull (*Ichthyaetus Relictus*). It is the wintering site for the Hooded Crane (*Grus Monacha*) and supports over 1% of the population of Common Shelduck (*Tadorna tadorna*), Hooded Crane (*Grus Monacha*), Eurasian Curlew (*Numenius Arquata*), Saunder's Gull (*Larus Saundersi*) and Kentish Plover (*Charadrius Alexandrinus*).

Figure 29 Map and Photographs of Suncheon Bay Tidal Flat Wetland Protected Area

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The Conservation Plan for Suncheon Bay Tidal flat WPA was re-established in 2018 by the Yeosu Regional Office of Oceans and Fisheries. As shown in Table 37, the conservation plan has been implemented since 2019 and consists of 1 goal, 4 strategies and 17 concrete project plans. The total budget for the five years is approximately USD 45,773k, and each project plan has its own annual budget. In accordance with the WPA conservation plan,

Suncheon City prepared an annual WPA management plan and has submitted a budget application annually to MOF via the Yeosu Regional Office of Oceans and Fisheries and Jeollanam-do provincial government for implementation.

Table 37 **Key Contents of the Conservation Plan for Suncheon Bay Tidal Flat Wetland Protected Area (2019-2024)**

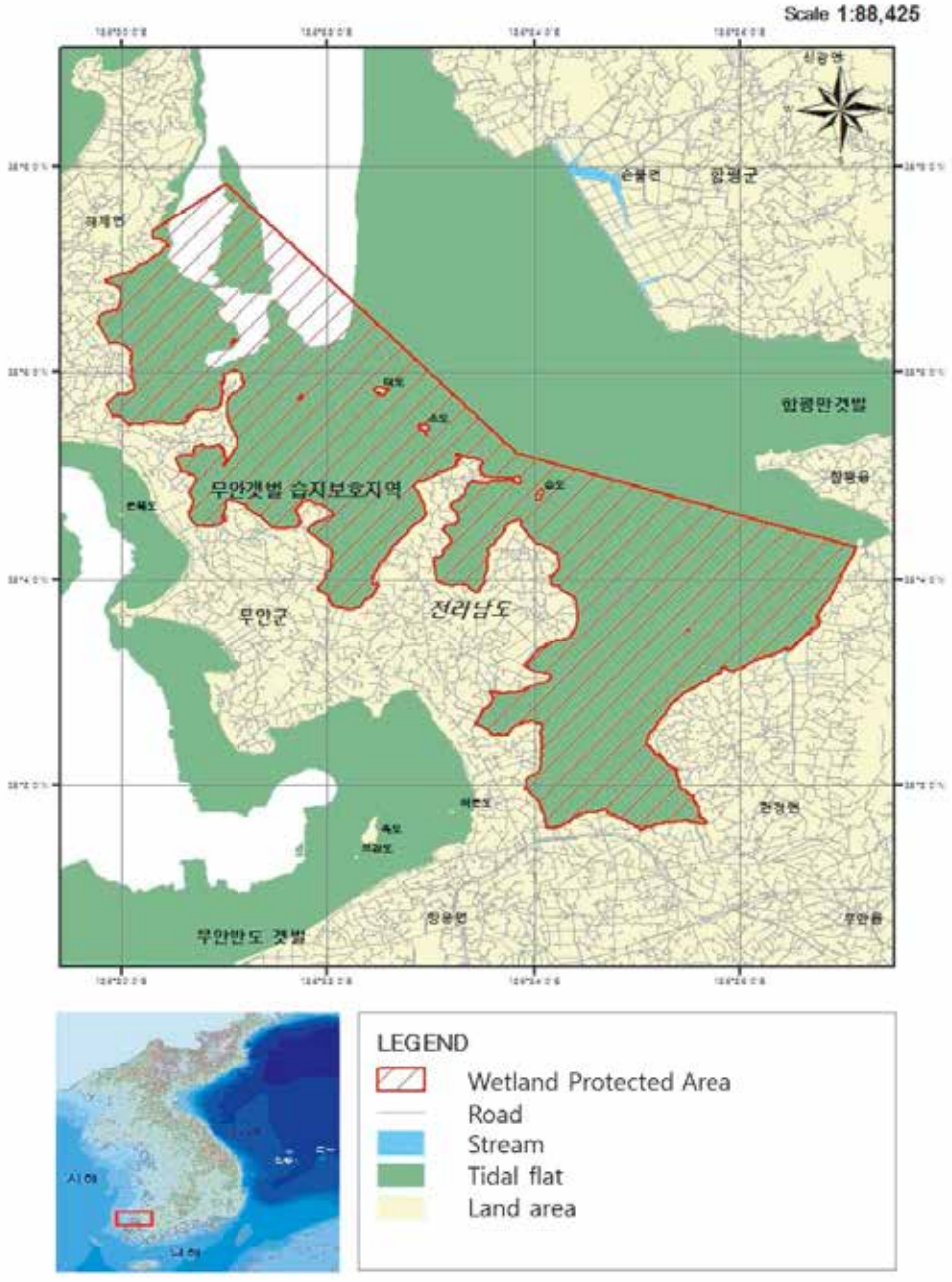
- **Management Goal**: Sustainable development of Suncheon Bay Tidal Flat WPA as a capital of ecology
- **Strategies and project plans**
  - **Strategy 1: Conservation**
    - · Fact-finding survey and management of marine protected areas
    - · Pollution prevention and management of neighboring waters
    - · Fact-finding survey and management of marine wastes
    - · Zoning of Suncheon Bay marine protected area
    - · Tidal flat restoration of Suncheon Bay
  - **Strategy 2: Management**
    - · Strengthening ecosystem preservation system
    - · Citizen monitoring led by local residents
    - · Honorary administrators program
    - · Installation and use of facilities for preservation and utilization
    - · Management evaluation of marine protected area and establishment of future plans
  - **Strategy 3: Capacity**
    - · Increased awareness of preservation of Suncheon Bay
    - · Capacity building in marine protected area management
    - · Increased awareness of sustainability
  - **Strategy 4: Abundance**
    - · Creating an environment for sustainable fishery
    - · Public contest project
    - · Ecological resource observation programs
    - · Increased brand value of Suncheon Bay

3.2 Muan Tidal Flat Wetland Protected Area Conservation Plan

Muan Tidal Flat was designated as the first wetland protected area of the ROK in 2001 (42 km^2). As shown in Figure 30, it is located in the mouth of the semi-enclosed inner bay. Some species of winter waterbirds have been observed, and the site provides habitat to various endangered and rare species such as Saunder's Gull (*Larus*

saundersi), Black-faced spoonbill (*Platalea minor*) and Chinese Egret (*Egretta eulophotes*). It is a notable spawning place for marine organisms providing valuable food resources for migratory birds.

Figure 30 Map and Photographs of Muan Tidal Flat Wetland Protected Area



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Muan Tidal flat WPA conservation plan was re-established in 2016 by the Mokpo Regional Office of Oceans and Fisheries. As shown in Table 38, the conservation plan has been implemented since 2017 and consists of 1 goal, 4 strategies and 13 concrete project plans. The total budget is approximately USD 16,590k, and each project plan has its own annual budget plan. According to the WPA conservation plan, Muan County, as an implementing body, established the annual WPA management plan and submitted a budget application annually to MOF through the Mokpo Regional Office of Oceans and Fisheries and Jeollanam-do provincial government.

Table 38 **Key Contents of Conservation Plan of Muan Tidal Flat Wetland Protected Area (2017-2021)**

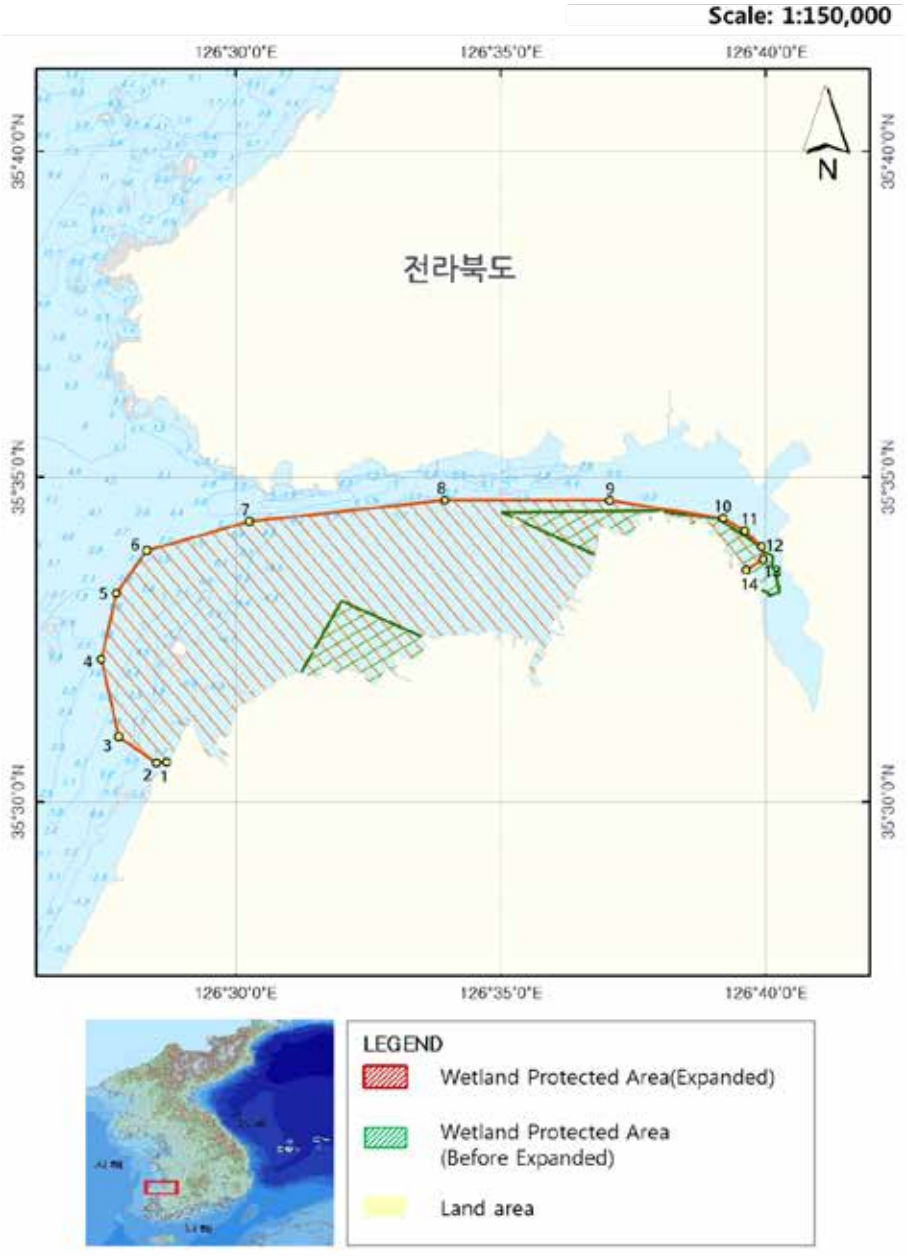
- **Management Goal**: Coexistence of wetland and human in harmony through sustainable development of Muan Tidal flat
- **Strategies and project plans**
  - **Strategy 1: Conservation and Management of Nature Resources**
    - Research and management of the natural environment
    - Establishment and management of coastal pollution prevention measures
    - Efficient space utilization through classification of use
    - Expansion and integrated management of WPAs
  - **Strategy 2: Revitalization of Muan Ecological Tidal Flat Center**
    - Revitalization of Muan Ecological Tidal Flat Center
    - Strengthening educational and experiencing contents at Muan Ecological Tidal Flat Center
    - Building Muan Ecological Tidal Flat Recreation Area
    - Rebuilding Muan Tidal Flat website
  - **Strategy 3: Enhancement of Muan tidal flat management governance with stakeholders' participation**
    - Increase of local participation in WPA Management Committee
    - Citizen monitoring project led by local residents
  - **Strategy 4: Management of quality of life of stakeholders**
    - Building a local network in Muan tidal flat area
    - Commercialization of fishery products from tidal flat
    - Clean-up of wetland environment

3.3 Gochang Tidal Flat Wetland Protected Area Conservation Plan

Gochang tidal flat was designated as a wetland protected area in 2007 (10.4 km^2) and expanded in 2018 (64.66 km^2). As shown in Figure 31, it is located in Gomso Bay and is one of the important tidal flats for migratory seabirds along the west coast of the ROK. It provides roosting sites for globally threatened species such as the endangered Oriental White Stork (*Ciconia boyciana*) and the vulnerable Saunders's gull (*Larus saundersi*). It is also

important for supporting populations of shorebirds, such as the Far Eastern Curlew (*Numenius madagascariensis*), Kentish plover (*Charadrius alexandrinus*) and Dunlin (*Calidris alpina*). The site is also an important area for fishery as it contains spawning and nursery grounds. The tidal flat is used for fishing and farming of Manila clam (*Tapes philippinarum*) and Corb shell (*Cyclina sinensis*).

Figure 31 Map and Photographs of Gochang Tidal Flat Wetland Protected Area



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Gochang tidal flat WPA conservation plan was re-established in 2019 by the Gunsan Regional Office of Oceans and Fisheries. As shown in Table 39, the conservation plan has been implemented since 2020 and consists of 4 strategies and 15 concrete project plans. The total budget for the five years is approximately USD 5,531k, and each project plan has its own annual budget plan. In accordance with the WPA conservation plan, Gochang County, an implementing body, established the annual WPA management plan and has submitted a budget application annually to MOF via Gunsan Regional Office of Oceans and Fisheries and Jeollabuk-do provincial government.

Table 39 **Key Contents of Management Plan of Gochang Tidal Flat Wetland Protected Area (2020-2024)**

- **Strategy 1: Healthy tidal flat conservation and nature-friendly recovery**
  - · Systematic management and survey of tidal flat ecosystem
  - · Management of protected marine species and biodiversity
- **Strategy 2: Securement of sustainable management base**
  - · Network establishment and enhancement of regional management
  - · Establishment of MPA management guideline
  - · Facility maintenance and additional installation
  - · Installation of a visiting facility and MPA notice board
  - · Management capacity building
- **Strategy 3: Eco-friendly management and awareness-raising of tidal flat**
  - · Establishment of sustainable tidal flat fishing area
  - · Awareness-raising of sustainable fishery
  - · Promotion public awareness of Gochang tidal flat
- **Strategy 4: Wise use and Improvement of quality of life of stakeholders**
  - · Project contest of residents
  - · Support for fishing villages for autonomous management
  - · Invigoration of fishing villages
  - · Establish Eco-tour manual for Gochang tidal flat

B. Monitoring and Assessment of Marine Protected Areas

1. Monitoring Parameters

1.1 Areas Addressed with Monitoring Parameters by Monitoring Bodies and Collection of Data

The Ministry of Oceans and Fisheries has jurisdiction over nationwide marine areas and operates survey systems such as the national marine ecosystem monitoring, the marine environment measurement network, the automatic measuring network for marine water quality, the fixed oceanographic survey, environmental monitoring for fishing grounds, and citizen monitoring, etc., for prompt diagnosis and evaluation of the marine ecosystem status and changes. Among them, the national marine ecosystem monitoring program and marine environment measurement network are regularly conducted to monitor and assess the three NEAMPAN sites in the ROK.

National Marine Ecosystem Monitoring Program

MOF has operated the national marine ecosystem monitoring since 2015, integrating existing marine ecosystem-related surveys which used to be operated individually (Table 40 and Figure 32). Commissioned by MOF, Korea Marine Environment Management Corporation (KOEM) has been producing basic scientific data for tidal flats, coastal and adjacent seas, and underwater ecosystems in the ROK. Focus monitoring is conducted annually for ecologically important areas such as marine protected areas; while the spread of fundamental monitoring sites is evenly distributed.

Figure 32 Implementation System of the National Marine Ecosystem Monitoring Program

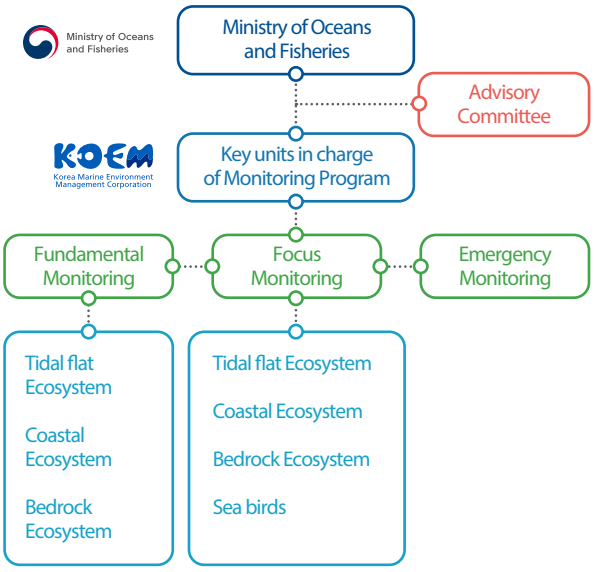


Table 40 Phased Implementation of the National Marine Ecosystem Monitoring Program

Step	Monitoring
Step 1 (2015~2020)	Tidal flat, inshore and offshore monitoring (biennial)
	- 2015/2017/2019: West sea and South-west sea - 2016/2018/2020: South-east sea, East Sea and Jeju
Step 2 (2021~2025)	Tidal flat, inshore and offshore (annual)

MOF has carried out the National Marine Ecosystem Monitoring Program annually for the basic monitoring of marine ecosystems status in coastal wetlands (tidal flats) (Table 41 and 42). Fundamental monitoring is conducted for ① coastal (inshore and offshore) ecosystems, ② bedrock ecosystems, and ③ tidal flat ecosystems. All three NEAMPAN sites are included in the tidal flat ecosystem, which has four monitoring parameters: ① sedimentary environments (granularity, organic matter concentration, and trace metals concentration), ② macrobenthos

(number of species, inhabitation density, and biomass), ③ salt plants (character species, companion species, vegetation area, colony area, and dry weight), and ④ sea birds (number of individuals, number of species, dominance value, and species diversity).

Table 41 Number of Sampling Stations for the National Marine Ecosystem Monitoring Program

Category	Total No. (828 stations)		
	Fundamental monitoring (555 stations)		Focus monitoring (273 stations)
	Odd year (326 stations)	Even year (229 stations)	
Tidal flat	231 stations	132 stations	189 stations
Rocky shore	11 stations	25 stations	6 stations
Inshore	73 stations	56 stations	38 stations
Offshore	11 stations	16 stations	6 stations
Sea bird	-	-	34 stations

Table 42 Parameters of the National Marine Ecosystem Monitoring Program

Category	Subcategory	Survey item	Target area	Detailed content
Biotic	Plankton	Microbe	Water area	Total count
		Plant plankton	Tidal flat	Chl a
			Water area	Chl a (total/nano), species composition, standing crop
		Animal plankton	Water area	Species composition, standing crop, biomass
		Roe/larva	Water area	Species composition, standing crop
	Benthos	Meiobenthos	Water area	Species composition, density, biomass
		macro benthos	Tidal flat	Species composition, density, biomass, dry strength
			Bed rock	Species composition, density, biomass
			Water area	Species composition, density, biomass, dry strength
		Sea algae	Water area	Species composition, coverage, biomass
		Ascidian	Water area	Species composition, coverage, biomass
		Halophyte	Tidal flat	Species composition, coverage, biomass
	Nekton	Fish	Water area	Species composition, standing crop, biomass, stomach content
		Crustaceans	Water area	Species composition, standing crop, biomass
		Cephalopods	Water area	Species composition, standing crop, biomass

Category	Subcategory	Survey item	Target area	Detailed content
Biotic		Other fishery resources	Water area	Species composition, standing crop, biomass
	Seabird	Bird	Tidal flat/ water area	Species composition, legal protected species, population characteristic
Abiotic	Marine environment	Water quality environment	Water area	T, S, nutrient salt, DO, SPM, POC/PON heavy metal (Cd, Co, Zn, Cu, Pb, Ni)
		Sediment environment	Tidal flat	Topography cross-section, sedimentation rate, particle size, acid volatile sulfide, COD, ignition loss, heavy metal (Al, Fe, Cu, Pb, Zn, Cd, Hg, As)
			Water area	Particle size, organic carbon, total nitrogen, carbonate, heavy metal (Cd, Co, Cr, Cu, Pb, Ni, Al)
		Residents' awareness change	Tidal flat	questionnaire survey on residents' awareness

The national marine ecosystem monitoring program also conducts a survey to see how the awareness and perception of marine protected areas change among residents to evaluate environmental and socio-economic factors. It measures perceived values of the surveyed areas and its outcomes will become the basis for further protection of natural habitats as well as revitalizing the region through domestic and international promotion. The resident awareness survey also provides an opportunity to receive support from the central and local governments for further administrative and conservation development after it is designated as a coastal wetland protected area . It also provides basic tidal flats data to assist in updating conservation/management policies as well as improve the quality of residents' life, by comparatively analyzing changes in conservation and management statuses and socio-economic changes after its designation.

