NEASPEC-NEAMPAN

Report on the Management Plans and Strategies of the NEAMPAN Site in Republic of Korea

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

Abbreviation

CHA	Cultural Heritage Administration
KOEM	Korea Marine Environment Management Corporation
LA	Local Administration
MA	Metropolitan Administration
ME	Ministry of Environment
MOF	Ministry of Oceans and Fisheries
MPA	Marine Protected Area
NEAMPAN	North-East Asian Marine Protected Areas Network
NEASPEC	North-East Asian Subregional Programme for Environmental Cooperation
PA	Protected Area
ROK	Republic of Korea
ROOF	Regional Office of Oceans and Fisheries
WPA	Wetland Protected Area

Contents

1 Review of management plans / strategies of the selected NEAMPAN site

1.1 Basic information of the target MPA

In marine of Republic of Korea (ROK), diversified protected areas are designated according to individual acts of 3 departments. Ministry of Oceans and Fisheries (MOF) in ROK has designated 4 types of protected areas according to the 4 acts for management. Ministry of Environment has designated 2 types of protected areas according to the 2 acts for management. Cultural Heritage Administration has designated 2 types of protected areas according to the 1 act for management. Of these, NEAMPAN sites designated in ROK are Coastal Wetland Protected Areas (WPA) designated and managed according to Wetlands Conservation Act. MOF and Ministry of Environment have joint jurisdiction over Wetlands Conservation Act while MOF has jurisdiction over Coastal Wetland and Ministry of Environment (ME) has jurisdiction over In-land Wetland. Protected area status in marine is shown in table 1.

ROK has three NEAMPAN sites, Muan tidalflat WPA, Suncheon Bay tidalflat WPA, and Gochang tidalflat WPA, which has been recently added for the NEAMPAN site. As shown in table 2, a total of 13 areas, 1,421.65㎢ has been designated as WPAs in accordance with the Wetland conservation act in ROK.

Table 1. Protected Area Status in Marine (As of 31th Dec 2018)

Ministry	Category of Protected Areas		Legislation Concerned	Number	PA (㎢)
Ministry of Environment (ME)	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
Ministry of Oceans and Fisheries (MOF)	**Coastal Wetland Protected Area (tidalflat)**		**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		2,526.0
Cultural Heritage Administration (CHA)	Natural Monument		Cultural Heritage Protection Act	3	960.19
	Scenic Area			?	0.09

Table 2. Coastal Wetland Protected Area Status (13 sites)

	Coastal WPA Name	Designation date	Area (㎢)	Location	Note
1	**Muan tidalflat**	2001.12.28.	42	Jeollanam-do Muan county	Ramsar site (‘08)
2	Jindo tidalflat	2002.12.28.	1.44	Jeollanam-do Jindo county	-

3	**Suncheon bay tidalflat**	2003.12.31.	28	Jeollanam-do Suncheon city	Ramsar site (‘06) UNESCO MAB(‘18)
4	Boseong bulgyo tidalflat	2018.09.03.	31.85	Jeollanam-do Boseong province	Ramsar site (‘06)
5	Ongjin jangbong-do tidalflat	2003.12.31.	68.4	Incheon metropolitan city Ongjin county	-
6	Buan Julpo bay tidalflat	2006.12.05.	4.9	Jeollabuk-do Buan county	Ramsar site (‘10) UNESCO MAB(‘13)
7	**Gochang tidalflat**	2018.09.03.	64.66	Jeollabuk-do Gochang county	
8	Seocheon tidalflat	2018.09.03.	68.09	Chungcheongnam-do Seocheon province	Ramsar site (‘09) EAAF site(’12)
9	Songdo tidalflat	2009.12.31.	6.11	Incheon metropolitan city Yeonsu-gu	Ramsar site (‘14) EAAF site(’19)
10	Masan bay bongam tidalflat	2011.12.16.	0.1	Gyeongsangnam-do Changwon city	-
11	Siheung tidalflat	2012.02.17.	0.71	Gyeonggi-do Siheung city	-
12	Daebudo tidalflat	2017.03.22.	4.53	Gyeonggi-do Ansan city	Ramsar site (‘18) EAAF site(’09)
13	Sinan tidalflat	2018.09.03.	1,100.86	Jeollanam-do Sinan county	Ramsar site (‘11) UNESCO MAB(’09)
	Total		1,421.65	-	-

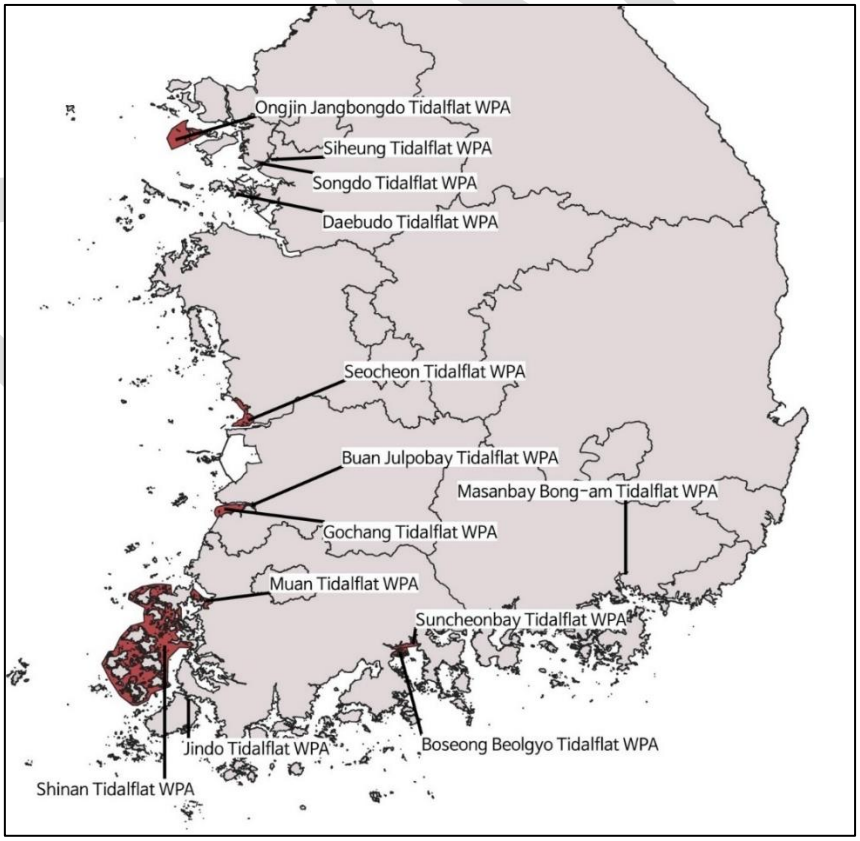


Figure 1. A map of Korean Wetland Protected Areas

Suncheon Bay Tidalflat WPA had designated in December 31, 2003 and area is 28㎢. It is Located in Suncheon-si, Jeollanam-do, Republic of Korea. Marine Components are Intertidal (sand and tidalflat), Yeosu regional office of oceans and fisheries has management authority. Conservation plan had been updated in 2018 and is being implemented from 2019 to 2023 by suncheon city, Monitoring have been conducted with National marine ecosystem monitoring Program every year since 2015. It has been listed as RAMSAR Site in 2006 and RAMSAR wetland city in 2018, designated as the "Scenic Site 41" on June 2008 and has been managed as one of the state-designated national heritage. And also it has been listed as UNESCO MAB in 2018.

Muan Tidalflat WPA had Designated in December 28, 2001 and area is 42㎢. It is located in Muan-gun, Jeollanam-do, Republic of Korea. Marine Components are Intertidal (sand and tidalflat), Mokpo regional office of oceans and fisheries has management authority. Conservation plan had been updatedin 2016 and is being implemented from 2017 to 2021 by muan county, Monitoring have been conducted with National marine ecosystem monitoring Program every year since 2015. It has been listed as RAMSAR Site in 2008.

Gochang Tidalflat WPA had Designated in 2007 and expanded in 2018 and area is 64.66㎢. It is located in Gochang-gun, Jeollabuk-do, Republic of Korea. Gunsan regional office of oceans and fisheries has management authority. Conservation plan had been updated in 2013 and is being implemented from 2014 to 2019 by gochang county, Monitoring have been conducted with National marine ecosystem monitoring Program every year since 2015. It has been listed as RAMSAR Site in 2010 and UNESCO MAB in 2013.

Designation of Wetland Protected Areas

Coastal WPA can be designated when more than one of the following are satisfied according to the paragraph 1 of Article 8 in Wetlands Conservation Act. In addition, MOF has politicized the designation standards and had announced the detailed WPA (coastal) designation standards in 2018 as follows to clarify conformance status to the designation requirements. Grounds of WPA designation and detailed designation guidelines of WPA are shown in table 3 and 4.

Table 3. 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 worth conservation and following areas as wetland protected area, and also designate surrounding area as 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 4. WPA Designation Guidelines

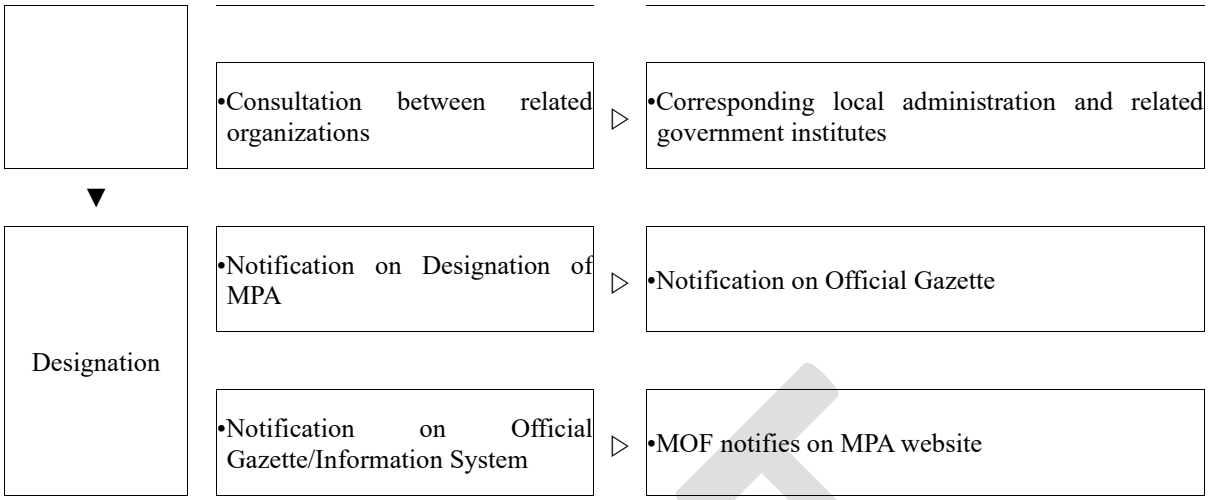
1. Uniqueness of Topographical·Geologic Features ㉠ Site which displays extremely standard or unique topographical and geological features, and is deemed worthy of preservation due to excellent scientific and aesthetic values ㉡ Site which preserves the continuity of untouched coastal sand dunes or wetlands, or which shows remarkable development of primitive seascapes such as shore cliffs or sea stacks at the dorsality of coastal wetlands ㉢ 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
㉠ Site habited by more than 100 species or legally protected species in a single unit tidalflat
㉡ Site habited by a large colony of species found only in Korea, rare species, or species with high ecological significance
㉢ Site known to display higher ecological indices including species diversity compared to other unit tidalflats
3. Coastal Vegetation and Flora
㉠ Site habited by legally protected species
㉡ Site in which the area of habitation of coastal vegetation exceeds 0.01㎢, or in which vegetation habits in an exceptionally extensive manner
㉢ 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
㉠ Site deemed worthy of preservation as the habitat or stopover of legally protected species
㉡ Site with appearance of 20,000 individual seabirds
㉢ Sites habited or utilized by more than 1% of the total population of a single seabird species
5. Other Taxa
㉠ Site habited by legally protected fish, amphibians, reptiles or mammals, among which the coastal wetland poses significant impact on the life history of the species