Table 43 Parameters of Resident Awareness Survey

Category	Content	Note
Recognition and recognition channel of WPA designation	Recognition of WPA designation	-
	Recognition of international Ramsar wetland site designation	Except Si-heung
	Recognition channel of WPA designation	-
	Recognition of necessity of wetland protection	-
	Reason of necessity of wetland protection	-
WPA P.R degree of local residents	Degree of wetland protected area designation P.R on residents	-

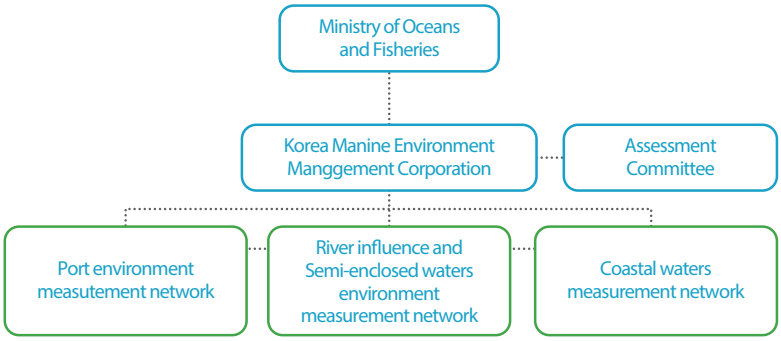
Category	Content	Note
Adequacy and high value of wetland protected area designation	Adequacy of wetland protected area designation	-
	High value factors of wetland protected area designation	-
	Occupation type of respondents	-
	Income proportion of fishery	-
	Main fishery activities	Except Si-heung
Effects of wetland protected area designation on region	Effects of wetland protected area designation on region	-
Impact of wetland protected area designation on life and income	Income change after designation as a wetland protected area	Include Si-heung
	Impact of wetland protected area designation on life	Include Si-heung
Assessment of conservation and management after wetland protected area designation	Degree of conservation and management after wetland protected area designation	-
	Reason of well-managed wetland protected area	-
	Reason of poorly managed wetland protected area	-
Threat factors of wetland protected area conservation	Threat factor of wetland protected area conservation	-
	Priority project for wetland protected area conservation	-
Agreement status of international Ramsar wetland site designation	Agreement status of international Ramsar wetland site designation on wetland protected area	Si-heung only
Agreement status of wetland protected area expansion	Agreement status of wetland protected area expansion	-
	necessary projects in case of additional designation on wetland protected area	-
Demographic information of respondents	Region/gender/age/householder, marital status of householder	-
	Family income, occupation	-
	Number of household members	-

** Si-heung tidal flat had been considered to be designated as a Ramsar wetland site.*

Marine Environment Measurement Network

Figure 33 shows the Marine Environment Measurement Network, operated by MOF since 1996. It aims to provide a scientific foundation for establishing and proposing effective national marine environment conservation policies and services for the public, as well as create a comprehensive environmental measurement network by conducting research on the marine ecosystem using a range of methods. By conducting scientific research, comprehensive understanding and information on the marine environment become available for a wide range of users, including Government, municipalities, academia, and the public, and effective environmental management policies thus are established. Commissioned by MOF, KOEM has been conducting monitoring and producing basic scientific data annually.

Figure 33 Implementation System of the Marine Environment Measurement Network



To monitor the marine environment's status, MOF conducts the marine environment measurement network four times (Feb, May, Aug, Nov) annually. The monitoring program has three types of measurement networks: ① Port environment measurement network (50 monitoring stations), ②river influence and Semi-enclosed waters environment measurement network (230 monitoring stations), ③coastal waters measurement network (145 monitoring station) (Table 44 and 45).

Table 44 Parameters of the Marine Environment Measurement Network

Division		Parameters	No. of stations
Sea water	General items (18)	Temperature, Salinity, pH, DO, COD, TN, DIN (NO_3^-, NO_2^-, NH_4^+), TP, DIP (PO_4^{3-}), Si $(OH)_4$, SPM, Transparency, Chlorophyll a	425
		Oil	50
		POC, DOC	44
	Trace metal (8)	Cu, Pb, Zn, Cd, Cr^{6+}, Total mercury, As, CN	198
	Environment radioactivity (6)	^{134}Cs, ^{137}Cs, Gross β, ^{3}H, $^{239+240}Pu$, $^{240}Pu/^{239}Pu$	32
Sediment	General items (4)	Particle size, IL, AVS, COD	198
	Trace metal (13)	Cu, Pb, Zn, Cd, Cr, Total mercury, As, Ni, Co, Al, Li, Fe, Mn	198
	Environment radioactivity (4)	^{134}Cs, ^{137}Cs, $^{239+240}Pu$, $^{240}Pu/^{239}Pu$	32
Biota	Trace metal (7)	Cu, Pb, Zn, Cd, Cr, Total mercury, As	50
	Environment radioactivity (2)	^{134}Cs, ^{137}Cs	7

Table 45 **Number of Sampling Stations of the Marine Environment Measurement Network**

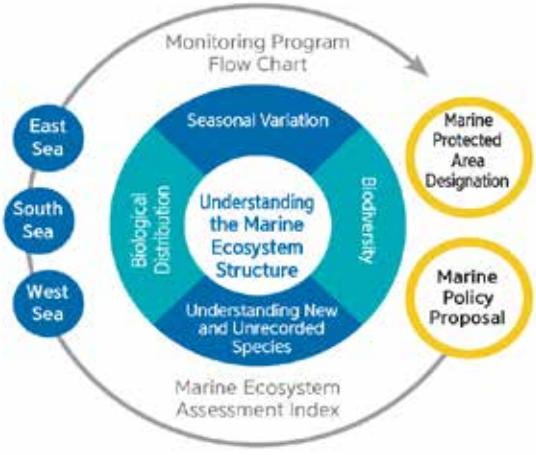
Measurement network	Ecology area		No. of Monitoring seas (No. of stations)
		Total	57 (425)
Port environment measurement network		**Subtotal**	31 (50)
	Mid-west sea ecology area		3 (3)
	South west sea ecology area		2 (3)
	Korea straits ecology area		12 (23)
	East sea ecology area		10 (14)
	Jeju ecology area		4 (7)
River influence and Semi-enclosed waters environment measurement network		**Subtotal**	21 (230)
	Mid-west sea ecology area	Han-river estuary	1 (38)
		Garorim bay	1 (3)
		Chunsoo bay	1 (9)
		Geum-river estuary	1 (23)
	South west sea ecology area	Hampyeong bay	1 (4)
		Youngsan-river estuary	1 (11)
		Doam bay	1 (5)
		Deukryang bay	1 (5)
		Yeoja bay	1 (3)
	Korea straits ecology area	Gamak bay	1 (5)
		Seomjin-river estuary	1 (25)
		Junju bay	1 (2)
		Jinhae bay	1 (33)
		Nakdong-river estuary	1 (30)
		Taehwa-river estuary	1 (19)
	East sea ecology area	Youngil bay	1 (11)
		Youngduk osipcheon estuary	1 (0)
		Wangpicheon estuary	1 (1)
		Samchuk osipcheon estuary	1 (1)
		Gangrueng namdaecheon estuary	1 (1)
		Yangyang namdaecheon estuary	1 (1)
Coastal waters measurement network		**Subtotal**	5 (145)
	Mid-west sea ecology area	Mid-west coastal sea ecology area	1 (10)
	South west sea ecology area	South west coastal sea ecology area	1 (25)
	Korea straits ecology area	Korea straits coastal ecology area	1 (44)
	East sea ecology area	East sea coastal ecology area	1 (47)
	Jeju ecology area	Jeju coastal ecology area	1 (19)

2. Assessment of Data

2.1 Assessment Criteria and Responsibilities

MOF evaluates and analyzes data collected from monitoring and scientific research, and has since established national marine environment policies to conserve healthy marine ecosystems. Policies include the preparation of a marine ecosystem map; the designation of marine protected areas; MPA management plans; and the response to global environmental changes. The concepts and purposes of the marine monitoring program are presented in Figure 34.

Figure 34 **Flow Chart of the Marine Monitoring Program**



2.2 Assessment against Goals And Indicators

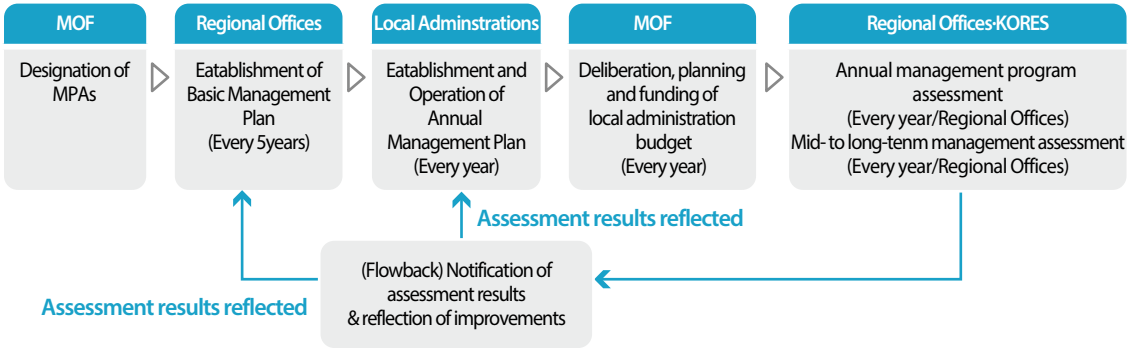
MOF has established a system to assess and evaluate monitoring data and conducted four types of assessment and evaluation (Table 46). The outcomes of assessment and evaluation are reflected in the annual management plan and basic management plan. Figure 35 shows the management process and feedback system for wetland protected areas.

Table 46 **Assessment and Evaluation System for Monitoring Data**

Category	Contents	Output
Reinforce threat management	Discover standard of risk for introduced species and noxious species	1) Safety management of genetically modified organisms
		2) Noxious marine life management
		3) Discover indicator species for contamination

Category	Contents	Output
Assessment and management of protected species	Reinforce management of species with high ecological value, such as protected species	1) Integrated assessment of marine life subject to protect
Discover indicator organisms	Discover indicator organisms to diagnose marine ecosystem	1) Discover indicator organisms through statistical methods or experiential analysis
Marine ecosystem assessment standard	Analyze policy impacts by developing indicators such as healthiness	1) Improve marine ecosystem plan
		2) Create an evaluation standard for marine ecosystem
		3) Develop evaluation indicators to analyze policy impacts

Figure 35 **Management Process of Wetland Protected Areas**



3. Links between Monitoring/Assessment Results and Management

3.1 Use of Monitoring Data

In the ROK, monitoring data is of utmost importance for policymakers within central government and related organizations. As shown in Table 47, based on the assessment and evaluation of the monitoring data, the central government decides overall policy directions, including whether to design new policies and how to prepare strategies and plans, etc.

Table 47 **Utilization of Monitoring Data**

Category	Contents	Output
Support policy for marine ecosystem and environment	Publish scientific data for policy enforcement and impact analysis	1) Establish a consultative body and plan
		2) Designate MPA and information support
		3) Proactively manage an emergency monitoring team
		4) Support international cooperation
Diversify public relations marine ecosystem and environment	Respond to global actions for marine ecosystem changes and analyze policy impact	1) Provide a regular press briefing
		2) Publish a regular policy report
		3) Reinforce public relations and education on marine ecosystem

3.2 Institutional Aspects

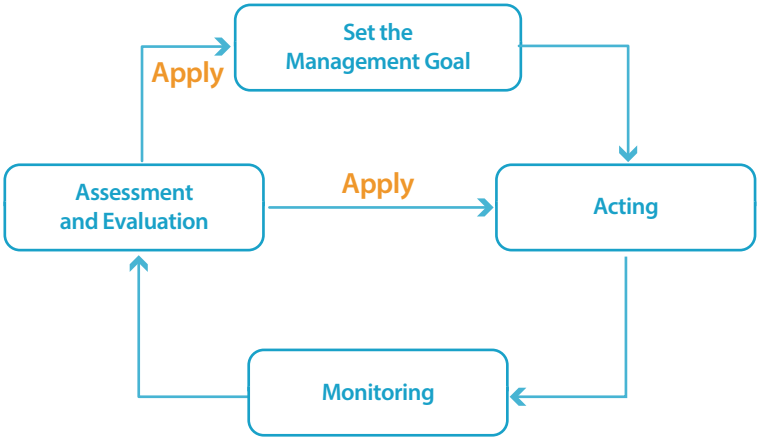
Wetland protected areas are independently managed by local governments to promote systemic conservation and wise use of excellent marine ecosystems. Local governments implement management plans through governance by organizing regional management committees which promote the participation of various stakeholders in wetland conservation and management; while the central government supports and evaluates management plans and projects and enhances public awareness on WPA, as well as establishes regional offices of MOF. MOF also assesses and evaluates MPA status with the national marine ecosystem monitoring program and related monitoring activities conducted by local administrations.

C. Feedback of Assessment Results to Management Plans and Practices

The ROK applies an adaptive management system for MPA management, similar to many other countries (WWF, 2008) (Figure 36). Regional Offices of Oceans and Fisheries (ROOF) establish a conservation plan for marine protected areas and sets management goals. Upon the completion of the conservation plan, local administrations execute projects for conservation and management, and MOF/KOEM conduct monitoring and assessment for all marine protected areas.

1. MOF designates an MPA and sets management and conservation goals.
2. ROOF establishes a mid-term management plan.
3. Local administrations implement various projects to manage and conserve an MPA site.
4. MOF and KOEM conduct a survey on the status of MPA sites.
5. MOF, ROOF and KOEM conduct an annual assessment and mid-term evaluation on management effectiveness.
6. Outcomes of assessment and evaluation are reflected in MPA conservation and management, including follow-up management plans.

Figure 36 **Concept of Adaptive Management of Wetland Protected Areas**



MOF and ROOF jointly conduct annual management assessment and mid-term evaluations on management effectiveness by mandating and consigning KOEM. Annual project evaluations have also been conducted since 2008 to determine if a regional management system has been independently established and carried out MPA management projects locally. Evaluation results are presented in the form of a checklist and reflected in the 5-year MPA basic management plans as well as annual management projects. Figure 37 presents the annual MPA management evaluation process and Table 48 is an annual MPA management assessment form.

Figure 37 **Annual MPA Management Evaluation Process**[14]

14 LA (Local administration); and MA (Metropolitan administration)

Table 48 Annual MPA Management Assessment Form

Management category (Score)	Evaluation indicators	Score
Management base (2)	Composition of Regional Management Committee	Composition: 1 None: 0 * Establishment of regional regulations: add 1
	Host result of Regional Management Committee Meeting <Functions of Regional Management Committee> 1. Establishment and amendment of a conservation plan 2. Establishment and amendment of detailed annual project plans 3. Evaluation of management project results	Twice: 1 Once: 0.5 None: 0 (number of meetings)
Projects Effect (3)	Development efforts of MPA project effect <Project Category> 1. CEPA efforts and outcomes 2. Site Management and Environment conservation efforts and outcomes 3. Supporting resident and Providing benefit efforts and outcomes	Very good: 3 Good: 2.5 Fair: 2 Insufficient: 1
Budget Execution (3)	Rate of annual budget execution	90%~: 3 80%-90%: 2.5 70%-80%: 2.0 60%-70%: 1.5 ~60%: 0
Participation (2)	Did MPA Managers (Local Administration manager) participate in workshops or capacity building programs?	Participation: 1 None: 0
	Did MPA Stakeholders (residents, NGO) participate in workshops or capacity building programs?	Participation: 1 None: 0

The mid-term management effectiveness evaluation has been conducted since 2012 against 11 indicators. It aims to evaluate the effectiveness of basic plans for MPA management from mid to long-term perspectives.

Evaluations are conducted every five years after newly establishing or re-establishing basic management plans. Qualitative and quantitative evaluations are first performed by reviewing implementation items in a written format, followed by field evaluation meetings with regional stakeholders. Evaluations on five areas, namely, management base, management plan, resource input, management process and management results, are reflected in the follow-up basic management plan.

Figure 38 **Mid-term MPA Management Effectiveness Evaluation Process (quinquennial)**

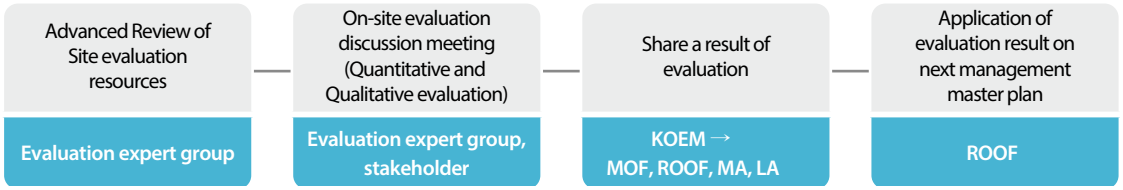


Table 49 **Mid-Term MPA Management Effectiveness Evaluation form**

Management section	Question	Score (Likert Scale, 1-5)
Management base	MPA regulation	
	Secure of MPA information	
	Level of stakeholder awareness	
Management plan	MPA Goal	
	Understanding of status of use and threat factors	
	Establishment of Conservation and Management plan	
Resource input	Research and Monitoring	
	Management human resources	
	Securing of budget	
Management process	Stakeholder communication	
	Management and supervision of regulation observance	
	Education and Awareness-raising Program	
	Education and capacity building of Management staff	
	Supplement of public relations (PR) and information resources	
Management result	maintain of purpose of MPA designation	
	Management of conflict factors	
	Appropriateness of charging management price and input of income	

D. Case Studies

1. Muan Tidal Flat Wetland Protected Area

1.1 Monitoring and Assessment Results

According to the analysis of monitoring data collected from the marine environment measurement network from 2011 to 2014 in Muan-gun, T-P (total phosphorus) and T-N (total nitrogen) exceeded the water quality standard. At Muan-gun, pollutants discharged from livestock farms flow down to the tidal flat along small streams, which intensify the pollution by forming deposits in the tidal flat. As a result, benthos has continually decreased to a level that presents a serious threat. Most pollution in the coastal area is sourced from the land. Harmful substances in sewage, industrial wastewater, and agriculture and livestock industry wastewater have a large impact on life in the marine area. Environmental hormones also have caused fatal impacts on the marine ecosystem.

A study on sewage and wastewater treatment in Muan-gun showed that 30-40% of total sewage and wastewater did not undergo proper treatment. Hyeongyung-myeon and Haejae-myeon, where the Muan Tidal Flat WPA is located, had an even higher ratio of non-treatment than the average ratio in Muan-gun.

Table 50 **Standard of Water Quality Index by Sea Area**

Sea Area	Chl-a (㎍/L)	DO (%) (Bottom layer)	DIN (㎍/L) (Surface layer)	DIP (㎍/L) (Surface layer)	Transparency (m)
East	2.1	90	140	20	8.5
Korea Straits	6.3		220	35	2.5
South West	3.7		230	25	0.5
Mid-West	2.2		425	30	1.0
Jeju	1.6		165	15	8.0

Figure 39 **Dissolved Inorganic Nitrogen Concentration of Hampyeong-bay (2011-2014)**

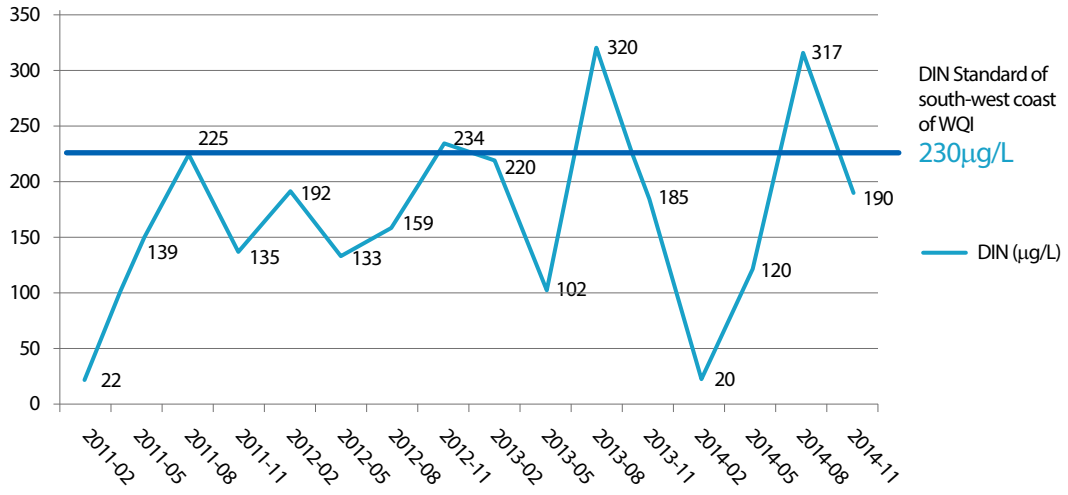
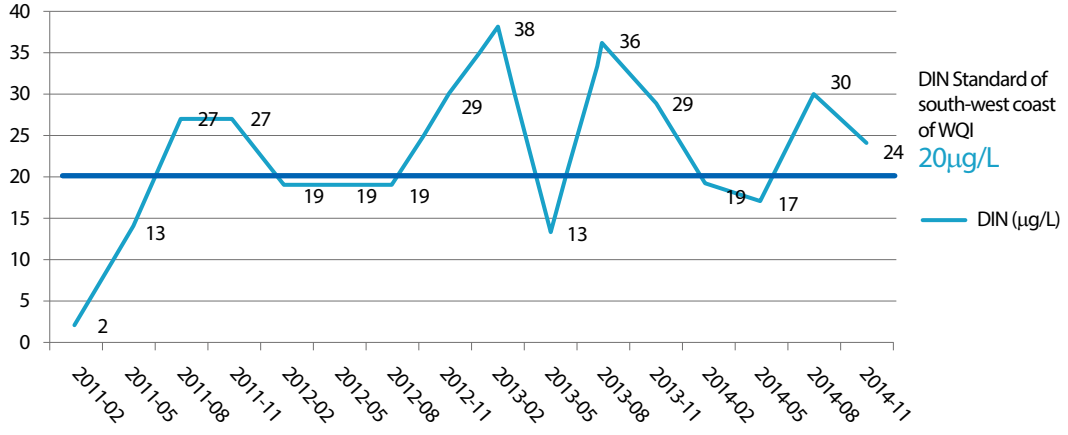


Figure 40 **Dissolved Inorganic Phosphorus Concentration of Hampyeong-bay (2011-2014)**



1.2 Corresponding Measures and Outcomes/Expectancy Effects

A high level of marine pollution in Muan-gun was identified when preparing the management plan for the Muan Tidal Flat WPA in 2015 when analysing the monitoring outcomes. To enhance the diversity of species and recover the health of the Muan tidal flat ecosystem, further surveys were conducted to assess (1) water quality in Hamhae Bay to establish management measures and (2) no-point pollution sources near the small streams flowing into the WPA. Sources of non-treated sewage water flowing into Hamhae Bay from Hyeongyung-myeon and Haejae-myeon were identified, and a plan to treat water flow into the Muan WPA was prepared. Non-treated sewage discharged from the livestock farm and farming area was also tracked down to identify its discharge

paths and management measures were established accordingly. A treatment project for waste deposited in the coastal area, such as fishing tools and nets waste, has also been incorporated into the management plan (2017-2021) for the Muan tidal flat WPA. Reflecting preventive measures for marine pollution in the management plan is expected to help maintain the health of marine ecosystems and build healthy fisheries with improved water quality in Hamhae Bay.