As shown in table 5, The designation procedure is implemented by being largely divided into 3 stages, with the designated candidate places being selected for the regions having a designation request by regional stakeholders based on the results of National Marine Ecosystem Monitoring Program. In the case of regions with insufficient survey results, precision surveys may be conducted to additionally review conformance status to designation requirements. By reflecting the survey results and advance consultation opinions of regional stakeholders, designation (plan) for WPA is prepared, for which sufficient opinions of the regional stakeholders are gathered through discussions and briefings. When sufficient discussions on designation have been conducted, the designation plans are consulted with related departments and local administrations, followed by announcement of the designation. In marine area, MOF or metropolitan city/provincial government have an authority to designate MPA.

Table 5. Announcement of Designation of MPA

Preparation	•Recommendation of MPA candidate sites	▷	•Reflecting the results of marine ecosystem research •Designation request from local administration
	•Detailed site investigation	▷	•Evaluation on appropriateness of grounds of designation
▼			
Designation Arrangement	•Preparation of Designation Draft Plan	▷	•Grounds of Designation/Plan
	•Local resident briefing session	▷	•Explanation/feedback collection



1.2 Background of strategic / management plan of the target MPA

Wetland Conservation Act

As shown in table 6, In accordance with Article 5 of Wetlands Conservation Act, MOF and Ministry of Environment establish the wetland conservation basic plan every 5 years since 2007. *MOF, ME, local administrations, concerned organizations are responsible for implementing the wetland conservation basic plan.* The 3rd wetland conservation basic plan is established in 2018 and it is being implemented from 2018 to 2022 by national/provincial government and local administration. In this case, plans concerning wetland conservation established according to concerned acts should be respected as much as possible, and the basic plans should include the items of each number of the following.

Table 6. Key Content 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, in accordance with Article 11 of Wetlands Conservation Act, MOF and ME establish a regional wetland protected area conservation plan according to the wetland conservation basic plan every 5 years. And the conservation plans should include the items of each number of the following. Key contents of the conservation plan of WPA are shown in table 7.

Table 7. Key Contents of the Conservation Plan of WPA

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

The Wetlands Conservation act is in place to define matters necessary for efficient conservation and management of wetland and to preserve wetland and biodiversity of wetland. This act designates and manages areas of value to specially conserve as WPAs. Three NEAMPAN sites in ROK are designated as WPAs according to the Wetland conservation act. In particular, the following acts are restricted to ensure sustainable use and systematic conservation of Marine resources. As shown in table 8, however, application of action restrictions is excluded concerning fishery acts for livelihood of regional residents. In comparison to other protected areas and acts, WPA is more focusing on sustainable fisheries and wise uses of residents. According to Natural Park Act of Ministry of Environment, park area is classified 4 types of zones; (i) park nature conservation zone; (ii) park nature environment zone; (iii) park village zone; (iv) park culture heritage zone, and except park village zone and park nature environment zone, fisheries are not permitted.

Table 8. Restricted Actions in WPA (Wetland Conservation Act)

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 Act of increasing or decreasing the water level or water amount of wetland
③ Act of collecting soil, sand, gravel or stone, etc.
④ Act of mining minerals
⑤ Act of 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 (in reference to Table 8)	Exemption
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 in (ii) park nature environment zone and (iii) park village zone
Coastal Wetland Protected Area (tidalflat)	**Wetlands Conservation Act**	①②③④⑤	Fishery for livelihood by local residents who had fishery authority more than one year.
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 the system where authority and tasks are mandated and consigned to regional office of oceans and fisheries, Provincial·local administrations. Items on detailed operation of KOEM are being managed according to 'Regulations on management, etc. of Marine Protected Area' as the instructions of MOF. Management systems of each organizations in ROK are shown in table 9.

Table 9. Management System of WPA

○ (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.
- (Raising Awareness) 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.

○ (Regional Office of MOF) Establishment of Basic Management Plan, Provision of Subsidies, Assessment of Subsidies

○ (Provincial·Local Government) Formation and Operation of regional commission, Implementation of Management Plan, Inspection on restrictions, Raising Awareness (Local level)

Offices	**Key responsibilities**	**Remarks**
Ministry of Oceans and Fisheries (MOF) · KOEM	Integrated Management	MPA Management Regulations
	Monitoring	• National marine ecosystem monitoring Program, • MPA citizen monitoring Program, etc
	Raising Awareness (at national level)	• World Wetland day Ceremony, • National Marine Protected Area Congress • MPA Manager Capacity Building Program • MPA Visitor Center Network General Meeting, etc.
	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	Tidalflat WPA: Suncheon bay Muan Gochang	(Conservation plans) 2018 2016 2019
Provincial/Local Government	Site management and Implementation of the annual management plans	• Formation and Operation of regional commission, • Implementation of Management Plan, • Inspection on restrictions, • Raising Awareness (Local level)

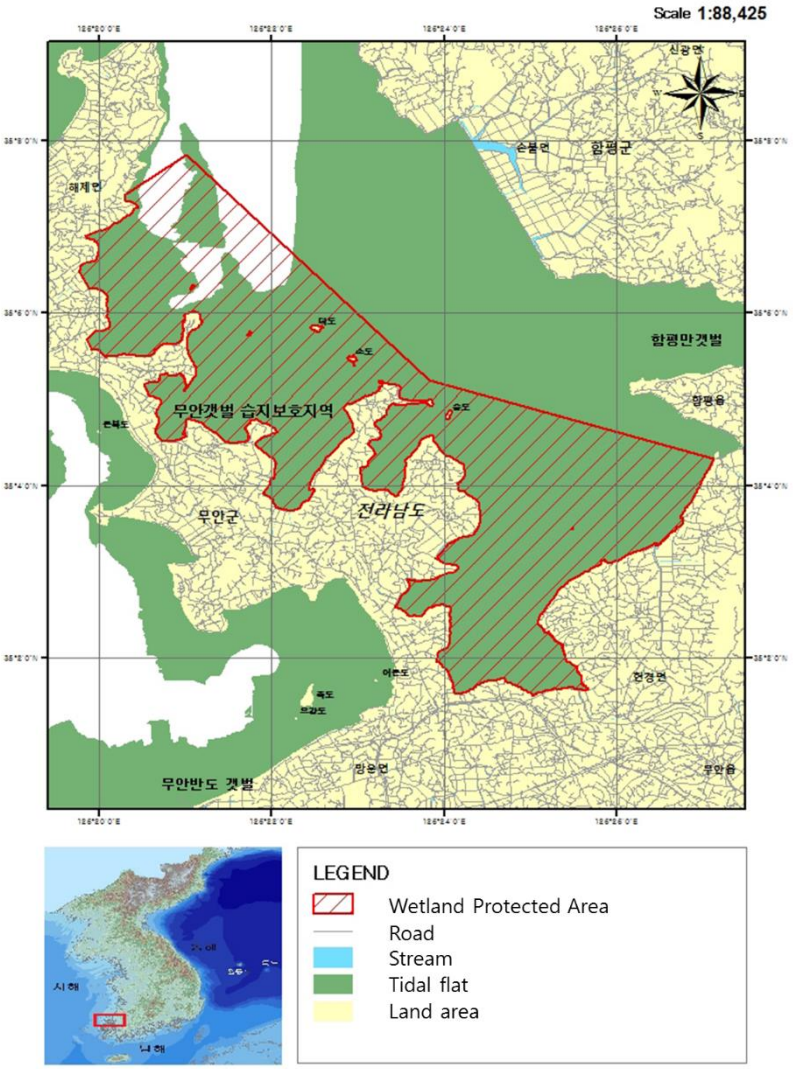
1.3 Objective and Key contents of MPA management plan

1.3.1 Muan tidalflat WPA conservation plan

Muan tidalflat WPA tidalflat was designated as first wetland protected area of ROK in 2001 (42 km^2). As shown in figure 1, it is located in the mouth of 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 the migratory birds.

Muan Tidalflat WPA conservation plan had been reestablished in 2016 by Mokpo regional office of oceans and fisheries. As shown in table 10, the conservation plan will be phased out from 2017 to 2021 and consists of 1 goal, 4 strategies and 13 concrete project plans. Each project plan has an annual budget plan. The total budget plan is about $16,590k. According to WPA conservation plan, Muan county establishes the annual WPA management plan and submit a budget application to MOF by way Mokpo regional office of oceans and fisheries and Jeollanam provincial government. Muan county implement the WPA management yearly as far as assigned budget and plan.



© Muan county

© Muan county

Figure 2. A Map and Photographs of Muan Tidalflat Wetland Protected Area

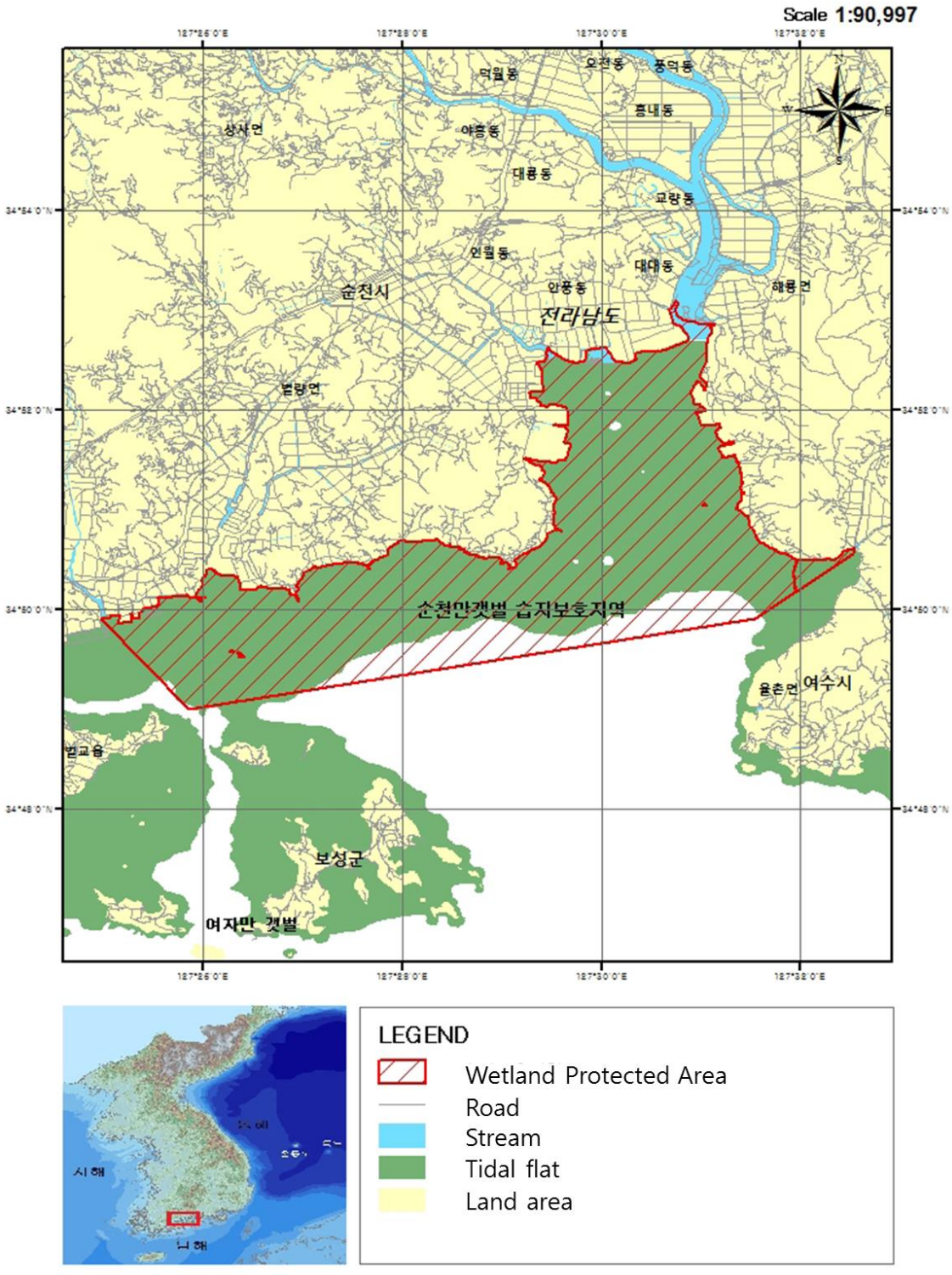
Table 10. Key Contents of Conservation plan of Muan tidalflat WPA (2017-2021)