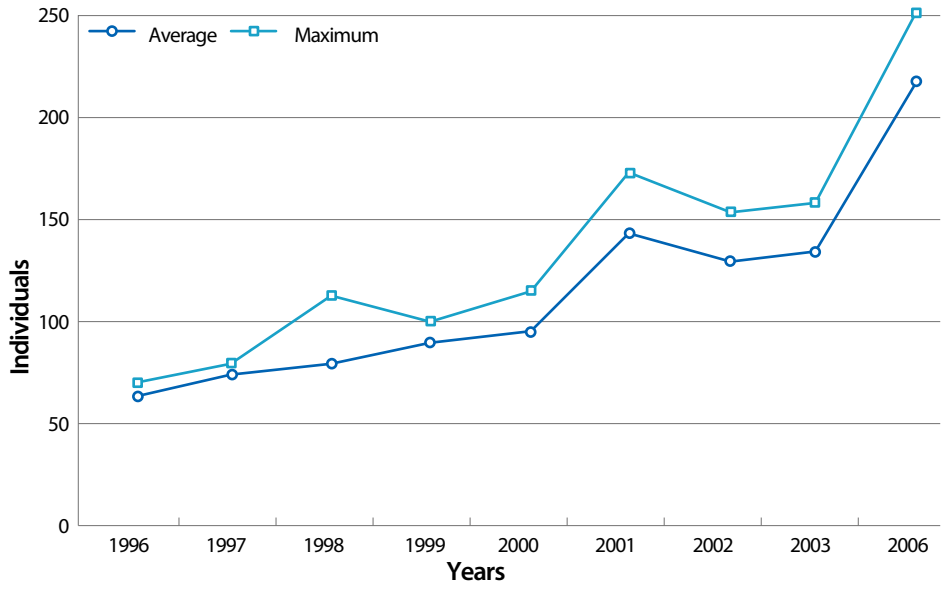
2. Suncheon Bay Tidal Flat Wetland Protected Area

2.1 Monitoring and Assessment Results

Monitoring Results

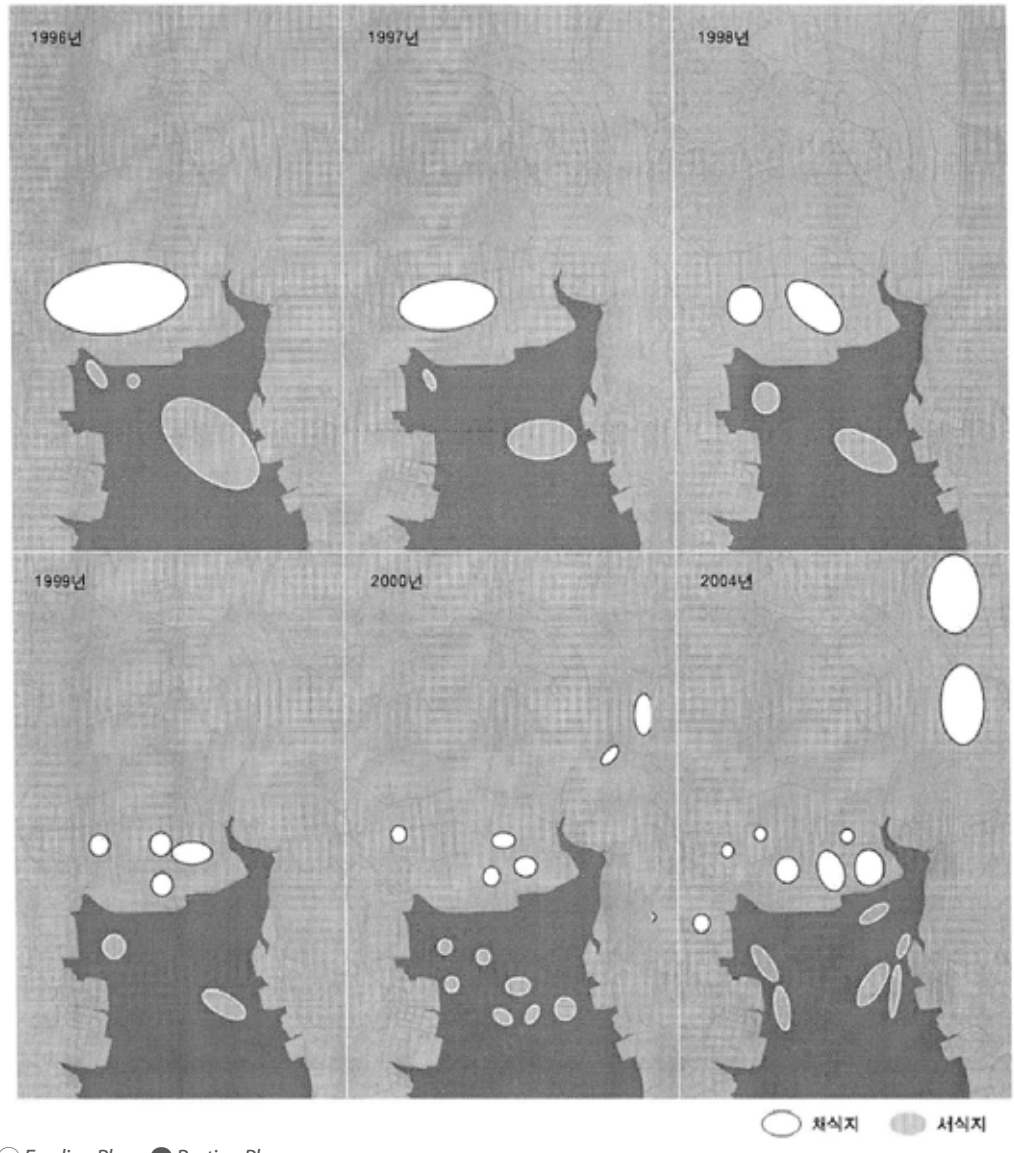
Suncheon Bay Tidal Flat is a popular place known for a wintering site for the hooded crane. The hooded cranes, symbolic of Suncheon City, return to the Suncheon Bay Tidal Flat every October for about 6 months in the winter and leaves again at the end of March in the following year. The hooded crane is designated as an Endangered Species Grade Ⅱ and Natural Monument No. 228 by the Korean Ministry of Environment. It is also classified as a Vulnerable Species (VU) of the Threatened Species in the Red List by the International Union for the Conservation of Nature (IUCN). As shown in Figures 41 and 42, for the first time about 70 cranes were observed in November 1996 in Suncheon Bay. The number of wintering population has increased to reach 219 in 2006.

Figure 41 **Number of Hooded Cranes in Suncheon Bay**



source: *Suncheon City, 2008*

Figure 42 **Distribution of Hooded Cranes in Suncheon bay**



○ *Feeding Place;* ● *Resting Place*

Assessment Results

Suncheon City conducted the "Study on efficient conservation and sustainable use of Suncheon-bay" in 2008 to create the image of a high-tech, eco-environment city through conservation of the natural environment of Suncheon-bay and promoting its sustainable use. In preparing a framework to improve and preserve habitats for the hooded cranes, Suncheon City also studied how the hooded cranes were distributed within the Suncheon Bay and what features the wintering sites exhibited. Local environmental groups also conducted monitoring of the hooded cranes and found their habitats had been actively expanded from tidal flat areas to reclaimed

farming areas. From the survey held in 2000 and 2004, the activity range of the hooded cranes was expanded up to Haervongdeul. As such expansion could have increased the possibility of conflict with humans, efficient management was required - for instance, designating an ecosystem preservation zone.

2.2 Corresponding Measures and Outcomes/Expectancy Effects

Suncheon City has taken various measures to protect and manage the habitats of migratory birds including the hooded cranes.

Tidal Flat Conservation

Suncheon bay tidal flat is an important resting place for the hooded cranes as well as an important source of livelihood for 11 fishing villages. Residents in those villages make efforts to conserve the coastal environment by participating in coastal management activities. For instance, they perform environmental cleanup activities by collecting marine garbage flowing into Suncheon bay due to typhoons and intense summer rainfall. Since 2000, fishing has been prohibited from July to August annually to prevent the depletion of fish stocks.

Reed colonies in the wetland conservation area, however, have been expanding and encroaching on the tidal flat areas. Such expansion blocks sunlight penetration to the surface of the tidal flat and inhibits phytoplankton growth and productivity. Thus, members of Fishing Village Fraternity have promoted a reed management project since 2010 to secure: habitats for benthic organisms; food for migratory birds; and maintain the landscapes aesthetic value. The project has also contributed to the income increase of residents living in the surrounding areas of Suncheon bay.

Farmland Management

The main resting places of the hooded cranes are the areas near the salt marsh and paddy fields and their main feeding places are the resting areas and farmlands nearby. Suncheon City, thus, prepared policies to create a diverse habitat environment for winter birds including hooded cranes. For instance, in line with the Act on the Conservation and Use of Biological Diversity, Biodiversity Management Contract[15] projects have been implemented by Suncheon City and the Ministry of Environment since 2005 for farmlands adjacent to the tidal flats to sustainably provide food for migratory birds. According to the Biodiversity Management Contract, Suncheon City compensates farmers if they leave rice straws, food for migratory birds, on the field surrounding Suncheon bay after harvesting or seeding. Additionally, Suncheon City designated the Inantteul (meaning "field"

15 Biodiversity Management Contract refers to a system that the local government leases farmlands on a seasonal basis.

in local dialect), paddy field as a scenic agriculture zone and removed 282 electric poles in the farmlands to protect the hooded cranes from being caught or injured by electric wires.

In the Hooded Crane Huimang[16] Agricultural Complex, the Hooded crane farming group has cultivated rice with eco-friendly farming practices since 2009 (Figure 43). Backed by Suncheon City's agricultural compensation to the farmers, the farming group cultivates organic rice in about 0.59 km^2 of the paddy fields and store about 50 tons of grains annually to feed migratory birds. When the winter migratory birds arrive, farmers scatter about 250 kg of grains a day around the farmlands (Figure 44). The Hooded crane farming group also conducts migratory bird protection activities by controlling the access of tourists into the farmlands in order to maintain stable habitats for the migratory birds during the wintering season.

Figure 43 Panoramic View of the Hooded Crane Huimang Agricultural Complex

© Suncheon City

Figure 44 Scattering Grains to Feed Migratory Birds

© Suncheon City

16 Huimang means hope in Korean.

Public Awareness-Raising Project

In 2007, Suncheon City changed its city bird to the hooded crane to attract public attention to the hooded crane as well as to encourage citizens to participate in habitat conservation activities. To ensure there were stable financial resources available for habitat conservation, Suncheon City enacted the Ordinance on Preservation of the Suncheon Bay Wetlands in 2014, which prescribed that 10% of the revenue from the Suncheon Bay National Park and the Suncheon Bay Wetland (about USD 520,000) should be used to fund the conservation of Suncheon Bay. Suncheon City has promoted and implemented several projects with the fund such as citizen/student monitoring of the hooded crane, academic research, symposiums, eco-festivals and public contests. The City also set February 28 as The Hooded Crane's Day and has held eco-festivals with local residents annually since 2013.

International Cooperation to Conserve Crane Habitats

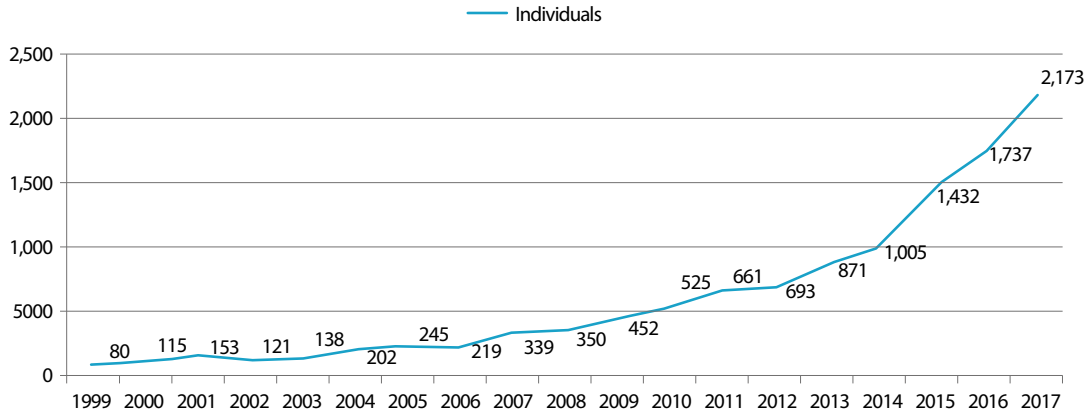
Suncheon City hosted an international symposium on the hooded cranes of Suncheon Bay in 2014 to help better conserve the hooded cranes and their habitats. During the symposium, participants reviewed the wintering status of the hooded cranes in the ROK, shared the wintering-related information and concluded an agreement among the ROK, China, Japan and the Russian Federation on habitat conservation. Based on the agreement, four countries have shared information on wintering hooded cranes every year and expanded international relations such as joint filming on the breeding places of hooded cranes in the Russian Federation and travelling exhibitions of Hooded cranes painted by children of the ROK, Japan, Russian Federation and Mongolia. Rice seeds produced in the Hooded Crane Huimang Agricultural Complex have been provided to stopover sites to feed Hooded cranes and strengthen international cooperation through habitat conservation.

In 2016, Suncheon City jointly hosted an international workshop on habitat preservation for migratory birds with EAAFP and the Ministry of Environment. The workshop shared knowledge on endangered species of the ROK, experiences in habitat preservation and desirable policy options to better conserve habitats of migratory birds.

In April 2018, Suncheon City also hosted an International Crane Symposium on the theme of the dispersion of crane habitats in the Korean peninsula and the joint response to the highly pathogenic Avian Influenza (AI). Participants shared the information on crane habitats and the occurrence of AI in China, Japan and the Korean peninsula. During the symposium, the International Crane Foundation, Suncheon City, Cheolwon County and Goyang City concluded an agreement to disperse crane habitats throughout the Korean peninsula.

The City has also continuously expanded its protected areas, implemented public awareness-raising projects, conducted several projects with local residents and stakeholders to preserve habitats and expanded domestic and international cooperation. With such continued efforts, the number of the wintering population of the hooded cranes in Suncheon bay has kept rising, from about 70 in 1996 to 202 in 2004, 871 in 2013, and 1,737 in 2016 (Figure 45).

Figure 45 **Number of Hooded Cranes Visiting Suncheon Bay**



However, as the habitats of the hooded cranes in the Korean peninsula have gradually become fragmented, hooded cranes have intensively flocked into Suncheon Bay for wintering, which may cause the spread of infectious diseases such as AI. To adequately control the population of the hooded crane, considering the environmental capacity of Suncheon bay, Suncheon City has promoted international cooperation, especially with Izumi city of Japan, and facilitated hooded crane habitat expansions and dispersions within the Korean peninsula.

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NORTH-EAST ASIAN MARINE PROTECTED AREAS NETWORK
MANAGEMENT PLANS, MONITORING AND ASSESSMENT OF MARINE PROTECTED AREAS

4

Russian Federation

A. BASIC INFORMATION OF THE TARGET MPAS

B. BACKGROUND OF STRATEGIC/MANAGEMENT PLAN OF THE TARGET MPAS

C. OBJECTIVE OF MPA MANAGEMENT PLAN

D. KEY CONTENTS OF THE MANAGEMENT PLANS

E. CASE STUDIES ON MONITORING IN THE NEAMPAN SITES

Chapter 4. Russian Federation[17]

A. Basic Information of the Target MPAS

Protected Marine Areas in the Russian Federation

In the Russian Federation, marine and coastal protected areas are areas in the tidal or marine area - together with the waters that cover them, and the flora and fauna associated with them. These areas have historical and cultural features, consequently, their environment is subject to full or partial protection by laws or other regulatory devices.

The main goal of marine protected areas is biodiversity conservation and increase, as well as the conservation of ecosystems, i.e., the ability of marine ecosystems to restore or maintain their natural state.

Effective MPAs can ensure the long-term viability and genetic diversity of marine species and systems. Such benefits are the result of the protection of rare and endangered species; conservation of habitats; as well as prevention of external activities that damage the marine environment.

Legislation of the Russian Federation of Specially Protected Areas (SPA)

The Federal law "On Environmental Protection"[18] is the basic umbrella law on the environment which defines environmental quality standards, grounds for the functioning of federal SPAs and activities banned on their territory.

17 This chapter was jointly prepared by Dr. Anatoly Kachur (Federal State Budgetary Instiution of Science "Pacific Institute of Geography", Far Eastern Branch, Russian Academy of Sciences), Mr. Anatoly Savelyev (Centre for International Projects, Russian Federation), Ms. Svetlana Sutyrina (Sikhote-Alin Biosphere Reserve, Russian Federation), and Dr. Tatiana Orlova (Federal State Budgetary Institution of Science "National Scientific Center of Marine Biology", Far Eastern Branch, Russian Academy of Sciences).

18 10 January 2002 № 7-FZ (as amended on 09.03.2021)

The Water Code[19] introduces the concept of "specially protected water bodies" and establishes its compliance with the legislation "on specially protected areas".

The "Law on specially protected areas"[20] is the basic law in the field of SPAs, which establishes permanent federal ownership of the federal SPAs, SPA categories and the scope of authority of federal and regional bodies. The law allows the establishment of natural reserves at the regional level.

Changes and additions made to the Federal Law on specially protected areas[21] specified the legal status of specially protected natural areas (reserves and national parks); introduced a ban on changing the purpose of land within reserves; and a ban on the alienation of federally protected areas from federal property.

Furthermore, the powers of state inspectors engaged in the protection of specially protected areas were expanded and penalties for violations of the legislation on SPAs were increased. This contributed to improving the efficiency of state supervision over compliance with environmental legislation on SPAs.

These laws – common in their content – do not consider the specificity and complexity of MPAs management.

A number of legislative acts adopted aim to increase the effectiveness of state supervision (control) in the field of compliance with legislation on wildlife, fisheries and the preservation of aquatic biological resources.[22]

Responsibility for illegal mining and trafficking of rare and endangered species has been strengthened. In particular, criminal liability has been established for illegal extraction and trafficking of particularly valuable wild animals and aquatic biological resources belonging to species list in the Red Book of the Russian Federation and/or protected by the international treaties of the Russian Federation such as sturgeon species, etc.

The Main Categories of Specially Protected Areas (SPAs)

The key criteria for SPA categories are strictness of protection, time frames of existence, establishment goals, and the level of management.

19 The Water Code 03.06.2006 № 74-FZ (as amended on 03.08.2018)

20 Federal Law of 14.03.1995 № 33-FZ

21 Federal Law of 14.03.1995 № 33-FZ (as amended on03.08.2018, 30.12.2020)

22 Resolution of the Government of the Russian Federation of 24.12.2012 № 1391 with amendments of 02.03.2019, "On the state surveillance in the field of protection and use of specially protected areas of the federal significance"

The main categories of SPAs under the "Law on specially protected areas" are:

- **reserves** (strict protection; the period of existence is not defined; the complete natural environment is under conservation; and the level of management is federal);
- **national parks** (strict protection only in a certain part – the "core"; functional areas with different anthropogenic load are allocated; period of existence is not defined; traditional nature use and ecotourism are allowed; and federal level of management);
- **nature monuments** (strictness of protection depends on the object of protection; and the level of management is federal, regional, local); and
- **zakazniks** (established for a specific time for the protection of certain ecosystems or species; certain types of economic activity are allowed; and management level is federal, regional). (see Table 51 and Figure 46)

Those listed above are the key categories of SPAs, occupying the big area of around 55 mln. ha, and are located in 81 subjects of the Russian Federation (see Figure 46).