○ Management Goal: Coexistence of wetland and human in harmony through sustainable development of Muan Tidalflat
○ Strategies and project plans
- Strategy 1: Conservation and Management of Nature Resources
· Research and management of 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: Activation of Muan Ecological Tidalflat Center
· Activation of Muan Ecological Tidalflat Center
· Strengthening educational and experiencing contents at Muan Ecological Tidalflat Center
· Building Muan Ecological Tidalflat Recreation Area
· Rebuilding Muan Tidalflat website
- Strategy 3: Enhancement of Muan tidalflat management governance with stakeholders' participation
· Increasing local participation in WPA Management Committee
· Citizen monitoring project led by local residents
- Strategy 4: Management of quality of life of stakeholders
· Building local network in Muan tidalflat area
· Commercialization of fisheries products from tidalflat
· Clean-up of wetland environment

1.3.2 Suncheon bay tidalflat WPA conservation plan

Suncheon bay tidalflat was designated as wetland protected area in 2003 (28 km^2). As shown in figure 2, 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 only wintering site for 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*).

Suncheon Bay Tidalflat WPA conservation plan had been reestablished in 2018 by Yeosu regional office of oceans and fisheries. As shown in table 11, The conservation plan will be phased out from 2019 to 2024 and consists of 1 goal, 4 strategies and 17 concrete project plans. Each project plan has an annual budget plan. The total budget plan is about $45,773k. According to WPA conservation plan, Suncheon city establishes the annual WPA management plan and submit a budget application to MOF by way yeosu regional office of oceans and fisheries and Jeollanam provincial government. Suncheon city implement the WPA management yearly as far as assigned budget and plan.



LEGEND

- Wetland Protected Area
- Road
- Stream
- Tidal flat
- Land area

© Suncheon city

© Suncheon city

Figure 3. A Map and Photopraphs of Suncheon Tidalflat Wetland Protected Area

Table 11. Key Contents of Conservation plan of Suncheon-bay tidalflat WPA (2019-2024)

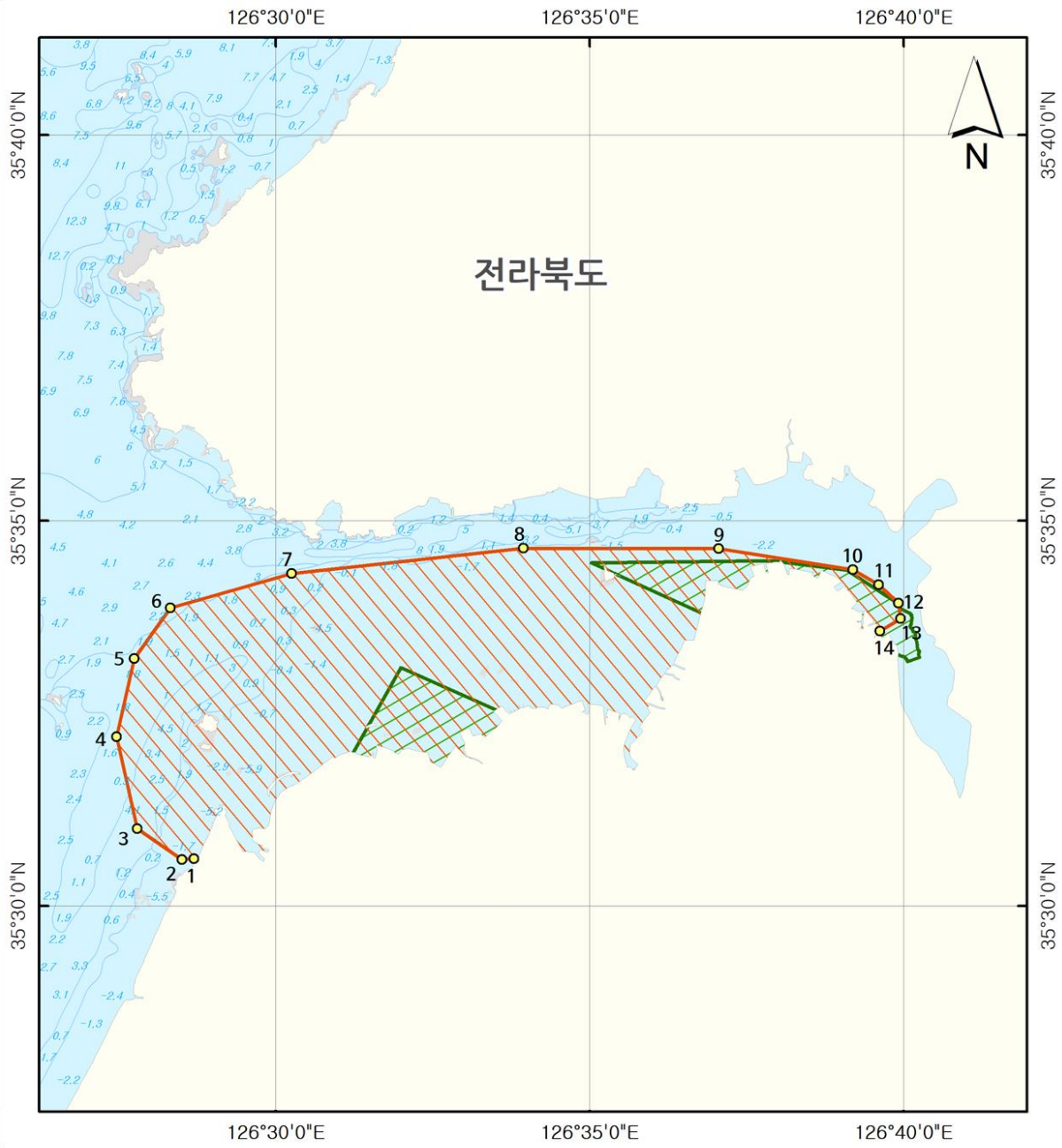
○ Management Goal: Sustainable development of Suncheon Bay tidalflat WPA as the capital of ecology ○ Strategies and project plans - Strategy 1: Conservation · Factual survey and management of marine protected areas · Pollution prevention and management of neighboring waters · Factual survey and management of marine wastes · Zoning of Suncheon Bay marine protected area · Tidalflat restoration of Suncheon Bay - Strategy 2: Management · Strengthening ecosystem preservation system · Citizen monitoring led by local residents · Running honorary administrators · 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 to preserve Suncheon Bay · Management capacity building in marine protected area · Increased awareness to sustainability - Strategy 4: Abundance · Creating sustainable fishing environment · Public contest project · Ecological resource observation programs · Increased brand value of Suncheon Bay

1.3.3 Gochang tidalflat WPA conservation plan

Gochang tidalflat had designated as wetland protected area in 2007 (10.4 km^2) and expanded in 2018 (64.66km^2). As shown in figure 3, it is located in Gomso Bay and is one of the important tidalflats for migratory seabirds along the west coast of 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 important for fish as spawning and nursery grounds. The tidalflat is used for fishing and farming of Manila clam (*Tapes philippinarum*), and Corb shell (*Cyclina sinensis*).

Gochang tidalflat WPA conservation plan had been reestablished in 2019 by Gunsan regional office of oceans and fisheries. As shown in table 12, the conservation plan phased out from 2020 to 2024 and consists of 4 strategies and 15 concrete project plans. Each project plan has an annual budget plan. The total budget plan is about $5,531k. According to WPA conservation plan, Gochang county establishes the annual WPA management plan and submit a budget application to MOF by way Gunsan regional office of oceans and fisheries and Jeollabuk provincial government. Gochang county implement the WPA management yearly as far as assigned budget and plan.

Scale: 1:150,000



LEGEND

Wetland Protected Area(Expanded)

Wetland Protected Area
(Before Expanded)

Land area

© Gochang county

© Gochang county

Figure 4. A Map and Photographs of Gochang Tidalflat Wetland Protected Area

Table 12. Key Contents of Management Plan of Gochang Tidalflat WPA

- Strategy 1: Healthy tidalflat conservation and nature-friendly recovery · Systematic management and survey of titalflat ecosystem ·Management of marine protected lives and bio-diversity - 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 Visiting facility and MPA notice board · Capacity building of Management - Strategy 3: Eco-friendly management and promotion awareness of tidalflat · Sustainable tidalflat fishing area building · Promotion awareness of sustainable fishermen · Promotion public awareness of Gochang tidalflat - Strategy 4: Wise use and Improvement of quality of life of stakeholders · Project contest of residents · Supportment of autonomous management fishing Village · Invigoration of fishing Village · Establish Eco-tour manual of Gochang tidalflat

2. Monitoring and assessment of designated MPAs

2.1 Monitoring parameters

2.1.1 Areas addressed by the monitoring parameters and Monitoring bodies and collection of data

In ROK, MOF as the central government having jurisdiction over nationwide marine of our country is operating survey systems such as National marine ecosystem monitoring, marine environment measurement network, automatic measuring network for marine water quality, fixed oceanographic survey, fishing ground environment monitoring, citizen monitoring, etc. for prompt diagnosis and evaluation of status and change of our country's marine ecosystem. In particular, to identify ecosystem's status of NEAMPAN Sites as the subject of this study, utilization of the results from national marine ecosystem monitoring program and marine environment measurement network are proper.

National Marine Ecosystem Monitoring Program

As shown in table 13 and figure 4, MOF has operated national marine ecosystem monitoring since 2015 which integrated existing surveys related to marine ecosystem that used to be operated individually. Korea Marine Environment Management Corporation (KOEM) has been producing basic scientific data throughout tidalflat, coastal, adjacent seas, and underwater ecosystem of our country according to the consignment by MOF. Focused monitoring is conducted every year and focused monitoring sites are ecologically important areas, such as MPAs. Fundamental monitoring sites are distributed evenly in sea area.

Table 13. Stepwise project implementation directions

Step	Contents
Step1 (2015~2020)	Tidalflat, inshore, offshore monitoring (two-year basis)
	- 2015/2017/2019: West sea, South-west sea - 2016/2018/2020: South-east sea, East Sea, Jeju
Step2 (2021~2025)	Tidalflat, inshore, offshore monitoring (one-year basis)