It should be noted that the Russian legislation does not single out any individual category of MPA, while a number of SPAs have marine water areas as their parts.

Thus, in accordance with the legislation, any SPAs with marine water areas will fall under one of these categories above and all the requirements for a system of terrestrial protected areas are extended to MPAs.

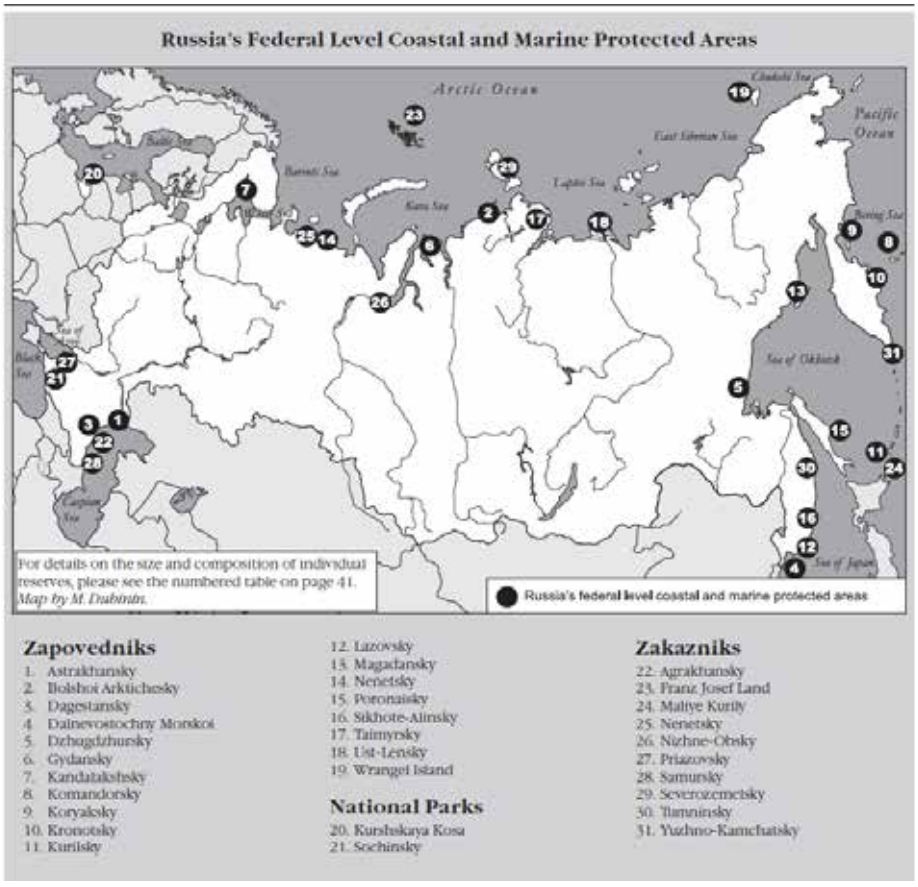
In accordance with Russian legislation, sea areas fall under federal jurisdiction. Therefore, SPAs that have marine areas may only have federal status. Their establishment and work are regulated by the Law of the Russian Federation "On specially protected areas".

Table 51 **Main Categories of SPAs**

Main categories of SPAs	Major criteria for SPA categories - strictness of protection	Major criteria for SPA categories - time frames of existing	Major criteria for SPA categories - goal of establishment	Major criteria for SPA categories - level of management
Reserves	strict protection, the complete natural environment is under conservation	the period of existence is not defined	the complete natural environment is under conservation	federal
National parks	strict protection only at certain part – "core", functional areas with different anthropogenic load are allocated	the period of existence is not defined	traditional nature use and ecotourism are allowed	federal

Main categories of SPAs	Major criteria for SPA categories - strictness of protection	Major criteria for SPA categories - time frames of existing	Major criteria for SPA categories - goal of establishment	Major criteria for SPA categories - level of management
Nature monuments	strictness of protection depends on the object of protection	the period of existence is not defined	conservation of natural complexes	federal, regional, local
Zakazniks	not very strict- economic activities are allowed	established for a specific time	protection of certain ecosystems or species, certain types of economic activity are allowed	federal, regional

Figure 46 Coastal and Marine Protected Areas of the Federal Level in the Russian Federation



* Note: *NEAMPAN sites are № 4. Far-Eastern State Marine Biosphere Reserve and № 16 Sikhote-Alin State Natural Biosphere Reserve.*

Assessing the Representativeness of the Existing Network of Russian SPAs that have Marine Water Areas as Their Parts

Gap-analysis is one of the modern tools for assessing the representativeness of the existing network of Russian SPAs with marine water areas with regard to their role in the conservation of marine biodiversity and identifying the completeness and sufficiency of such a network.

According to the WWF gap analysis[23] of Russian marine protected areas (MPAs) on the federal level, the existing SPAs system has uneven representation compared to its continental counterparts. This suggests the need for the development and expansion of the MPA system in order to protect Russia's unique natural heritage and diversity of coastal and marine ecosystems.

The vast majority of rare and endangered species listed in Russia's Red Book are present in protected marine areas. However, the concentration of the various species differs between MPAs. For many species, protected marine areas are transit biotopes that do not play an important role in their life cycle. On the other hand, many critically important biotopes for marine mammals and birds (rookeries, colonies etc.) exist outside the reserve system (*Current state, 2009*).

Institutional Framework for SPAs, including the MPAs, Policy and Management

The Ministry of Natural Resources and Environment (MNRE Russia) is the federal executive body responsible for the development of state policy and legal regulation, including the development and implementation of the state policy and legal regulation in the field of specially protected areas, including wildlife and their habitats and state environmental monitoring (state ecological monitoring).

MNRE of Russia maintains the state cadastre of specially protected areas of federal significance; carries out the protection and reproduction of wildlife objects within the in specially protected areas of federal significance; protects aquatic biological resources located in specially protected natural areas of federal significance; and makes decisions on the establishment of protective zones within state nature reserves, national parks and natural monuments of federal significance and the establishment of their boundaries.[24]

MNRE Russia carries out its activities directly and through its subordinate organizations in cooperation with other federal executive authorities; subjects of the executive authorities of the Russian Federation and local authorities,

23 Current status and development prospects of specially protected natural areas. M., 2009.

24 Regulations on the Ministry of Natural Resources and Ecology of the Russian Federation- Resolution of the Government of the Russian Federation of 11.11.2015 № 1219 (as amended on 24.11.2020)

public associations and other organizations.

Implementation of the basic powers in the field of protection and use of fauna and its habitat, and fisheries are transferred to public authorities of the subjects of the Russian Federation.

The MNRE of Russia coordinates and controls the activities of:

- The Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET);
- The Federal Service for Supervision of Natural Resources (ROSPRIRODNADZOR);
- The Federal Agency for Water Resources; and
- The Federal Agency for Subsoil Use.

Science and information organizations subordinate to MNRE Russia, such as the All-Russian Scientific Research of Environmental Protection (VNII Ecology) and the Information-Analytical Center for Reserves Support (Roszapovedcenter), carry out activities on the development of the SPA system, increase the efficiency of the organizations work performing the management of SPAs of federal significance and also on methodological support for the works on the preparation of data for state accounting, state cadastre as well as state monitoring of fauna in state nature reserves, national parks and state natural sanctuaries of federal significance.

Given the cross-sectoral nature of conservation and sustainable use of biodiversity and the operation of SPAs - including MPAs - the Ministry of Agriculture is responsible for sustainable fisheries and conservation of aquatic biological resources (Federal Agency for Fishing), and the Ministry of Science and Higher Education is responsible for scientific and technical policy.

Public councils established under federal executive bodies preliminary discuss projects and documents being developed, including on the operation of SPAs and the conservation and sustainable use of biodiversity.

There is an Expert council on specially protected areas under MNRE of Russia, whose purpose is to develop proposals and recommendations to ensure decision-making on strategic issues of the development of the system of specially protected areas as well as important issues related to certain specially protected areas.

Institutions of the Far Eastern Branch of the Russian Academy of Sciences, such as the National Scientific Center of Marine Biology, the Pacific Oceanological Institute, the Pacific Geographical Institute etc., as they are structural units of the Ministry of Science and Higher Education, carry out studies on the conservation of marine biodiversity and participate in international programmes and projects.

Overview of NEAMPAN Reserves: Sikhote-Alin Nature Reserve and Far Eastern State Marine Biosphere Reserve

The Far East of the Russian Federation as a whole, and its South in particular, has no equal among all regions in Russia on its variety of species of flora and fauna including its coastal marine zones. There are also unique natural sites, many of which are of international or federal significance. Due to its geographic location, the region possesses a high activity of geological processes and specific climatic features which have formed unique natural complexes. These unique natural complexes characterize the region and its drastic contrasting landscapes. Its complex combination of them in the environment and a different set of species of plants and animals.

With regard to the biocenotic diversity of the coastal zone of the Far Eastern seas of Russia, the existing system of protected marine areas is not representative (*Current state, 2009*).

Selected model reserves of the NEAMPAN sites (the **Sikhote-Alin State Natural Biosphere Reserve** named after K.G. Abramov under the MNRE Russia and the **Far-Eastern State Marine Biosphere Nature Reserve (FEMBR)**) are linked to the conservation of marine ecosystems and increase of biodiversity, and satisfy the Sustainable Development Goal 14 of the UN 2030 Agenda for Sustainable Development and other modern international approaches to the operation of the MPAs. The reserves are part of UNESCO's international biosphere reserves system.

Both sites are state nature reserves which are defined by the following goals:

- protection of natural areas in order to conserve biological diversity and maintain protected natural complexes and objects in their natural condition;
- scientific research, including the keeping of the *Chronicles of Nature*;
- state environmental monitoring;
- environmental education and development of educational tourism; and
- contribute to the training of scientific staff and professionals in the field of environmental protection.

The **Sikhote-Alin State Natural Biosphere Reserve** named after K.G. Abramov under the MNRE Russia **(Sikhote-Alin Reserve**) was established to reduce threats to the marine and coastal ecosystems of the reserve.

Since 1991 the water area has been included in the protective reserve zone of the reserve.

The Resolution of the Governor of Primorsky Krai March 5, 1997,[25] established the protective zone for marine areas of the reserve, including areas of the reserve where the marine reserve area was lacking.

The coastal areas and water areas are characterized by a large number of rare endemic and relict species.Specific brackish-water biotopes – mineralized lakes, estuaries, lagoons and estuaries of rivers – are formed at the junction where there is a mixing of saline seawater and fresh continental waters.

Brackish waters also serve as a place for "physiological sluicing" for the most commercially valuable anadromous fishes – sturgeons and salmons. Here, they have adapted to the changing conditions of salinity and osmoregulation. Compared to other brackish-water complexes of Siberia and the Far East of Russia, the inhabitants of estuaries and lagoons at the basin of the Reserve are distinguished by large species diversity.

The coastal strip - stretching 25 km wide - is characterized by the largest range of habitats, and high diversity of ecosystems and species.

From the perspective of biogeographic regularities which have manifested in the reserve, the reserve's natural complexes are representative of the province's landscape in general (*Current state, 2009*).

The Sikhote-Alin Reserve is under MNRE of Russia and its activities are determined by the Regulations on the Federal State Institution "Sikhote-Alin State Natural Biosphere Reserve".[26]

The reserve is a legal entity – a federal state institution and is funded by the federal budget.

The director of the reserve directly supervises the reserve and is personally responsible for its activities and is accountable to MNRE of Russia.

The Far-Eastern State Marine Biosphere Nature Reserve (FEMBR) is a Branch of the Federal State Budgetary Institution of Science *AV Zhirmunsky* National Scientific Center of Marine Biology of Far Eastern Branch of the Russian Academy of Sciences.

The Reserve, established in 1978, is the first Russian SPA aimed at the conservation of marine ecosystems and to perform research activities in the field of marine biology.

25 Resolution of the Governor of the Primorsky krai of 05.03.1997 № 93, as amended on 27.02.2015 № 15-pg.

26 Order of the MNRE of Russia of 07.08.2003 № 712 with amendments of 26.03.2009 № 71.

It is a specialized marine reserve and includes various types of ecosystems – terrestrial, marine and island - and is located in an area that is exposed to a tangible anthropogenic impact, including oil transport.

The biodiversity of the reserve is associated with the coastal part of the Gulf with littoral (tidal zone) and sublittoral zones. These zones are characterized by specific species of animals and plants (littoral zone – small crustaceans and wingless insects; and sublittoral zone – bottom vegetation and organisms).

Species listed in the Red Book of Russia registered in the Reserve include:

- marine invertebrates – 10 species (1 species of brachiopods, 7 species of mollusks, and 2 species of crustaceans);
- about 60 species of birds, among which – crested shelduck, spoonbill, Chinese egret, small petrel, Von Schrenck's bittern, white-tailed eagle, Steller's sea eagle, peregrine falcon, black vulture, Far Eastern curlew, etc.; and
- marine mammals – false killer whale, harbor porpoise, and sei whale.

FEMBR is a multifunctional organization and its activities are determined by the Provision on the Reserve.[27]

The Reserve is managed by the National Scientific Center for Marine Biology of the Far Eastern Branch of the Russian Academy of Sciences. State supervision of the Reserve is carried out by the Federal Service for Supervision of Natural Resources MNRE of Russia.

Please see section E for further details on the two NEAMPAN sites.

B. Background of Strategic/Management Plan of the Target MPAs

Official Documents at the Federal and Regional Level for Planning the Development and Improvement of the Russian SPA System, including MPAs

The basis of strategic planning in the Russian Federation,[28] including for the purposes of marine protected areas, is the system of state strategic planning. State strategic planning is based on programme-and-target planning, including territorial planning to determine and implement the priorities of the socio-economic development of

27 Order of the Ministry of Science and Higher Education of the Russian Federation on April 29, 2019 No. 45n "On the approval of the Regulations on the Far Eastern Marine Biosphere State Nature Reserve"

28 Federal law "On strategic planning in the Russian Federation" of 28.06.2014 № 172-FZ as edited on 31.07.2020 № 264-FZ

Russia for the medium (up to 6 years) and long-term (over 6 years) perspectives.

Planning for the development and the improvement of the Russian SPA system, which includes MPAs, is envisaged in various documents at the federal and regional levels (Table 52).

Strategic documents such as the **Concept of the Long-Term Socio-Economic Development of the Russian Federation**[29] are important for the management of MPAs. This document determines that ensuring environmental protection and rational use and reproduction of natural resources is a key public good that forms the basis for long-term socio-economic development. The document envisages the preservation and protection of the natural environment, increases in the bioproductivity of natural systems to safe levels, and restoring species diversity.

The "**Fundamentals of environmental policy of the Russian Federation for the period through 2030**"[30] states that the strategic goal of state policy in the field of environmental development is addressing socio-economic tasks that will ensure: environmentally oriented economic growth, the conservation of a favorable environment and biological diversity and natural resources.

The "**Concept of development of a system of protected natural areas of federal importance**"[31] aims to develop the system of SPAs by improving: the efficiency of state management in the sphere of organization and functioning of the SPA system for sustainable development of the Russian Federation; providing ecological safety; protection of biological and landscape diversity; and the conservation and rational use of natural and cultural heritage. To achieve this goal it is necessary to address a number of tasks, including the formation of a representative geographical network of SPAs – the establishment of new reserves and national parks; as well as provision of an effective system of protection for natural and historical-and-cultural complexes and objects in specially protected areas.

The "**Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030**"[32] provides for the task of habitats conservation of rare and endangered species of animals, plants and fungi by ensuring the functioning of an effective system of specially protected natural areas, defines the important role of regional and local protected areas in the formation of a space-functional network of natural areas with different environmental regimes in order to preserve biodiversity.

29 Directive of the Government of the Russian Federation of November 17, 2008 № 1662-p, as amended on 28.09.2018
30 Decree of the President of the Russian Federation of 30.04.2012
31 Directive of the Government of the Russian Federation of 22.12.2011 № 2322-r
32 Directive of the Government of the Russian Federation of 17.02.2014 r. № 212-r

The strategic and programmatic documents for the development of the fisheries complex envisage the implementation of measures for the conservation, reproduction and effective use of aquatic biological resources; for the prevention, containment and elimination of illegal and unregulated fishing; and for the development of principles of sustainable use, which corresponds to the objectives of biodiversity conservation ("**Strategy for the development of the fisheries complex of the Russian Federation for the period up to 2030", 2017**[33]).

Comprehensive marine scientific research in the interest of the Russian Federation and the development of the systems for monitoring the state of the marine environment and coastal areas are among the principles of the national maritime policy specified in the "**Maritime Doctrine of the Russian Federation**".[34] The long-term objectives in the field of industrial fisheries are set forth by the Marine Doctrine, including the adoption of measures - with strict enforcement - aimed at the conservation of populations of valuable fish species and other biological resources.

The **"Strategy for the Development of the Maritime Activities of the Russian Federation for the period through 2030"**[35] determines the transition to an integrated approach to planning of the development of the coastal zones of the land and marine areas of specific coasts of the country through separating them into a single object of state administration as one of the strategic objectives of the development of maritime activities of the Russian Federation.

The **State Programme of the Russian Federation "Environmental Protection"**[36] which has a special sub-programme "Biological diversity of Russia", is also the basis for strategic planning for MPAs. The programme determines that an effective system of state regulation and management in the field of environmental protection requires the development and effective operation of a network of specially protected areas (including marine) for the conservation and restoration of populations of rare and endangered species of flora and fauna; to reducee regional differences in the network of specially protected areas, and ensure the adoption of science-based decisions in the conservation of biological diversity and use of natural resources.

The sub-programme is aimed at the implementation of the main priorities and objectives of the state policy in the field of biodiversity conservation which stipulates the assignment of issues of conservation and sustainable use of biological diversity and ecosystem services to the priority areas of national policy.

33 Directive of the Government of the Russian Federation of 26.11.2019 № 2798-p

34 Decree of the President of the Russian Federation of 26.07.2015

35 Directive of the Government of the Russian Federation of 08.12.2010 r. № 2205-p as amended on 30.08.2019 № 1930-r

36 Resolution of the Government of the Russian Federation of 15.04.2014 № 326, as amended on 12.11.2020

Other Contributions to the Development of Medium-term Management Plans

International GEF/UNDP projects implemented in 2010-2015 under the auspices of the MNRE have contributed to the development of medium-term management plans for a number of reserves, including those with marine water area, as well as institutional improvement of the network of marine and coastal protected areas. For instance, with the support of the MNRE Russia / GEF / UNDP project "Strengthening the Marine and Coastal Protected Areas of Russia" (2010-2013), a management plan for the Far Eastern State Marine Biosphere Reserve was developed.

Table 52 **Documents at the Federal and Regional Levels Related to the Planning and Development of an SPA System for Russia, including MPAs**

	Key strategies / programmes	Key relevant contents
Government strategic documents	Concept of the Long-Term Socio-Economic Development of the Russian Federation	Ensuring environmental protection, rational use and reproduction of natural resources is a key public good that form the basis of long-term socio-economic development.
	Fundamentals of environmental policy of the Russian Federation for the period through 2030	The strategic goal of state policy in the field of environmental development is addressing of socio-economic tasks that ensure environmentally oriented economic growth, conservation of a favorable environment and biological diversity and natural resources.
	Maritime Doctrine of the Russian Federation	Conducting marine science research, developing systems to monitor the state of the marine and coastal environment, developing and taking measures aimed at preserving populations of valuable fish species and other biological resources
	Strategy for the Development of the Maritime Activities of the Russian Federation for the period through 2030	Determines the transition to an integrated planning approach of the development of coastal zones of land and marine areas of specific coasts in the country through separating them into a single object of the state administration
	Concept of development of a system of protected natural areas of federal importance	Objectives include: development of a system of SPAs by improving the efficiency of the state management in the sphere of organization and functioning of the system of SPAs for sustainable development of the Russian Federation, provision of ecological safety, protection of biological and landscape diversity, conservation and rational use of natural and cultural heritage.
	Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030	Preserving habitats of rare and endangered species of animals, plants and fungi by ensuring the operation of an effective system of SPAs; determining the important role of SPAs of regional and local significance in the formation of a spatially functional network of areas with various nature use regimes for the conservation of biological diversity; identification of scientific grounds, principles and methods for the conservation of rare and endangered species of flora and fauna

	Key strategies / programmes	Key relevant contents
Government strategic documents	Strategy for the development of the fisheries complex of the Russian Federation for the period up to 2030	Outlines the implementation of measures for the conservation, reproduction and effective use of aquatic biological resources; for the prevention, containment and elimination of illegal and unregulated fishing and for the development of principles of sustainable use
State programmes	The State Programme of the Russian Federation "Environmental Protection	For an effective system of state regulation and management in the field of environmental protection, it requires the development and effective operation of a network of specially protected areas (including marine) for the conservation and restoration of populations of rare and endangered species of flora and fauna; reducing regional differences in the network of specially protected areas; ensuring the adoption of science-based decisions in the conservation of biological diversity and use of natural resources.

C. Objective of MPA Management Plan

The main strategic documents of the Russian Federation related to the functioning of protected areas and the conservation of rare and endangered species of plants and animals contain appropriate plans for measures to improve the management of protected areas and the conservation of rare species of animals, plants.

The **Plan for the conservation of rare and endangered species of animals, plants and fungi for the period through 2030 of Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030- Stage two 2018-2020**[37] envisages the tasks of preserving habitats of rare and endangered species of animals, plants and fungi by ensuring the operation of an effective system of SPAs, and determines the important role of SPAs of regional and local significance in the formation of a spatially functional network of areas with various nature use regimes for the conservation of biological diversity.

The objectives of the development of the system of SPAs including: marine, conservation of natural ecological systems, natural landscapes and natural complexes and flora and fauna are anchored by the **Action Plan for the implementation of the «Fundamentals of environmental policy of the Russian Federation for the period through 2030».**[38]

The **Action Plan for its implementation** of the **Concept of development of the system of specially protected**

37 Order of the MNRE Russia of 27.12.2018 № 40-r

38 Directive of the Government of the Russian Federation of 18.12.2012 № 2423-r (as amended on 10.08.2016)

areas of the federal significance for the period through 2020[39] includes objectives and activities to develop a network of protected natural areas of federal importance, to improve public administration in the field of protected areas and to develop medium-term management plans for each state nature reserve and national park.

The Plan for the Management of SPAs, which includes marine protected areas, is a document developed by the SPAs themselves for ongoing and operational planning of activities and identifying activities for the management of a SPA taking into account the economic, social and environmental conditions of the reserve location.

The management plan of a SPA includes activities:

- on monitoring;
- to ensure the reliable protection of natural complexes and objects in the relevant SPA;
- on regulation of limited economic activity and nature use within the SPA and its protective zone;
- on carrying out scientific research; and
- on the development of environmental education, etc.

This document justifies the material costs for carrying out such necessary works, determines the expected results of the activity and establishes a monitoring programme that allows one to assess the effectiveness of the SPA management.

All SPAs are within the boundaries of one or more administrative districts (municipalities). In this regard, the SPA management could not be effectively planned in isolation from its surroundings and from integrated planning and design, which are carried out by the relevant administrative entities. Plans for the management of a protected natural area are correlated with the socio-economic development programmes of the regions in which the SPAs are located.

Objectives of the NEAMPAN MPAs

In accordance with the **Action Plan for its implementation of the Concept of development of the system of specially protected areas of the federal significance for the period through 2020** SPAs must develop appropriate management plans to achieve their goals and objectives.[40]

39 Directive of the Government of the Russian Federation of 22.12.2011 № 2322-r

40 Directive of the Government of the Russian Federation of 22.12.2011 № 2322-r

The main goal of the Sikhote-Alin Reserve-World Natural Heritage Site (**Sikhote-Alin Reserve**) is the conservation of the natural functioning of typical and unique natural complexes, including marine complexes; the study of the natural course of natural processes and phenomena; individual species, typical and unique to the ecological systems; as well as development of principles and methods for control of the natural environment.

The main objectives of the **Sikhote-Alin Reserve** include:

- organization of ongoing studies of protected marine ecosystems with interrelation to the terrestrial and river ecosystems;
- studies of the ecological state of the coastal sea waters of the Sikhote-Alin Biosphere Reserve;
- the study of modern relief-forming processes in the coastal part of the Sikhote-Alin Reserve;
- the organization and monitoring of natural dynamics of the Reserve's ecosystems, including marine ecosystems at 64 permanent test sites - located in all vegetation zones and three topo-ecological profiles;
- study of the distribution and number of waterfowls on the sea coast of Northern Primorye; and
- study of the population structure and population dynamics of the Larga seal.

The main goal of the **Far Eastern State Marine Biosphere Reserve** is to protect the environment of the structurally rich marine and island flora and fauna of the Peter the Great Bay, and above all – conservation of the gene pool of marine and coastal communities.

The objectives of the **FESMBR** include:

- protection of water and coastal areas;
- research and monitoring of the marine and island biocenoses of animals and plants;
- development of scientific bases for conservation and restoration of marine and island biogeocenoses and scientific recommendations for marine conservation;
- implementation of the protection of natural areas aimed at the conservation of biological diversity and maintaining the natural state of protected natural complexes and objects;
- implementation of the state environmental (ecological) monitoring;
- environmental education and development of educational tourism; and
- assistance in training of scientific personnel and specialists in the field of environmental protection.

D. Key Contents of the Management Plans

The Contents and Development of Management Plans for SPAs, including MPAs

The key contents of Russia's SPA management plans, including MPAs, are related to the task of conservation of the landscape and ecological diversity of the coastal marine areas of Russia and adjacent waters considering the identified trends in environmental changes and the specificities of their regional manifestations.

The contents of management plans for SPAs, including MPAs, must be matched with the basic strategic documents of development of Russia, related to the maritime, natural resource, environmental and scientific activities. They should also include activities on strengthening the role of MPA in the conservation of endangered rare species of marine and near-water migratory animals.

Since the Russian MPAs play an important role in the conservation of the marine environment, water bodies, biodiversity; monitoring of global changes and the implementation of Russia's international obligations in the field of environmental protection and biological diversity, the content of the MPA management plans should reflect this.

The management plans of the SPAs, including the MPAs, should be based on the interaction of federal protected areas with regional protected areas and other forms of territorial protection (fisheries protected areas, sites with special navigation regime). For this purpose, appropriate principles and mechanisms for their integration should be developed.

The MPA management plan should include sections on the territorial structure of reserves, the action plan itself, and monitoring and evaluation of the implementation.

Aimed at planning the activities of SPAs, the Federal Service for Supervision of Natural Resources (Rosprirodnadzor) has developed "**Recommendations for the development of medium-term management plans for state natural reserves and national parks**",[41] which are used by SPAs as a reference. This document recommended that the SPAs should interact with a sufficient number of stakeholders during the preparation of the management plan, involving them in its development and discussion.

41 Order of the Federal Service for Nature Use Supervision of the Ministry of Natural Resources and Environment of the Russian Federation of 03.12.2007 № 491 "On improvement of the system of planning of major activity of the state natural reserves and national parks"

As was indicated in section B, the management plan for the Far Eastern State Marine Biosphere Reserve was developed with the support of the MNRE of Russia / GEF / UNDP international project, which included three main steps of development:

- analysis of the natural features of SPAs, including marine SPAs;
- analysis of the current organization and activities of the reserves (national park); and
- identification of strategic directions and priorities of activities.

This plan takes into account: all possible financial revenues, issues of equipment modernization, and issues of interaction with other organizations. The plan contains the complete official name of the SPA type (Marine and coastal SPA); SPA current status (Active); SPA category (state nature reserve); SPA significance (Federal); international status of SPA (Biosphere reserve); profile (biosphere); date of establishment; regulatory legal framework for the operation of SPA; SPA location in the structure of administrative and territorial division; cadastral number on the land plot; total area of SPA; the area of the marine specially protected area; protective zone size; the rationale for the SPA establishment and its significance; geographical position; and number of sites.

Of importance in the management plan of the reserve is information on: the list of the main subjects of protection; the existence within the borders of SPA of other SPAs; the documents that establishes the mode of economic use and zoning of the territory; list of zones; the documents that establishes the regime of protection and use of the buffer zone; the list of protective zones; information on prohibited and permitted activities and nature use; and information about the state agencies and legal persons responsible for providing the operation and safety of SPA.

The Sikhote-Alin Reserve also has a management plan.

Regime of the Reserves

A **special regime for the Sikhote-Alin State Natural Biosphere Reserve** is established in accordance with the 2009 Regulation on the Federal State Institution.[42]

On the whole land and water area of the reserve, any activity contrary to the objectives of the reserve and the regime of special protection of its territory are banned, including: activities that change the hydrological regime of the land; prospecting and development of minerals; destruction of soil cover, mineral outcrops, and rock outcrops. The reserve carries out activities that do not contradict with its objectives and the established

42 Order of the MNRE of Russia of 07.08.2003 № 712 with amendments of 26.03.2009 № 71.

regime. The reserve carries out business activities solely in so far as it serves to achieve the goals for which it was established.

Also, in accordance with the **Provision on the Far Eastern Marine Biosphere State Nature Reserve**,[43] the regime for the protection and use of land areas and water bodies within the protective zones of the Reserve is established.

In general, the integration of SPAs, including marine and coastal, into a single management system of environmental protection activities through the development and implementation of management plans, is a particularly important task in the strategy of development and integration of all types of SPAs of the Russian Federation (federal and regional).

1. Links between Monitoring/Assessment Results and Management

Regular evaluation and monitoring should be an important component of any programme or action plan to assess, within a specific time frame, the goals and objectives for the implementation of the relevant measures. Monitoring and evaluation is recognized as a necessary tool for the management of any programme or project activity and is an integral part of any internationally recognized project activity.

Monitoring and Evaluation as Management Tools of the SPA, including MPAs

The section "Monitoring and Evaluation of Implementation" of the SPA management plan is in accordance with the "**Recommendations for the development of medium-term plans for the management of state nature reserves and national parks**".[44] It should provide indicators for carrying out the monitoring of core activities and indicators of implementation of integrated environmental monitoring of the state of protection and use of natural, historical and cultural complexes and objects in SPA.

Monitoring of the main activity includes monitoring the implementation of the action plans and the achievement of forecast indicators of the activities in all structural divisions. It is mandatory to include the main forecast indicators, in terms of the implementation of the function of the state management of SPA, as well as the observation of the dynamics of violations of the nature protection regime and the effectiveness of protective

43 Order of the Ministry of Science and Higher Education RF of 29.04.2019 № 45.

44 Order of Rosprirodnadzor under the MNRE of Russia of 03.12.2007 № 491.

measures; the attendance in the territory and the impact of the development of tourism and recreation on natural, historical and cultural objects; effectiveness of environmental education activities; the influence of economic activity in the protective zone of the state of natural, historical and cultural complexes and objects.

State Cadastre of Specially Protected Areas – Instrument Linking Monitoring Results and Management

An important instrument of communication between the results of monitoring and management is the **State Cadastre of Specially Protected Areas**[45] – a systematic collection of documented information on SPAs of federal, regional and local significance.

The purpose of the State Cadastre of Specially Protected Areas is to assess the state of the natural reserve fund; identifying the prospects for the development of the network in these areas, increase the effectiveness of state control in the field of protection and use of specially protected areas, and also the accounting of these territories under the planning of the socio-economic development of regions.

In general, the formation of a geographically representative network of specially protected marine areas of different statuses and specializations should be based primarily on the results of monitoring and assessment of the effectiveness of biodiversity conservation through the existing system of MPAs and on the identified gaps in their system that affect the efficiency of their core environmental functions (*Current state, 2009*).

2. Conclusions and Recommendations

Marine reserves should be considered as reference areas of the sea that have been significantly less affected by humans than other areas. These water areas are of great economic and scientific value, as they are indispensable for comparative analysis and research of environmental processes in fishing areas of the sea.

To ensure the sustainable development of the marine regions of the Russian Far East, the Russian Federation should promote the development of ecosystem services and promote regional cooperation for the conservation of marine ecosystems of the seas of the North-Western Pacific.

45 Order of the MNRE of Russia of 19.03.2012 № 69.

Planning of MPA Network

It is necessary to assess existing and planned marine and coastal SPAs using a criteria-based network planning system for the development of a methodology for planning an MPA network.

International experience in assessing the biotic and economic significance of MPAs of different levels should be taken into account in planning the establishment of the territorial network of MPAs. This should be based on the integrated zoning of the marine areas of the Russian Federation and coasts by physical-geographical criteria, biological criteria, and criteria of vulnerability and resistance to basic economic activities.

An Integrated approach would improve the effectiveness of the MPA network management in the determination and establishment of boundaries and zoning of these areas, which would be adapted to specific conditions.

The integration of different sectoral approaches and different levels of the state management in the context of the 'land-sea' boundary is a fundamental basis for the effective management and conservation of the coastal marine environment.

Managing MPAs

The management plans should envisage measures to increase the efficiency of the MPA management. To improve the management of the Russian MPAs and biodiversity conservation, there must be optimization of the management structure of national protected areas and development of an environmental and economic rationale to ensure the conservation and restoration of biodiversity in coastal ecosystems.

The MPA plans should include measures to assess existing and emerging risks and threats to Russia's marine biological diversity, as well as a forecast of relevant threats and their characteristics.

The plan should draw attention to threats and assist in the understanding of the need for urgent action.

The MPA plan should also give precedence to the necessary measures to increase the degree of preparedness of MPAs for emergency situations; safeguarding of protected objects in the event of spills of oil products and other chemicals; as well as other technogenic disasters.

Improving the mechanism of integrated coastal areas management will contribute to minimizing the anthropogenic destruction of habitats and improve the management of these areas.

MPA management plans should include partnership activities with extracting companies and other economic entities in the field of biodiversity monitoring (including invasive species) and the protection of MPA marine areas, as well as the promotion of environmental tourism and possible strengthening of the MPA role in supporting the traditional management of indigenous peoples.

Activities on environmental education and public awareness and the development of eco-tourism on the basis of MPAs are also part of the management plan.

MPAs can serve as a focal point for the development of eco-tourism. At this, it should be beared in mind that the increase in the number of visitors is likely to cause damage to the protected area. Therefore, the plan should include the development of methodic recommendations to identify the permissible load of ecotourism on the MPA and necessary measures for the development of ecotourism in such areas, where permissible.

The appropriate organizational structure allowing for the avoidance of intersectoral conflicts, incompatibility of decisions/actions and inefficiency of the management system in general should also be part of the management plans.

Scientific Research and Monitoring

Scientific research should identify the main limiting natural factors affecting the development of natural complexes of MPAs and also assess the degree of threats in various types of environmental management to optimize biodiversity conservation and improve the management of MPAs taking into account anthropogenic pressures such as economic activities in the coastal marine area and climate change.

Research and environmental monitoring in SPAs, including MPA, should be based on priorities, taking into account the natural specifics and actual needs of SPA, as well as the potential needs of the state authorities and the management bodies at the regional and federal levels. This system of priorities should be applied for inventory, monitoring, and problem-oriented research as follows;

- The priority inventory work should include:
  - the compilation of an annotated species lists; and
  - compiling of inventories of rare, unique subjects and subjects requiring special attention of both animate and inanimate nature and habitats of rare species of animals and plants.

- The priority areas for monitoring natural processes and phenomena should include:
  - observations of changes in the level of biodiversity and the qualitative composition of biota (flora

and fauna), primarily vertebrates and vascular plants;

- observations of the status of populations ofrare plant and animal species;
- species which are particularly vulnerable due to the formation of mass aggregations (colonial birds, marine mammals etc.);
- species-indicators of natural communities and ecosystems;
- observations of the state of ecosystems, which are the etalons for a specific physiographic region; and
- observations of extremely rare and unique species.

- Priority in nature reserves and national parks should be considered in problem-oriented research aiming at:
  - development or improvement of environmental monitoring methods;
  - identification of the norms of the state of the environment and the levels of permissible impacts on natural complexes;
  - elucidating the causes of adverse trends in the dynamics of natural complexes, the forecast of their consequences, as well as the consequences of potentially adverse external impacts on natural complexes of a specially protected area;
  - development and improvement of measures for the conservation and restoration of natural complexes and objects;
  - scientific support for the organization of environmental education and educational tourism; and
  - increasing the ability of protected ecosystems and landscapes for self-regulation and self-recovery. (*Recommendations for the development of mid-term plans, 2007*)

- The priority activities in the field of MPA monitoring are:
  - studying and monitoring the state and functioning of marine and coastal natural complexes and their individual components;
  - monitoring natural recovery processes and environmental reactions to changes in the intensity of anthropogenic impact, including the development of programmes containing measures aimed at reducing and eliminating the impact on the MPA;
  - monitoring the ecological consequences of climate change on the dynamics of modern relief-forming , especially on coastal processes, the state of bottom sediments and soils of coasts; and
  - monitoring the vegetation, marine fauna and coastal natural complexes of MPA, including the study of processes and mechanisms of adaptation of their biota to climate change.

For the water areas of marine reserves, it is reasonable to monitor and conduct a complete inventory of bottom natural complexes to identify the completeness of the spatial structure of bottom communities.

E. Case Studies on Monitoring in the NEAMPAN Sites

1. Monitoring of the Sites

As in all reserves of the Russian Federation, the monitoring of biological systems in MPA is conducted in the form of:

- A "Chronicle of Nature" - the inventory of the fauna and flora; and
- A Study of biological diversity and monitoring of protected areas.

According to the standard monitoring instruction in biosphere reserves of Russia, which include the two NEAMPAN sites, monitoring (including environmental monitoring) is continuous and unlimited time tracking of an object in order to ensure the desired state or development of the object. All protected areas (biosphere reserves) should conduct background monitoring in their territories and waters.

No economic activity is carried out in the territories of the protected areas, but the impact of regional and local economic systems is monitored according to the load level through the assessment of the input of pollutants with atmospheric precipitation and surface runoff.

Environmental monitoring includes monitoring of: atmospheric air, land, forests, water bodies, wildlife, the unique ecological system of Lake Baikal, the continental shelf, the state of the subsoil, the exclusive economic zone, inland waters and the territorial sea of the Russian Federation.

In Russia, MPAs are not singled out as a separate type of protected areas; therefore,

- Ministry of Natural Resources and Environment (MNRE):
  - coordinates the activities of federal executive bodies in organizing and implementing environmental monitoring;
  - Coordinates methodological and regulatory technical documents of federal executive bodies on the organization and implementation of environmental monitoring; and
  - provides compatibility of information systems and databases on the state of the environment.

- MNRE and other federal executive bodies (e.g., Russian Academy of Sciences, Ministry of Science and Higher Education, Ministry of Agriculture and others):
  - form a state system for monitoring the state of the environment and ensure the functioning of this system;
  - interacts with public authorities of the constituent entities (government bodies of the

constituent entities of the Russian Federation on the organization and implementation of environmental monitoring; federal executive bodies are ministries, and their structures in the regions are subordinate only to the federal level);

- local government bodies, in this case, the administrations of the subjects of the federation (territory, region, republic); and
- with the participation of executive authorities of the constituent entities, collects, stores, analyzes and generates state information resources on the state of the environment and the use of natural resources.

In other words, the executive branch of the constituent entities of the federation, through its bodies (for example, the natural resources department and nature protection departments) creates information resources which can be used by all consumers.

The main issues facing the study of the natural environment for monitoring are:

- what is the present state of the environment, what are the trends in natural changes and what changes can be expected in the future?;
- what are the reasons for possible changes (including unwanted ones), and what is their source?; and
- what loads/impacts are harmful and what level of exposure is permissible.

The goals and objectives of ecological monitoring determine the main criteria for the selection of objects of observation (indicators), the frequency and time of observations, and the territorial distribution of their points:

- *Sensitivity criterion*: Operational forecast and operational management is only possible if tracking is sensitive enough to environmental changes, i.e. during tracking, slight changes in observed variables should be recorded;
- *Selectivity criterion*: Prediction and control tasks determine the need for selective tracking, i.e. the tracking system should not only provide a general assessment of environmental changes, but also identify its causes and factors specifically;
- *Criteria for representativeness*: The prediction results and management strategies should be acceptable for a sufficiently large area, which requires representativeness of the tracking results; and
- *Criterion of economic efficiency*: The entire monitoring organization should ensure the full implementation of the above three conditions with minimum of observations and at a minimum cost.

Observed objects ultimately possess individual characteristics of the elements of their respective ecosystems and processes. Additionally, for the selected zones of the biosphere region, monitoring requires the use of a system of different, but mutually related methods. In the core area, only non-perturbing methods (mainly full-scale decryption of aerospace images with minimum groundwork) are used, while in the buffer and peripheral zones a

whole range of possible methods are used.

Given the above criteria, observations cover the following components:

a) geological and mineralogical base;

b) relief;

c) meteorological regime and climate;

d) hydrological regime;

e) the composition of atmospheric deposition and the composition of surface and underground runoff;

e) fauna;

g) microbiota;

h) soil;

i) population; and

j) household and equipment.

For marine and coastal waters, the following components and processes are added:

k) geochemical parameters of the water;

l) biotic components (bioindicators of the state of the marine environment); and

m) sedimentation processes in the mixing zone of fresh water and seawater.

In this way the priority areas for monitoring natural processes and phenomena should include:

- observations of
  - changes in the level of biodiversity and the qualitative composition of biota (flora and fauna), primarily vertebrates and vascular plants;
  - the status of populations, rare plant and animal species;
  - the state of ecosystems, which are the etalons for a specific physiographic region; and
  - extremely rare and unique species;
- species particularly vulnerable due to the formation of mass aggregations (colonial birds, marine mammals etc.); and
- species-indicators of natural communities and ecosystems.