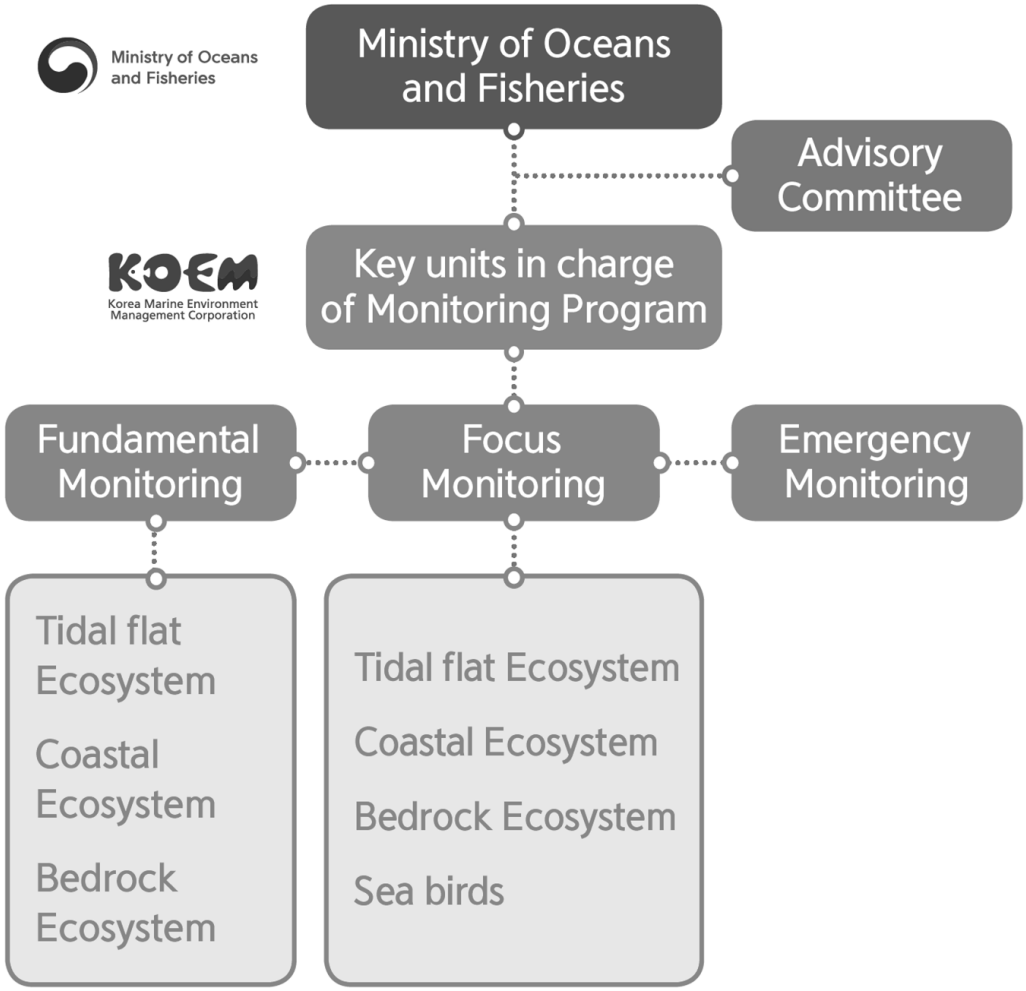


Figure 5. Implementation system of National marine ecosystem monitoring program

As shown in table 14 and 15, to basically monitor the marine ecosystem status in coastal wetland (tidalflat), MOF has implemented the National marine ecosystem monitoring program every year. The fundamental monitoring program has three classified types of monitoring: ① Coastal (inshore, offshore) ecosystem, ② bedrock ecosystem, ③ tidalflat ecosystem where the tidalflat ecosystem monitoring program is relative to the NEAMPAN sites. The tidalflat ecosystem monitoring program has four monitoring parameters: ① sedimentary environments (granularity, organic matter concentration, and trace metals concentration), ② macro benthos (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).

Furthermore, in order to evaluate the nature society economy status factors, this study utilizes the resident awareness survey results performed as part of the National marine ecosystem monitoring program. It measures the values of tidalflat ecosystem conservation areas and will become the basis of protecting natural habitat and revitalize the region through domestic and global promotion. In particular, the resident awareness survey is known to have provided an opportunity of receiving administrative and conservation development supports from the government and local governments by comparatively analyzing the conservation and management status and socio-economic changes after the designation in the coastal wetland protected areas. Also, it has been performed to provide basic data in tidalflat conservation and management policies by comparatively analyzing the conservation and management status and socio-economic changes after designation in coastal wetland protected areas. It also contributed to providing basic data for expanding local participation and improving quality of life by preserving wetland near coastal wetlands.

Table 14. The sampling station number of 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)	
Tidalflat	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 15. Parameters of National marine ecosystem monitoring program

Category	Subdivision	Survey item	Object domain	Detailed content
Biotic	Plankton	Microbe	water area	Total count
		Plant plankton	tidalflat	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	tidalflat	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	tidalflat	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
		Other fishery resources	water area	Species composition, standing crop, biomass
	Seabird	bird	tidalflat/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	tidalflat	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	tidalflat	Residents' awareness questionnaire survey

Table 16. Parameters of Residents' awareness change

Contents	Detailed content	Note
Cognition and Cognition channel of WPA designation	Cognition of WPA designation	-
	Cognition of international ramsar wetland site designation	Except Si-heung
	Cognition channel of WPA designation	-
	Cognition of Wetland protection necessity	-
	Reason of Wetland protection necessity	-
WPA P.R degree of local residents	Degree of wetland protected area designation P.R on residents	-
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	-
Effects of Wetland protected area designation on life and Income	Income change after wetland protected area designation	Include Si-heung

	Effects 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 good wetland protected area management	-
	Reason of poor wetland protected area management	-
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
Agreement status of wetland protected area expansion	Agreement status of wetland protected area expansion	-
	necessary progects in case of additional designation on wetland protected area	-
Character of respondents	Region/sex/age/householder otr marital status of householder	-
	Family income, occupation	-
	Number of household members	-

* Si-heung tidalflat had been considered to designate ramsar wetland site.

Marine Environment Measurement Network

As shown in figure 6, MOF has been operated as marine environmental measurement network since 1996 to provide the scientific foundation necessary for establishing and proposing effective national marine environment conservation policies, and providing services for the public and create a comprehensive environmental measurement network by conducting research on the marine ecosystem using a range of methods. The main objective of project is to conduct research on the marine environment and conditions of coastal waters and to gain a comprehensive understanding of this environment in order to establish effective environmental management policies. Marine environment information made available to a wide range of user groups, including Government, municipalities, academia, and the public, and Strengthened measurement functions for marine environment research and study. Korea Marine Environment Management Corporation (KOEM) has conducted monitoring and produced basic scientific data according to the consignment by MOF every year.