The priority inventory work should include compilation of:

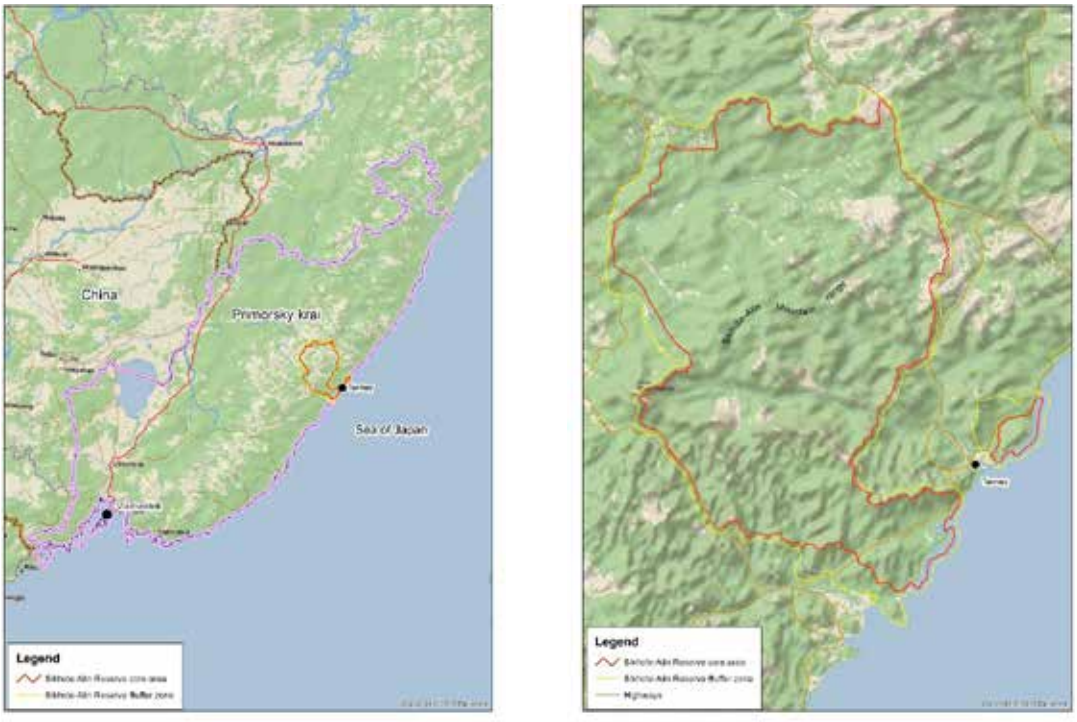
- annotated species lists; and
- inventories of rare, unique subjects and subjects requiring special attention of both animate and inanimate nature, as well as habitats of rare species of animals and plants.

All these components, processes, and priority areas for monitoring are carried out at weather stations ROSKOMHYDROMET (MNRE) and are used by the MPA for their research.

2. Sikhote-Alin Nature Biosphere Reserve

Sikhote-Alin Nature Biosphere Reserve (Sikhote-Alin Reserve) was founded in 1935 within the protected territory of 10,000 km^2 and a buffer zone of 7,000 km^2. The reserve is 4,016 km^2 (Figure 47) and consists of two units: a basic area of 3,974 km^2 and a separate area «Abrek» of 42 km^2.

Figure 47 **Sikhote-Alin Reserve Map**



The protected marine zone is 29 km^2. Sikhote-Alin Reserve occupies the Central Part of Sikhote-Alin mountain range with peaks ranging from 600 to 1,000 m above the sea level. The highest peak is Gluhomanka mountain (1,598 m).

The climate of the Reserve is of a distinctive monsoon character, with harsh westerly winds in winter and light easterly winds in summer. The Reserve territory is 95% forested with a large number of species, including 24 bird species on the IUCN Red List.

There are three main directions of the Reserve's activity:

- territory protection (prevention of poaching in the land area and in the marine zone, prevention and suppression of forest fires, forestry works). Protection of the sea includes regular patrols on a boat to detect violations, as well as monitoring the sea from the coast and using a webcam for timely detectation of vessels illegally located in the marine area of the reserve.;
- scientific activity (monitoring of natural communities, use of scientific achievements in wildlife management practices in the region, participation in ecological assessments, organization of student practices of profile high schools); and
- environmental education (work with local populations, tourist activity and dissemination of information about the Reserve activity).

The activity of the Reserve is carried out in accordance with the Charter of the Reserve, the Regulation on the Reserve, and the Regulation on the Buffer zone.

Any type of activity in the territory and water area of the reserve should have non-interference in the natural course of natural processes.

The primary activity of the Reserve Protection Department is to prevent and suppress poaching in the territory, to prevent and suppress forest fires, and to maintain forest infrastructure. Inspectors of the reserve regularly patrol the territory of the reserve in order to reveal and prevent violation of the nature protection legislation.

For marine area, the Reserve Protection Department have joint spot-checks with frontier management of the Federal Security Service (FSB) of Russia in Primorsky Krai to protect the marine core area.

Support of international funds, such as WCS, WWF, Rhinoceros and Tiger Conservation Fund, Tiger Conservation Fund, gives the possibility to use modern technologies in the reserve's activity: independent photo , video-cameras and satellite phones. Use of the new equipment allows for an increase in the efficiency of nature protection actions.

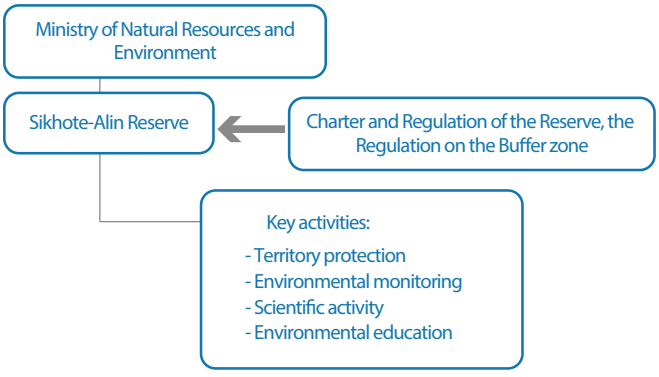
Work with local population is also an important component of Ecological Education Department activity. Regular lectures, excursions in the museum of the Reserve, etc. provides the possibility for inhabitants of nearby settlements to learn more about the Reserve.

There are 6 Ecological Trails in the Reserve. International cooperation concerning ecological education is actively developing. The Reserve also attracts attention of foreign tourists and film crews from media outlets suchas Netflix and the BBC.

Management and Administration Peculiarity

The Sikhote-Alin Nature Reserve is an environmental research, and environmental-educational institution managed by the MNRE (Figure 48).

Figure 48 Management Structure of Sikhote-Alin Reserve



Socio-economic Situation

The socio-economic situation in the region in which the reserve is located has a significant impact on all areas of the reserve's work: the level of poaching, the local population's interest in the reserve's activities, etc. The reserve receives annual data on the socio-economic situation in the region from the local administration, including the main types of industry in the region, population size, average wage and unemployment rate. This data helps understand the location of the reserve in the region, to compare the level of wages in the reserve and the region.

The Reserve is located in the north of Primorsky Krai which has a low population density. Near the border of the reserve are 3 large settlements: Terney, Plastun, Melnichnoe, with a total population of about 7-8 thousand people. Most of the reserve is located within the Terney administrative district, the total population of which is about 11 thousand people.

The economy of the region is determined by forestry, woodworking and the food industry. All large enterprises in this sector of the economy are focused on exporting products to Japan, China and Korea. The main types of products manufactured on the territory of the Terney municipal district are commercial wood, veneer, wood chips, and lumber. Extraction of aquatic biological resources is not a significant industry in the Terney district.

According to statistics for 2018, the population employed in the economy was 7.2 thousand people, which is 69.19% of the total population of the region. The registered unemployment rate is 2.18% of the total working-age

population of the region.

However, despite official data, the income level of most of the population is low. This affects the level of local residents' use of both forest and marine ecosystem resources.

Existing Factors and Potential Threats Adversely Affecting the Nature Complexes of the Reserve

For land areas, the main negative anthropogenic factors in the Reserve are associated with the main industry of the region - logging. For main area, the main marine biological resources are salmon, crab, squid and marine invertebrates. Although federal laws determine the norms for the extraction of marine bioresources, in reality, these norms are not always respected. Moreover, local residents very rarely receive permits for the extraction of marine biological resources. Yet for local residents this type of fishing (crab, salmon, etc.) is the main source of income. It is explained by high unemployment in the region and low wages among the working population. Extraction of marine bioresources allows local residents to receive a much higher income than through legal work. The main problem of illegal extraction of marine bioresources near the reserve's water area is that there are no fish-breeding sites in this area, and thus local residents do not have the opportunity to acquire a license for legal fishing.

Another anthropogenic factor that probably has a significant impact on marine ecosystems is plastic pollution within the marine area. The Reserve, together with GREENPEACE Russia, plans to conduct the first study in 2019, to assess the plastic pollution in the reserve's water. Similar studies are planned to be carried out on an ongoing basis. Based on the results of the work, recommendations will be developed to reduce the level of plastic pollution.

Organization of Protection of the Marine Area of the Reserve

During the navigation period (April-October), the inspectors of the reserve's protection department regularly patrol the reserve's water area and the protected area to identify and prevent violations of the protection regime.

In addition, reserve inspectors regularly conduct joint raids with inspectors of marine services (State Inspectorate for Small Vessels, State Maritime Inspectorate). During the period of active extraction of marine biological resources, inspectors are put on duty on huts and observation posts located on the shores. Also, in the Blagodatnoye area (the most attractive bay for the extraction of marine biological resources), round-the-clock video surveillance of the sea is organized using a webcam with the possibility of remote online viewing.

Management of Scientific Research in the Sikhote-Alin Reserve

Scientific research in the Sikhote-Alin Reserve is carried out in accordance with research plans. A long-term 5 year plan of scientific research has been developed and approved by the Department of Protected Areas of the MNRE. Currently the Research Plan is for 2018-2023. The annual research plan is prepared in accordance with the long-term plan and approved by Director of the Reserve.

These plans are developed by scientists of the reserve. The decision to include themes in the plans is made at the Scientific and Technical Council, which is an advisory agency to the Director of the reserve. The Council includes all the scientific staff of the Reserve, Deputy directors, members of scientific institutes, members of non-profit organizations and members of the district administration.

Scientific research in the territory and water area of the reserve requires the permission of the Administration of the Reserve.

Organization of Scientific Research of the Marine Area

Due to the limited staff of scientists in the reserve, it is impossible to carry out comprehensive monitoring of all parameters (hydrochemical, hydrobiological, assessment of micro- and macrobenthos andassessment of the status of ichthyofauna, etc.) of marine ecosystems annually. Environmental monitoring is a mandatory activity of the reserve. However, the list of specific parameters for monitoring depends on the resources available to the reserve (financial and human).

The scientific department annually record marine pinnipeds (*Phoca largha*): the total number of animals, as well as the number of subadults and youngs are estimated. As marine mammals are on the top of the food pyramid of marine ecosystems, they are indicators of the state of the entire ecosystem.

Every 5-10 years, the reserve carries out comprehensive monitoring of the state of marine ecosystems in the water area of the Reserve together with the institutes of the Far Eastern Branch of the Russian Academy of Sciences. The latest comprehensive monitoring of marine phytocenoses and marine invertebrates was carried out in 2010 (Galysheva et al. 2012). As a result of this work, the species composition of macrobenthos was compiled, lists of species of marine invertebrates were supplemented and the composition of soils was determined. Monitoring data showed the stable state of marine ecosystems of the reserve.

Scientific Research and Monitoring in the Sikhote-Alin Reserve

The most important direction of the research activity of Sikhote-Alin Reserve are its long-term complex research of ecosystems and their components of Central Sikhote-Alin in the permanent marked grounds, routes and

profiles. The Reserve thus interacts and has close cooperation with Russian and foreign research institutions, higher schools, and local forestry, industrial, agricultural enterprises and foundations.

All research results are used for implementing the main activities of the reserve, for preparing documents for different authorities in order to make a decision on nature protection actions, such as the protection of rare species of plants and animals, the creation of new nature protected territories, providingecological expertise and fulfillment of economic projects.

The main scientific areas of long-term investigation in the Reserve are:

- Climate change;
- Vegetation transformations under the impact of the external factors;
- Natural dynamics of the native and the derivative associations;
- Biodiversity and its transformation;
- Destructive processes;
- Plant and animal phenology;
- Dynamics of rare species populations;
- Dynamics of main animal species population size; and
- **Marine ecosystems**

Climate Change

The reserve does not monitor climatic indicators in the marine area (water temperature, ice thickness, etc.). This monitoring is conducted by the Hydrometeorological Research Center (Hydrometcenter of Russia).

Marine Ecosystems

The organizationof long-term research of protected marine and terrestrial ecosystems, ecosystems of lakes, rivers and other systems within a cooperation area which are in economic use is one of the major activities of Sikhote-Alin Biosphere Reserve, the territory of the World Nature Heritage.

These investigations are very important for understanding many processes that occur in the seas. The current that comes from the Strait of Tartary to the south not only considerably cools the coastal waters and affects the climate of the Central Sikhote-Alin but also contributes to the sea organisms moving, which includes organisms of the ecosystems of the Reserve. The sea ecosystems are highly damaged by fisheries, especially in aquatories of buffer zones and pollution from the rivers and the sea. In the low watercourse of Serebryanka river, a sufficiently large Terney settlement is located. During the periodic rise of the river level and flooding in the summer and autumn time, the river sweeps up household rubbish which pollutes the sea and the sea coast across a 20 km radius, which includes the reserve areas.

There are five main directions of scientific research of Marine ecosystems. That are studies of:

1. marine phytocenosis;
2. marine invertebrates;
3. marine ichthyofauna;
4. seabirds; and
5. marine mammals (See Box 1).

Box 1. Key Species Studied

- Marine phytocenosis:
  - Laminaria phytocenoses (*laminaria japonica*)
  - Zoster (*zostera asiatica*)
  - Laminaria gurjanovae
- Marine invertebrates (inventory ongoing – by scientists both of the reserve and Institutes of Academy of Science)
  - Marine bivalve mollusks
  - Types
    - Cnidaria
    - Sipuncula
    - Annelida
    - Mollusca
    - Arthropoda
    - Echinodermata
    - Tunicata
- Marine ichthyofauna
  - Thermophilic fish species
- Seabirds
- Marine mammals
  - Harbor seal
  - Sea lions

Study of Marine Phytocenosis

The flora of marine plants includes 37 species from 3 Divisions: Green algae Division (4 species); Brown algae Division (17 species); and Red algae Division (16 species). The inventory of marine flora is ongoing.

The first hydrobiological surveys of the phytocenoses of the marine area was conducted in 1978-1979 using the diving quantitative method (Fadeev 1980).

A sampling of hydrobiological samples from depths of 2.5–15m in 2008-2010 revealed that the biocenoses in the northern Primorye water area are distinguished by the smallest benthos variety (Shannon index up to 2.5), however, characterized by its maximum quantitative indicators (up to 30 kg / m^2 in the Laminaria japonica belt) (Galysheva, 2012).

Study of Marine Invertebrates

The modern fauna of marine bivalve mollusks of the Reserve includes 27 species belonging to 6 orders, 15 families and 25 genera.

An inventory of marine invertebrates in the reserve was conducted in 2006-2008. As a result, the list of marine invertebrates in the marine area of the Reserve was supplemented with 31 new names of the following types: Cnidaria, Sipuncula, Annelida, Mollusca, Arthropoda, and Echinodermata.

At present, the fauna of marine invertebrates includes 59 species of 7 types:

- Cnidaria - 3 kinds (2 classes);
- Sipunculida - 1 species;

- Annelida - 20 species;
- Mollusc - 21 species (3 classes);
- Arthropoda - 3 species;
- Echinodermata - 9 species; and
- Tunicata - 2 species.

The inventory of the invertebrate fauna is ongoing.

Study of Marine Ichthyofauna

The first inventory of the ichthyofauna of the reserve was carried out in 1999. The annotated list included 64 species of fish from inland waters and the marine area of the reserve.

The taxonomic composition of marine fish species varies from year to year. It should also be beared in mind that during the summer period, thermophilicfish species can penetrate into the waters of the northern Primorye due to the closeness to the southern border of the Pacific boreal region.

At the time of writing, 34 thermophilic fish species have been registered in the water area of the reserve. The total ichthyofauna of the reserve has 207 species (Table 53).

Table 53 Fish of the Sikhote-Alin Reserve

Class Petromyzontida	
Order Petromyzontiformes	2 species
Family Petromyzontidae	
Class Chondrichthyes	
Order Lamniformes	2 species
Family Lamnidae	
Order Carcharhiniformes	1 species
Family Sphyrnidae	
Order Squaliformes	1 species
Family Squalidae	
Order Rajiformes	1 species
Family Rajidae	
Class Actinopterygii	
Order Acipenseriformes,	3 species
Family Acipenseridae	
Order Clupeiformes,	

Class Actinopterygii (cont.)	
Order Gasterosteiformes	
Family Hypoptychidae	1 species
Family Gasterosteidae	4 species
Order Syngnathiformes,	1 species
Family Syngnathidae	
Order Scorpaeniformes	
Family Sebastidae	5 species
Family Hexagrammidae	4 species
Family Cottidae	29 species
Family Hemitripteridae	3 species
Family Psychrolutidae	2 species
Family Agonidae	12 species
Family Cyclopteridae	4 species
Family Liparidae	2 species
Order Perciformes	

Family Engraulidae	1 species	Family Lateolabracidae	1 species
Family Clupeidae	3 species	Family Polyprionidae	1 species
Order Cypriniformes		Family Coryphaenidae	1 species
Family Cyprinidae	23 species	Family Echeneidae	1 species
Family Cobitidae	2 species	Family Carangidae	3 species
Family Nemacheilidae	2 species	Family Bathymasteridae	1 species
Order Osmeriformes		Family Cryptocanthodidae	1 species
Family Osmeridae	3 species	Family Zoarcidae	2 species
Family Salangidae	1 species	Family Stichaeidae	14 species
Order Salmoniformes		Family Pholidae	4 species
Family Thymallidae	2 species	Family Anarhichadidae	1 species
Family Salmonidae	12 species	Family Trichodontidae	1 species
Order Esociformes	1 species	Family Ammodytidae	1 species
Family Esocidae			
Order Gadiformes		Family Gobiidae	6 species
Family Gadidae	3 species	Family Trichiuridae	1 species
Family Lotidae	1 species	Family Scombridae	2 species
Order Lophiiformes,	1 species	Family Centrolophidae	1 species
Family Lophiidae		Family Stromateidae	3 species
Order Mugiliformes,	2 species	Order Pleuronectiformes,	18 species
Family Mugilidae		Family Pleuronectidae	
Order Beloniformes		Order Tetraodontiformes	
Family Exocoetidae	1 species	Family Monacanthidae	1 species
Family Hemiramphidae	1 species	Family Tetraodontidae	4 species
Family Belonidae	1 species	Family Molidae	1 species
Family Scomberesocidae	1 species		

Constant faunistic study of the ichthyofauna of the reserve is an important part of scientific research, since the emergence of new, thermophilic fish species is one of the signs of global climate change and changes in the oceans.

Study of Seabirds

Ornithological research is one of the main directions of scientific work in the reserve. Lagoon lakes in the coastal part of the reserve and the coastline are one of the key resting places along the migratory paths of migratory birds. Annual bird counts during spring and autumn migration allow for the tracking of global changes in the world avifauna and distribution of birds.

Currently, the scientists of the Reserve are analyzing the accounting results of 1968-2018 (See Box 2 for the list of seabirds in the Reserve).

Box 2. List of Seabirds of Sikhote-Alin Reserve

- *Gavia stellata* (Pontoppidan, 1763). Red-throated Loon
- *Gavia arctica* (Linnaeus, 1758). Black-throated Loon
- *Gavia pacifica* (Lawrence, 1858). Pacific Loon
- *Gavia adamsii* (G.Gray, 1859). Yellow-billed Loon
- *Podiceps auritus* (Linnaeus, 1758). Horned Grebe
- *Podiceps grisegena* (Boddaert, 1783). Red-necked Grebe
- *Podiceps cristatus* (Linnaeus, 1758). Great Crested Grebe
- *Fulmarus glacialis* (Linnaeus, 1761). Northern Fulmar
- *Puffinus carneipes* (Gould, 1844). Flesh-footed Shearwater
- *Puffinus tenuirostris* (Temminck, 1836). Short-tailed Shearwater
- *Phalacrocorax carbo* (Linnaeus, 1758). Great Cormorant
- *Phalacrocorax capillatus* (Temminck et Schlegel, 1849). Japanese Cormorant
- *Phalacrocorax pelagicus* (Pallas, 1811). Pelagic Cormorant
- *Aix galericulata* (Linnaeus, 1758). Mandarin Duck
- *Clangula hyemalis* (Linnaeus, 1758). Long-tailed Duck
- *Histrionicus histrionicus* (Linnaeus, 1758). Harlequin Duck
- *Melanitta americana* (Swainson, 1832). Black Scoter
- *Melanitta deglandi* (Bonaparte, 1850). White-winged Scoter
- *Larus ridibundus* (Linnaeus, 1766). Black-headed Gull
- *Larus vegae* (Palmen, 1887). Vega Gull
- *Larus schistisagus* (Stejneger, 1884). Slaty-backed Gull
- *Larus hyperboreus* (Gunnerus, 1767). Glaucous Gull
- *Larus canus* (Linnaeus, 1758). Common Gull
- *Larus crassirostris* (Vieillot, 1818). Black-taile Gull
- *Rissa tridactyla* (Linnaeus, 1758). Black-legged Kittiwake
- *Uria aalge* (Pontoppidan, 1763). Common Murre
- *Uria lomvia* (Linnaeus, 1758). Thick-billed Murre
- *Cepphus carbo* (Pallas, 1811). Spectacled Guillemot
- *Brachyramphus perdix* (Pallas, 1811). Long-billed Murrelet
- *Synthliboramphus antiquus* (J.F.Gmelin, 1789). Ancient Murrelet
- *Aethia cristatella* (Pallas, 1769). Crested Auklet
- *Cerorhinca monocerata* (Pallas, 1811). Rhinoceros Auklet
- *Aethia pusilla* (Pallas, 1811). Least Auklet
- *Lunda cirrhata* (Pallas, 1769). Tufted Puffin

Study of Marine Mammals

The reserve staff register all meetings with marine mammals in the reserve marine area and buffer zone. This information is recorded in a special database. At present, among the marine mammals, representatives of the orders Predatory (3 species) and Cetacea (8 species).

The most common species of the kilometer preserved marine area of the reserve are the Harbour Seal (*Phocalargha Pallas*) and sea lions (*Eumetopiasjubatus Schreber*).

On the coast of the reserve there are 2 largest rookeries of the Harbour Seal. Seal registration surveys on rookeries are carried out constantly.

In accordance with legal documents, the reserve does not have the right to interfere in the life of the forest and marine ecosystems of the reserve. Therefore, the results of scientific research on the study of natural complexes of the reserve can only be used to prepare recommendations for improving the protection and conservation program of entire ecosystems or their components.

3. The Far-Eastern State Marine Biosphere Nature Reserve (FEMBR)

The FEMBR occupies about 10% of the area of Peter the Great Bay, the southernmost and warmest waters of the Far Eastern seas of Russia. The area of the reserve is 641.363 km^2, of which 630 km^2 is water and 11.363 km^2 is land consisting of islands, kekurs (sea stacks) and the island botanical garden on Popov island. The small islands of the reserve, comprising a total area of barely 10 km^2, show remarkable examples of plant community adaptations to specific marine conditions. As the first marine reserve in Russia, this area has natural coasts, islands and the shelf of Peter the Great Bay, which is the richest in terms of biological diversity of Russia's coastal waters. The Reserve and the area adjacent to Khasan natural park, are situated on a crossing of spring-autumn migrations of birds (Siberia-Japan and Arctic-China) and about 360 bird species can be observed. Also 18 out of 19 Larga seal breeding-grounds of Peter the Great Bay are located in the Reserve.

The nature reserve consists of 4 different sitesm, clustered by their different functions (also see Table 54):

- *Eastern marine cluster* (marked as No. 2 in Figure 49) is situated in Rimsky-Korsakov Islands and bights (Figure 50). The marine protected area is 45,000 ha, and the area of islands including Stenin Island is 900 ha. Eastern cluster, including the islands, is a strictly protected area, where any type of human activity is not allowed.;
- *Southern marine cluster* (No. 4) is situated on the western coast of Possiet Bay and includes Vera and

Falshivy islands. The marine protected area is 150 km^2 (Figure 51). The estimated area of the islands is less than 200 ha. Southern cluster is the research zone, where scientific research info conversation and rehabilitation of natural ecosystems is performed, and educational excursions are allowed.;

- *Western marine cluster* (No. 3) has the marine protected area is 30 km^2 (Figure 51). This marine cluster is the research zone, where scientific research info conversation and rehabilitation of natural ecosystems is performed and educational excursions are allowed.; and
- *Northern cluster* (No. 1) has no marine part. It includes a land plot on Popov island 2.163 km^2 (Figure 52). The Northern cluster, like the whole of Popov Island, is located within the city of Vladivostok and is open to visitors and is meant for environmental education. Here the Museum «Marine nature and its conservation», Botanical Gardens, Ecological Education Center, ancient village and the ecological trails are located, which attract numerous visitors.

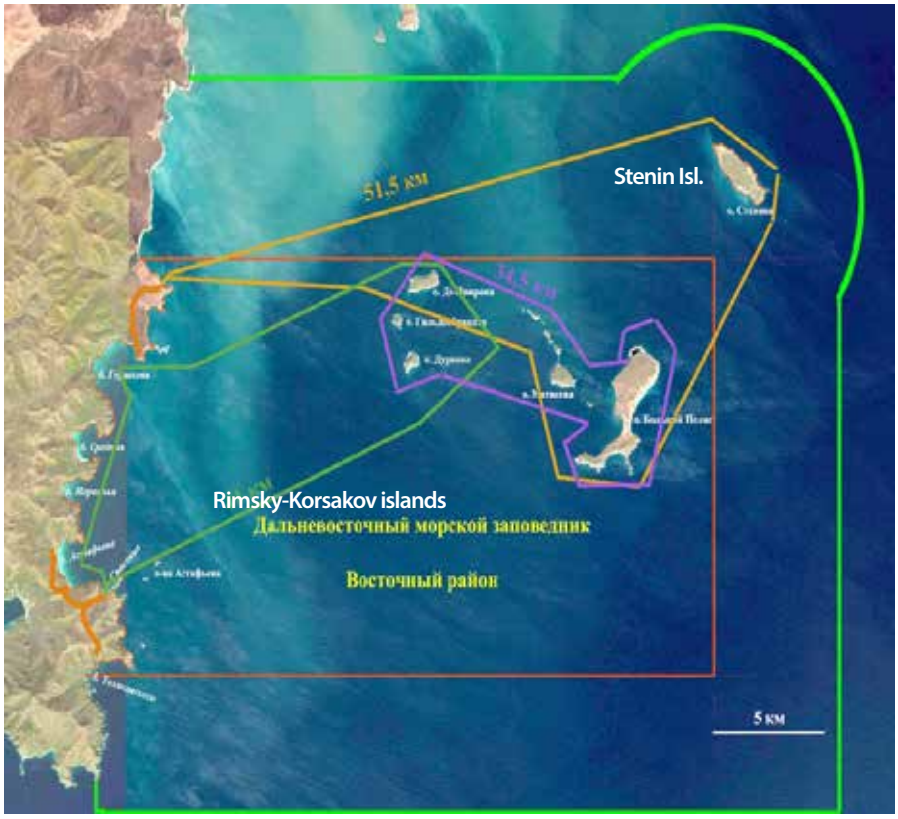
Figure 49 Map of FEMBR including Four Different Clusters

* Note: *1- Northern cluster, 2 – Eastern marine cluster, 3- Western marine cluster, 4 – Southern marine clusters.*

Table 54 **Summary of the FEMBR Clusters**

	Eastern marine cluster	Southern marine cluster	Western marine cluster	Northern cluster
Marine protected areas	450 km^2 + 9 km^2 (islands)	150 km^2 + 2 km^2 (islands)	30 km^2	No marine part& 2.163 km^2 (land and islands)
Restrictions	Strictly protected area	Research zone	Research zone	Educational / excursion zone
Human activities		Research and rehabilitation of natural ecosystem, Educational excursion	Research and rehabilitation of natural ecosystem, Educational excursion	Open to visitors Environmental education

Figure 50 **Eastern and Western Marine Clusters**



* Note: *the boundary of the FEMBR (red line), the boundary of the security zone (bright green line), patrol routes (orange, purple, brown, dark green lines)*

Figure 51 Southern and Western Marine Clusters of the Eastern Marine Cluster

* Note: *the boundary of the FEMBR (red line), the boundary of the security zone (bright green line), patrol routes (orange, purple, brown, dark green lines)*

Figure 52 **Northern Clusters**

*Note: *the boundary of the FEMBR reserve (red line), pedestrian routes (orange line), car routes (green line)*

Institutional Structure

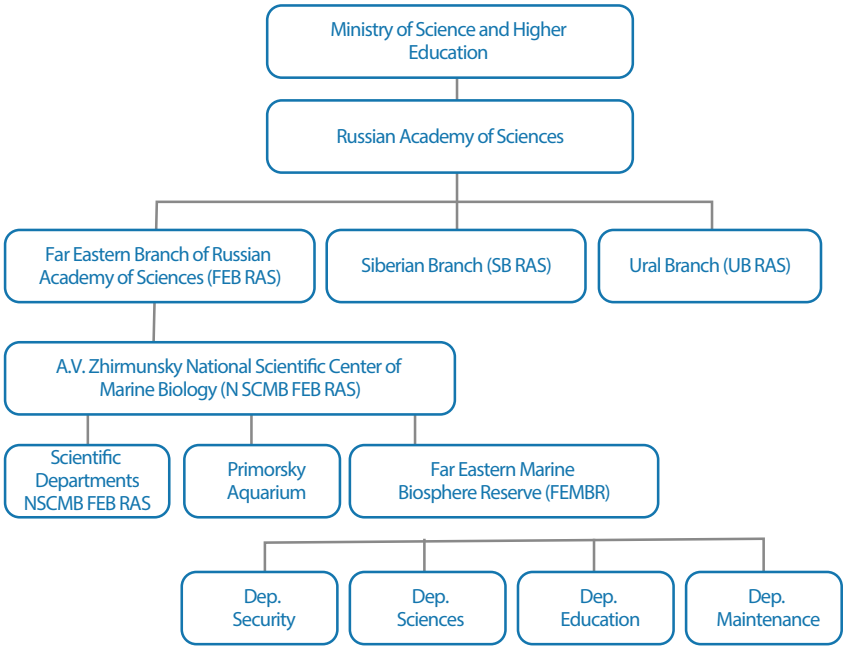
Far-Eastern State Marine Biosphere Nature Reserve (FEMBR) is a Branch of the Federal State Budgetary Institution of Science "*AV Zhirmunsky* National Scientific Center of Marine Biology of Far Eastern Branch of the Russian Academy of Sciences (NSCMB FEB RAS).

The structural units of FEMBR (as of April 2019) (Figure 53) include the following departments:

1. *Department of security* - organization of protection and interaction with related structures, work with the local population, and conducting internal control;
2. *Department of sciences* (Laboratory for the study of biological diversity and monitoring of protected areas) - conducting an inventory and monitoring of the fauna and flora of the reserve;
3. *Department of educational tourism and environmental education* - organization and development of tourism, promotion of tourism products of the reserve to the tourist services market, organization of environmental education activities of the Museum "Nature of the Sea and its Protection" and the Center for Environmental Education; and
4. *Department for the maintenance* - organization of supplies for all departments, repair of buildings and structures, etc.

Affiliation: since 1978, Russian Academy of Sciences; and since 2018-now, Ministry of Science and Higher Education.

Figure 53 Institutional Structure of the FEMBR



Monitoring and Assessment of the Current Status of FEMBR

Biological Parameters

As mentioned above, the monitoring of biological systems in MPAs is carried out in the form of research works. Active research of the FEMBR biota started in 1978. For example, the main topic of scientific research in 1981-1985 was an inventory of marine and island ecosystems of the Far Eastern State Marine Reserve, such as description of the flora of the islands of the reserve, study on birds, sea belly, phytoplankton, algae, etc. were studied by the Institute of Marine Biology, Far Eastern Scientific Center of the USSR. In the 90s, it continued extensive research of biota of the FEMBR. The results of the decades of study of the flora and fauna in FEMBR were published. Annotated list and charts with indication of organisms sampling locations form a basis for future monitoring of the Reserve biota and large-scale biomapping.

The biota of the reserve is investigated in accordance with the Plan of research works of the Far Eastern Marine Biosphere State Nature Reserve, Far East RAS for 2014-2017, approved on December 24, 2014.

Plants

The small islands of the reserve, comprising a total area of barely 10 km^2, show remarkable examples of plant community adaptations to specific marine conditions. A total of 880 species of plants have been recorded on the islands, 62 of which are classified as Specially Protected Species and are included in the Red Data Book of the Russian Federation with various ranks.

Birds

Small rocky islands give shelter to thousands of birds. 188 species of birds (nesting, colonial, and migratory) can be observed in the reserve. The islands are home to the world's largest population of nested black-tailed gulls (*Larus crassirostris*) and Ussuri cormorants (*Phalacrocorax capillatus*). In the lagoon near Cape Ostrovok Falshivi, about 100,000 birds gather each year, including waders, ducks, geese, herons and storks. In total, the reserve has 28 species of birds included in the Red Book of the IUCN and of Russia. Among these are the deadlock-rhinoceros (*Cerorhinca monocerata*), falcon-peregrine (Falco peregrinus), small sturgeon (*Oceanodroma monorhis*), streaked shearwater (*Calonectrisleucomelas*) and grasshopper warbler (*Locustellapleskei*). On the island of Furugelma, the rare small spoonbill (*Platalea minor*) and yellow-eared heron (*Egrettaeulophotes*) have recently begun nesting.

Aquatic Creatures

The water surface and the deep sea of the reserve are inhabited by more than 1600 species of multicellular plants and animals. It is made up of boreal, subtropical, and arctic species, including 200 species of fish, 450 species of crustaceans, 30 species of echinoderms and more than 200 species of mollusks. The reserve contains wide representation of mollusks or soft-bodied animals, 7 species of which are listed in the Red Book of Russia.

Cephalopod mollusks in the reserve include not only typical inhabitants of the cold Far Eastern seas, but also thermophilic marine animals. The most unusual of these are octopuses. Less known species include cuttlefish, which are representative of subtropical waters. The Far Eastern trepang (*Apostichopus japonicus*) is on the verge of extinction, and is a specially protected echinoderm resident at the reserve. Trepang is known for its pharmacological properties. Furthermore, the reserve is a unique place of the island rookeries of the seal (*Phoca largha*), where these animals reproduce and nurture their offsprings.

Data Availability

The main theme of scientific research is an inventory of marine and island ecosystems of the Reserve. The results of 30 years of study of the flora and fauna FEMBR were presented in the three Catalogues (Kussakin O.G., A.V. Adrianov, Tyurin S.A.) and two monographs "Far-Eastern Marine Biospherical reserve". Biota. (Eds. A.N. Tyurin, A.V. Drozdov). More than 5,000 species are included in the list: marine biota is represented by 32 phyla and island and freshwater biota is represented by 26 phyla (Table 55). An annotated list and charts with indication of organisms sampling locations form a basis for future monitoring of the Reserve biota and large-scale biomapping.

In 2014 FEMBR and the Presidium of the Far Eastern Branch of the Russian Academy of Sciences founded the Journal "Biota and the environment of protected areas" (Figure 54). The journal publishes articles on a wide range of issues related to protected natural areas but based on scientific research on the biota and environment of the FEMBR (*http://biota-environ.com/*).

(See reference E.3_1 for significant contributions on respective areas above (macrobenthos, plants, birds, fish, sea mammals)).

Figure 54 **Journal "Biota and the Environment of Protected Areas" Founded by FEMBR**

Table 55 **The Results of the Chronicles and Biota Census of the FEMBR**

Regnum	Phylum	# Species
Animalia	Annelida	248
	Arthropoda	825
	Brachiopoda	1
	Bryozoa	16
	Cephalorhyncha	1
	Chaetognatha	5
	Chordata	528
	Cnidaria	41
	Ctenophora	4
	Echinodermata	38
	Mollusca	340
	Nematoda	121
	Nemertea	22
	Phoronida	2
	Platyhelminthes	12
	Porifera	3
	Rotifera	14
	Sipuncula	3
	Tardigrada	1
	Xenacoelomorpha	6
Chromista	Bacillariophyta	522
	Cercozoa	1
	Cryptophyta	11
	Foraminifera	78
	Haptophyta	1
	Myzozoa	151
	Ochrophyta	163
Fungi	Ascomycota	466
	Basidiomycota	66
Plantae	Bryophyta	76
	Charophyta	212
	Chlorophyta	314
	Glaucophyta	1
	Marchantiophyta	45
	Rhodophyta	81
	Tracheophyta	904
Protozoa	Euglenozoa	109
Eubacteria	Cyanobacteria	217
	Total	**5649**

* Note : 1) *38 types from 6 kingdoms, 5649 species were described.*
* Note : 2) *References (significant contribution): see reference list E.3_1*

Research Results and Issues/Threats Identified

Within the framework of the program "Biodiversity of the World Ocean: composition and distribution of biota (2014-2017)" research of biological diversity of flora and fauna is carried out. Modern technologies which aid in accounting marine biological resources and monitoring natural populations of especially valuable commercial hydrobionts are being developed.

Monitoring of macrobenthos communities (Southern and Western parts): Studies of macrobenthos communities are carried out in the western part of the Far Eastern Marine Reserve during summer 2014 and 2015. The results

of remote monitoring studies of the benthos of this region were summarized and analyzed; results show that on five base sections note a decrease in the biocenotic role of macrophytes. (see reference list E.3_2)

Studies of epifauna – assessment of the state of trepang (Southern and Eastern section (except islands): The epifauna of macrobenthos of the FEMBR were studied using a remote-controlled underwater vehicle. The present state of settlements of Far Eastern trepang (*Apostichopus japonicus*) in the Far Eastern Marine Reserve were studied during summer 2014. As a result of the studies, it was shown that the density of trepang settlements near the mainland coast is higher than in the pristine water areas of the reserve (4 times in the Southern section and 2.5 times in the Eastern section). Seasonal movements of trepang are noted: in autumn, large specimens migrate to depth and in early summer to shallow water. At present, the average size of individuals and the density of trepang settlements in the reserve do not differ from indicators in the unguarded waters of the Peter the Great Bay. In the period of maximum settlement density, the population of trepang in the reserve reaches 600 thousand, which is 8% of its population in the Peter the Great Bay in the early 2000s (see reference list E.3_3).

Studies on coastal scallop (Southern section): Using underwater control apparatus, the distribution of the coastal scallop (*Mizuhopecten yessoensis*) was studied in the water of the Southern section of the Far Eastern Marine Reserve (2014-2017). It was shown that one-quarter of the seaside scallops in Peter the Great Bay are concentrated in this site (see reference list E.3_4).

Monitoring of coastal fish biotope (Southern part): Monitoring of coastal biotope fish in the southern part FEMBR is being carried out. The study of the distribution of fish and their density records, conducted in 2012 and 2014 in Furugelma Island, as well as in the bays of Sivuchya, Kalevala and Pemzova in 2014, revealed a decrease in species diversity, density and biomass compared to mid-1990s levels. The decrease in the species diversity of fish is explained by the partial degradation of biotopes (disappearance of the *Zostera marina*) and a slight increase in the period of high water temperatures, which prevents the approach of some cold-water fish to shallow coastal waters (see reference list E.3_5).

Survey of sea birds population: Counts are conducted to ascertain the number of seabirds - migratory and nesting birds - in the Far Eastern Marine Reserve in 2014. New data has been obtained on the penetration of alien species of aquatic organisms into the waters of the Reserve (see reference list E.3_6).

Protection and inspection: On the territory of the reserve, there are 8 cordons of protection, with 38 state inspectors who have access to motorboats. Two of these cordons include video surveillance. The main violations of the protected regime include poaching of valuable sea animals: trepang (*Apostichopus japonicus*), seaside scallop (*Mizuhopecten yessoensis*) and Kamchatka crab *(Paralithodes camtschaticus*). There is no information exchange between scientific studies and inspectors about the situation of the species available.

Socio-economic Aspects

- *Educational facilities in FEMBR*:

For the environmental education of the local people and the promotion of environmental knowledge in the reserve, a museum called "Nature of the Sea and Its Protection" was established in 2007. The exhibition in the museum gives particular attention to protected plant and animal species in the FEMBR. The Center for Environmental Education of the Population was established in the reserve, offering educational programmes and excursions on natural routes.

- *Environmental education / engagement of local community:*

For dissemination of knowledge about biological diversity and preservation, FEMBR establishes alliances with local organizations, international foundations, and cultural and scientific organizations at local and regional levels. With these public organizations, the Reserve raises funds, engages in environmental actions, and environmental education activities. Local residents are attracted to work serving tourists such as providing transport and guiding tourists on the route. Special training is conducted for local residents who are willing to conduct excursions inside the reserve.

- *Participation in international projects:*

In addition, the Reserve took part in international projects, such as: "Assessment of the effectiveness of management of marine protected areas" by IUCN, WWF, and NOAA; "Economic development of the TUMANNA TREDA area" (Tumen River Economic Development Area) by UNDP; "Establishment of a transboundary PA system in the area of the Tumen River and the adjacent water area and territory" by UNDP; "Strengthening Marine and Coastal Protected Areas of the Russian Federation" by UNDP/GEF/Ministry of Natural Resources of Russia Future vision.[46]

- *Tourism:*

At the local and regional levels, alliances have been established with public organizations, international foundations, educational, cultural and scientific organizations to promote knowledge of biological diversity and the need to preserve it.

Within the framework of green sustainable technologies, a number of excursion routes are operated within the reserve. Some of the routes were taken outside the reserve. This makes it possible to develop tourism without increasing the burden on the reserve. In addition, a museum and an open-air archaeological and ethnographic complex are open for tourists to visit. The tourism infrastructure is represented by the Center for Environmental

46 More details on: *http://www.imb.dvo.ru/index.php/ru/mezhdunarodnoe-sotrudnichestvo; and https://morskoyzapovednik.ru*

Education (Popov Island – in Northern Cluster described in Table 54), with some facilities for accommodation, classes and mass events. For instance, the total number of tourists visits to these routes was 5,620 people in 2017.

Under the agreement with FEFU, students of the faculty of service and tourism are involved in assessing the presentation of the reserve on social networks. Prospects of tourist products for promotion of the reserve are studied. (Notes: no official information on the contribution of the tourism in the FEMBR for economy of the local community available) (see reference list E.3_7).

As for socio-economic parameters, there is no official information on economic activities affecting the ecology of the FEMBR.

Environmental Parameters

The reserves do not conduct regular monitoring of environmental parameters. The environmental state in the FEMBR is estimated, taking into account the data of the automatic meteorological station of the Primgidromet located on the Furugelm Island in the southern section of FEMBR, which measures parameters such as the direction and speed of wind, precipitation, atmospheric pressure and air temperature (see the next section for more detail).

4. Environmental Monitoring in Russia's NEAMPAN Sites

MPAs (Reserves) conduct research on monitoring species and ecosystems, but not routine environmental monitoring. Environmental monitoring in the Reserves is usually carried out at network stations of the Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET).

Environmental monitoring of ROSHYDROMET networks covers the following areas (see Table 56 for detail):

- atmospheric air, atmospheric precipitation and snow cover;
- sea and surface water on hydrochemical and hydrobiological factors;
- sediments;
- soils; and
- radioactive contamination of all objects of ecosystems.

In Primorsky Kray, monitoring of the contamination of air, inland waters, soil and marine environment is implemented by Primorsky Territorial Office on Hydrometeorology and Environmental Monitoring (Primgidromet), which is part of ROSHYDROMET. Primgidromet carries out its activities in accordance with Article 69 of the Federal Law "On Environmental Protection" and Resolution "On Approval of the Regulation on public

service monitoring the state of the environment".[47]

The data from the nearest stations of the Primgidromet are used to assess the state of ecosystems in the reserves and determine the impact on them.

In the Sikhote Alins Reserve, the monitoring station is located almost in the center of the reserve in the Terney settlement, and for the FEMBZ the station is located more than 50 km south of the Reserve.

Table 56 Structure of Programs of Environmental Monitoring Network

Environment	Number of items	Periodicity of observations	Controlled parameters
Atmospheric air	12	At 3 terms Daily	NO, NO_2, CO, CO_2, SO_2, H_2S, Dust, SO_4=, NH_3, HCl, CH_2O, C_6H_5OH, Heavy metals, benz (a) pyrene
Atmospheric precipitation and snow cover	22	Monthly and seasonal	Specific electro conductivity, pH, $SO_4^{=}$, NO_3^{-}, NH_4^{+}, Cl^{-}, HCO_3^{-}, Na^{+}, K^{+}, Ca^{++}, Mg^{++}, Zn
Surface water	34	Every 10 days, Monthly Seasonal	Gas composition, main ions, N, P, K, O_2, phenols, oils, pesticides, detergents, heavy metals, fluorides, boron, hydrogen sulfide,
Sea water and sediments	37	Every 10 days, Monthly Seasonal	Oxygen, N, P, K, phenols, oils, pesticides, detergents, heavy metals, Phyto-zoo-plankton,
Marine hydrobionts stations	39	Seasonal	Phyto-zoo-plankton, benthos
Freshwater hydrobionts points	29	Seasonal	Phyto-zoo-plankton, benthos
Soils	15	Seasonal	Pesticides, heavy metals, pH, fluorides, benz (a) pyrene
Radioactive contamination of environment	33	Daily	radionuclide composition of atmospheric fallouts, sea and river water, sediments and soils

Monitoring Atmosphere Pollution

Monitoring of atmospheric pollution in the cities of the Far East of Russia and chemical composition of precipitation in the region are carried out by the ROSHYDROMET (Table 57 and Table 58).

The main monitoring station for Far Eastern State Marine Biosphere Reserve is Posyet (years of observation 1947-2019) and the main station for the **Sikhote-Alin Biosphere Reserve** of the MNRE of Russia is Terney.

47 August 23, 2000 N 622. *http://www.primgidromet.ru/*

Precipitations sampled at the national network stations are sent to the chemistry laboratory Center for Monitoring and Pollution Control of Primorsky administration of ROSHYDROMET for analysis.

Table 57 Sample Analysis Methods

(A) Precipitation and Snow Cover Composition

Components	Methods
NO_3, NH_4	Spectrophotometry
Na, K, Ca, Mg	Flame spectrophotometry
pH	Potentiometric
Conductivity	Conductometer
SO_4	Nephelometric
Cl, HCO_3	Potentiometric titration

(B) Air Pollution

Components	Methods
NH_3, NO, NO_2, SO_2, H_2S	Spectrophotometry
Formaldehyde	Spectrophotometry
Fe, Cd, Co, Mn, Cu, Ni, Pb, Cr, Zn	Atomic Absorption Spectrometry
CO	Electrochemical
Suspended solids (SS)	Gravimetric
SO_4	Nephelometric
Benz(a)pyrene	Electrochemical

(C) EANET

Components	Methods
Wet deposition (the same parameters as for precipitation)	The same methods as for precipitation composition
Dry deposition (NH_4, NO_3, SO_4, Cl, K, Na, Ca, Mg)	Ion chromatography (analysis is performed in Irkutsk)

Table 58 **Frequency of Observations at Different Monitoring Stations in Primorsky Kray**

Kind of monitoring	Frequency
Air pollution	three times a day
Precipitation composition	once a month
Snow cover composition	once a winter
Precipitation acidity	every rain event
EANET, dry deposition	every two weeks
EANET, wet deposition	every rain event

Monitoring Water Pollution (Sea and Surface Land Water) - National Programs of Water Monitoring

In Primorsky Kray, monitoring the contamination of the air, river waters, soil and marine environment is implemented by Primgidromet according to State Monitoring Programs.

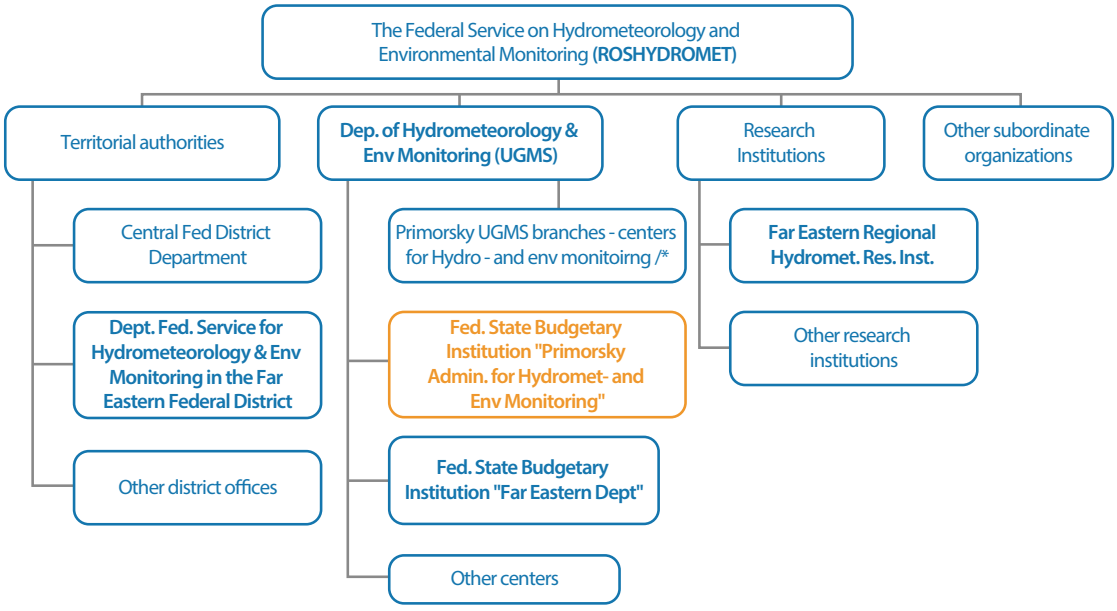
The background monitoring at Biosphere Reserves is currently carried out by Primorsky UGMS branches - centers for Hydro - and environmental monitoring (Figure 55).

The amount and quality of all types of municipal and industrial wastewaters are controlled by the subdivisions of the Federal Service for Environmental, Technological and Nuclear Supervision (ROSTECHNADZOR). The main related issue is the development of maximum permissible discharge (MPD) of wastes, based on Maximum permissible concentration of chemical substances (MPC) (Table 59 and Table 60).

The MPC are developed by scientific and engineering organizations for the different water users and affirmed by the ROSTECHNADZOR, and Ministry of Natural Resources and Environment (MNRE). The quality of underground water is a subject of responsibility of subdivisions of the MNRE.

The monitoring of these parameters is mainly responsible for the ROSKOHYDROMET network, and the departments of nature protection and nature management of the Primorsky Krai are responsible for the implementation of measures to prevent/mitigate the emergency, while the Ministry of Emergency Situations is responsible in case of emergency.

Figure 55 Institutional Framework of ROSHYDROMET



/* *In the past, background monitoring at Biosphere Reserves was conducted by Far Eastern Regional Hydromet.*

Table 59 Maximum Permissible Concentration of Chemical Substances (MPC) (mg/l) in Waters Used for the Different Purposes

Parameter	Drinking	"Public" waters	Fishery purpose
pH	6-9	6-9	6.5-8.5
Mineralization	1000 mg/l	1000 mg/l	1000
BOD5	nd	nd	2.0
COD	5.0 mg/l ($KMnO_4$)	5.0 mg/l ($K_2Cr_2O_7$)	15 ($K_2Cr_2O_7$)
PHC (petroleum hydrocarbons)	0.1 mg/l	0.1 mg/l	0.05
Detergents (Surfactants)	0.5 mg/l	0.5 mg/l	0.1
Phenols (summary)	0.25 mg/l	0.25 mg/l	0.001
Al^{3+}	0.5 mg/l	0.5	0.04
Be^{2+}	0.0002 mg/l	0.001	0.0003
B (summary)	0.5 mg/l	0.5	10*, 0.1
Fe (summary)	0.3 mg/l	0.3	0.05*, 0.1
Cd (summary)	0.001 mg/l	0.001	0.005
Mn (summary) , Ni (summary)	0.1 mg/l	0.1	0.05*, 0.01
Cu (summary)	1.0 mg/l	1.0	0.005*, 0.001
As (summary)	0.05 mg/l	0.05	0.01*, 0.05
Hg (summary)	0.0005 mg/l	0.0005	0.0001*, $<10^{-5}$
Cr	0.05 Cr^{6+}, 0.5 Cr^{3+}		0.02Cr^{6+},0.07Cr^{3+}
Zn (summary)	5 mg/l	1.0	0.05*, 0.01
Pb (summary)	0.03 mg/l	0.03	0.01*, 0.1
$N\text{-}NO_3^-$	10 mg/l	10	9.1
$N\text{-}NO_2^-$	0.75	0.8	0.02
$N\text{-}NH_4^-$	nd	1.0	0.4
SO_4^{2-}	500 mg/l	500	100
F^-	1.2-1.5 mg/l	1.5	0.75
CN^-	0.035 mg/l	0.1	0.05
HCH	0.002 mg/l	0.02	<0.00001
DDT (summary)	0.002 mg/l	0.1	<0.00001
PCBs	0.001	0.001	0.0001

*: *for sea water only; nd: not determined*

Table 60 Water Quality Criteria Based on Concentration of Chemical Substances (mg/l)

Parameter	Type of water use	MPC	High pollution	Extremely high pollution
Mineralization	fisheries	1000	> 10000	> 50000
DO			< 3.0	< 2.0
BOD5		2.0	> 10	> 40
COD($K_2Cr_2O_7$)		15	> 150	> 750
N-NH_4^+		0.4	> 4.0	> 20
N-NO_2^-		0.02	> 0.2	> 1.0
N-NO_3^-		9.1	> 91	> 910
P-PO_4		0.05	> 0.5	> 2.5
SO_4^{2-}		100	> 1000	> 5000
Al		0.04	> 0.4	> 2.0
Zn		0.01	> 0.1	> 0.5
Mn		0.01	> 0.3	> 0.5
Ni		0.01	> 0.1	> 0.5
Cu		0.001	> 0.03	> 0.05
Cr^{6+}		0.02	> 0.2	> 1.0
Cr^{3+}		0.07	> 0.7	> 3.5
PHC		0.05	> 1.5	> 2.5
Detergents		0.1	> 1.0	> 5.0
Phenols		0.001	> 0.030	> 0.050
HCH, DDTs		0.00001	> 0.00003	> 0.00005
F^-		0.75	> 7.5	> 37.5
H_2S		0.00001	> 0.00010	> 0.00050
Fe	hygienic	0.1	> 3.0	> 5.0
Cd		0.005	> 0.015	> 0.025
Pb^{2+}		0.006	> 0.018	> 0.03
B		2.67	> 26.7	> 133.5

Based on the quantitative criteria on the concentration (MPC), observed parameters are classified as High pollution and Extremely high pollution (see Table 60). The State Office for Supervision on the Protection of Consumer's Rights and Human Welfare under Ministry of Health and Social Development is an executive authority responsible for the establishment of sanitary hygienic MPC, and the State Fishery Service under the Ministry of Agriculture are responsible for the establishment and affirmation of MPC for the waters used for fishery purposes.

Responses required in case of the high level of pollution may vary. In case of serious problems of the administration of the territories and municipalities, the bodies of the Ministry of Emergency Situations may decide to introduce an emergency regime with appropriate measures for the evacuation of the population and rehabilitation of the territory.

The water quality monitoring plan at different monitoring sites have been established according to several criteria including the population of the watershed and its significance for biological resources. The several classes of monitoring sites have been established.

In addition to the hydrological and chemical parameters, hydrobiological features are studied, such as description of phytoplankton, zooplankton, zoobenthos and periphyton communities (Table 61 and Table 62).

Table 61 Description of Observation (Parameters Measured) on the Monitoring Stations of Different Classes in Primorsky Krai

Class of Station	Type of observation	Parameters measured
II	Concise Program Type 2 (CPT-2)	Hydrological parameters, visual observation, temperature, conductivity, DO, pH, SS, BOD, COD, and 2-3 characteristic pollutants
III	Concise Program Type 3 (CPT-3)	CPT-2 plus all characteristic pollutants
IV	Full Program	CPT-3 plus Eh, macro-ions, N-NH_4, NO_3, NO_2, PO_4, Fe, Si, oil products (PHC), PAH, trace metals, POPs

* Note: *A total of 5 categories of station classes in the Russian Federation*

Table 62 Number of Monitoring Stations of Different Class in Primorsky Kray and Frequency of Observations

Number and class of stations	Frequency
1 station of class II	Every 10 days
19 stations of class III	Every month
13 stations of class IV	Every hydrological phase

Information on analytical methods required for the various water quality monitoring parameters is given in Table 63.

Table 63 Brief Description of Some Analytical Methods Used in the Monitoring of Ambient Water Quality in Primorsky Kray

Parameters	Methods	Measurement range	Precision
Suspended solids (SS)	Gravimetric	2-50 mg/l	---
SO_4^{2-}	Nephelometry	2.0-50 mg/l	0.1 + 0.17C
Surfactants (detergents)	Colorimetry after extraction	0.010-0.050 mg/l 0.050-0.400 mg/l	0.006 0.12C
Phenols		0.002-0.018 mg/l 0.018-0.025 mg/l	0.6 + 0.13C 1.6 + 0.05C
$N\text{-}NO_2^-$, $P\text{-}PO_4^{3-}$	Colorimetry	0.010-0.300 mg/l	0.004 + 0.13C
NH_4^+		0.30-4.00 mg/l	0.05
Si		0.1-2.0 mg/l	0.05 + 0.045C
Fe_{Total}		0.05-1.00 mg/l	0.006 + 0.12C
NO_3	Potentiometry	0.01-6200 mg/l	20%
F		0.2-4.0 mg/l	0.01 + 0.096C
pH		4.0-10	0.01
O_2	Titration	1.0-15.0 mg/l	0.034C
Cl		2.0-15.0 mg/l	0.17C
Ca, Mg		1.0-100 mg/l	0.2 + 0.044C
COD ($K_2Cr_2O_7$)		4.0-80 mg/l	1.3 + 0.057C
BOD_5		1.0-11.0 mg/l	0.3 + 0.06C
Petroleum Hydro-carbons(PHC)	Infrared spectrophotometry	0.02-2.0 mg/l	0.004 + 0.20C
ά, γ-HCH	Gas chromatography	0.002-0.050 µg/l	0.0008 + 0.17C
DDE		0.005-0.150 µg/l	0.002 + 0.093C
DDD		0.010 –0.300 µg/l	0.001 + 0.22C
DDT		0.020-0.500 µg/l	0.010 + 0.096C
Na	Flame spectrometry	1.0-50 mg/l	0.08 + 0.04C
K		1.0-5.0 mg/l	0.03 + 0.06C
Cu, Ni, Co, Pb, Hg	Voltamperometry (ASV) and/or Atomic Absorption (AAS)	0.1-1000µg/l	20%
Mn, Zn		5–300 µg/l	5%
Cd		0.05-50 g/l	15%

* Note: *"C" in the last column means "concentration".*

Monitoring Results and Assessment of Causes

An analysis of the results of monitoring pollution of coastal sea waters in the MPA area showed that in the Northern region (where Sikhote-Aline Reserve is located) there are several local sources of significant pollution to coastal waters, largely from ore-mining and ore-chemical production. The largest is located near Rudnaya and Zerkalnaya Bays. Pollution includes large quantities of Pb, Cu, Zn, Cd, As, B and others in dissolved and suspended forms. Insignificant dot pollution of coasts and coastal waters is marked by garbage and waste products.

In the southern part of Primorskii Krai, where the Far Eastern Marine Reserve is located, the landscape is mainly low mountains with river valleys going out to the sea. The coastline is heavily rugged. Sources of sediment run-off in combination with an active wave regime has resulted in the formation of sea deposits of titanium-magnesium and building sand. Accessibility of shores and large bays allows easier port construction. The vast shallow-water bays and favourable hydrological conditions give rise to valuable fishery resources and provide a good base for mariculture development. Rivers have maintained their fishery potential only partially, however. The aesthetic beauty of the shores, favourable climate and sandy bays and beaches make this region suitable for recreation. Deposits of curative mud in the south of this sub-region have led to development of curative-sanatorium establishments.

In this region water pollution is sporadic and is connected with the disposal of sanitary and, to a lesser extent, industrial waste waters. Build-up of pollutants in marine organisms is not high. River flow is a major natural source of chemical substances in coastal marine areas. Anthropogenic pressure on coastal watersheds influences the concentration and flow of different chemical substances, including river pollutants. It is difficult, however, to distinguish anthropogenic impact from natural variability.

Constantly increasing pollution from the Tumen River basin has become an issue here. Whilst many years of effort to treat waste in the PRC have eased its industrial pollution, pollution from domestic sewage is on the rise. Pollution of coasts and coastal waters by garbage and waste water is significant and is dated near settlements and mouth zones of rivers.

The results of the analysis of environmental monitoring revealed a number of environmental hot spots in Russian coastal waters near the MPAs under consideration (Table 64).

Table 64 Environmental Hot Spots in Coastal Waters near Russian MPA of NEAMPAN

Location	Problems	Roots of problems
Some localities of the Amurskii Bay near FESBR	Elevated concentration of POPs, metals, nutrients in coastal waters, plankton, bottom sediments, organisms. Depletion of oxygen content. Deterioration of benthic and plankton communities. Marine litter and oil sleeks.	Water contamination by industrial and municipal sewage due to lack of treatment. Weak port management of pollution from ships and/or port facilities.
Small bays in the southern part of Peter the Great Bay included FESBR equatoria	Seasonal eutrophication and marine litter	Contamination due to unorganized recreation activity during summer season.
Rudnaya Pristan in the middle Primorskii Krai near SASBR	High concentration of metals in bottom sediments, water and organisms. Deterioration of benthic communities.	Contamination by river discharge and atmospheric deposition from the adjoining watershed with mining and ore processing industries.
Coastal waters of Primorskii Krai	Elimination of high valuable species (sea cucumber, sea urchin, some crabs)	Poaching or irrational over exploitation of resources.

Monitoring and Assessment Strategies and Plans for Sustainable MPAs

Analysis of results of ecological monitoring in MPA, such as air and river pollution monitoring problems highlighted in the previous section also suggest the following key issues for monitoring of MPAs:

- Unify monitoring parameters, methodologies and technical standards/criteria used in country studies. The lack of unified standards limits the effort to jointly address atmospheric deposition and contaminated river inputs in the NEAMPAN sites Region;
- Conduct additional joint research and develop an integrated regional monitoring network that tracks dust/sandstorms and that looks for ways to reduce pollution delivered by rivers and trans-boundary movement of pollutants such as dust and sandstorms in the region; and
- Expand the effort to obtain reliable regional and national level data on trace pollutants (dissolved forms of some metals and persistent organic pollutants at µg and ng volumes) in air pollution and on river and coastal water pollutants.

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North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC)

NEASPEC is a comprehensive intergovernmental cooperation framework, established in 1993 by six member States, namely, China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea, and the Russian Federation. Senior Officials Meeting (SOM) is held annually as the governing body and principal vehicle for the evolution of NEASPEC. United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) East and North-East Asia (ENEA) Office functions as the NEASPEC Secretariat.

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NEASPEC North-East Asian Subregional Programme for Environmental Cooperation