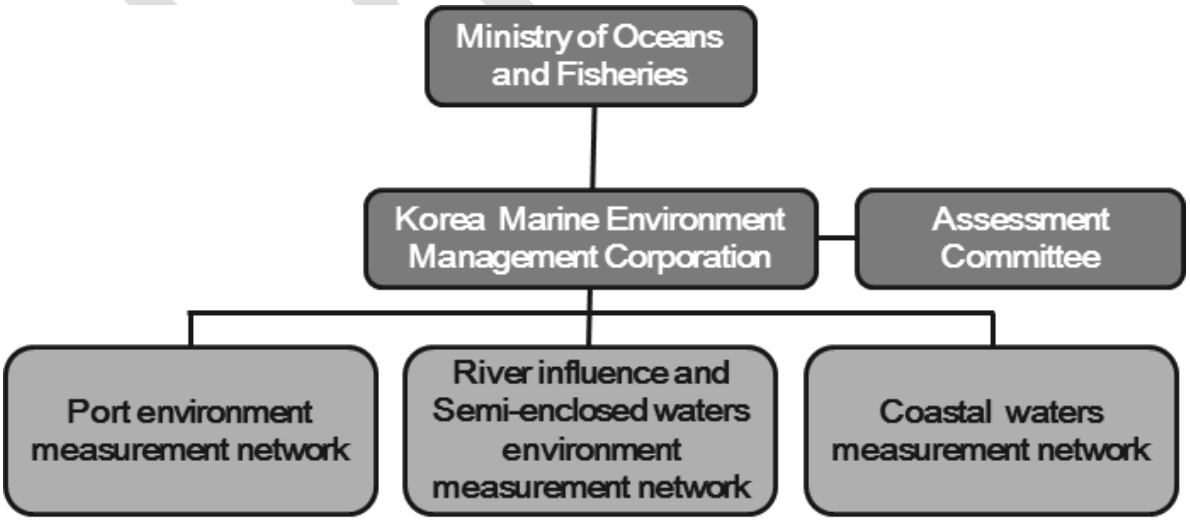


Figure 6. Implementation system of the marine environment measurement network

To monitor the marine environment status, MOF has implemented the marine environment measurement network 4 times (Feb, May, Aug, Nov) every year. As shown in table 17 and 18, The monitoring program has three classified types of monitoring:①Port environment measurement network (50 stations), ②River influence and Semi-enclosed waters environment measurement network (230 stations), ③Coastal waters measurement network (145 station), and a total of 425 monitoring stations.

Table 17. 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 18. The sampling station number of the marine environment measurement network

Measurement network	**Ecology area**		**No. of monitoring seas (No. 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	Hampyeong bay	1 (4)

	area	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)

2.2 Assessment of data

2.2.1 Assessment criteria and responsibilities: How and who evaluate the monitored data

MOF has established national marine environment policies for conservation of the healthy marine ecosystem such as preparation of marine ecosystem grade map, designation of Marine Protected Area, establishment of MPA management plan, conservation of biodiversity, sustainable use of ocean, whole response to global environment changes, etc. by evaluating the survey and analysis data. Concepts and purposes of marine monitoring programs flow chart is shown in figure 7.

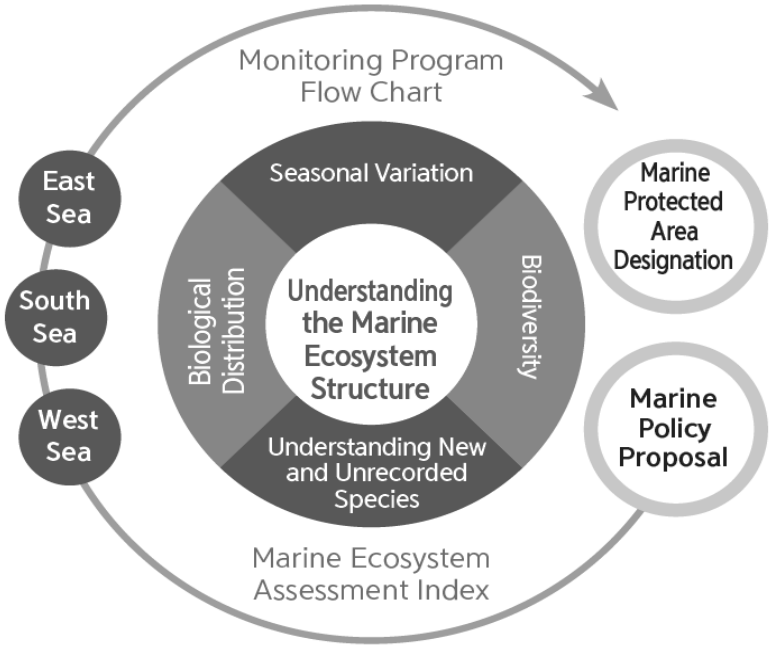


Figure 7. Marine monitoring programs flow chart

2.2.2 Assessment against goals and indicators: How the evaluation / assessment is made against goals / indicators identified (if any) in the strategic / management plan

As shown in table 19, MOF has established and implemented the assessment and evaluation system of the monitored data and 4 types of the assessment and evaluation has implemented. The results of assessment and evaluation are applied to annual management plan and basic management plan. Management process and feedback system of WPA are shown in figure 8.

Table 19. System for Assessment and Evaluation of the Monitored 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
Protected Species Assessment and Management	Reinforce Management of Species with high ecological value, such as protected species	1) Integrated assessment of Marine life subject to protect

Discover Indicator Organism	Discover indicator organisms to diagnose marine ecosystem	1) Discover indicator organisms through statistical methods or experiential analysis
Marine Ecosystem Assessment Standard	Analyze Effect of Policy by developing indicators such as healthiness	1) Improve Marine Ecosystem Plan
		2) Create Evaluate Standard for Marine Ecosystem
		3) Develop Evaluation Indicator to analyze the effect of policy

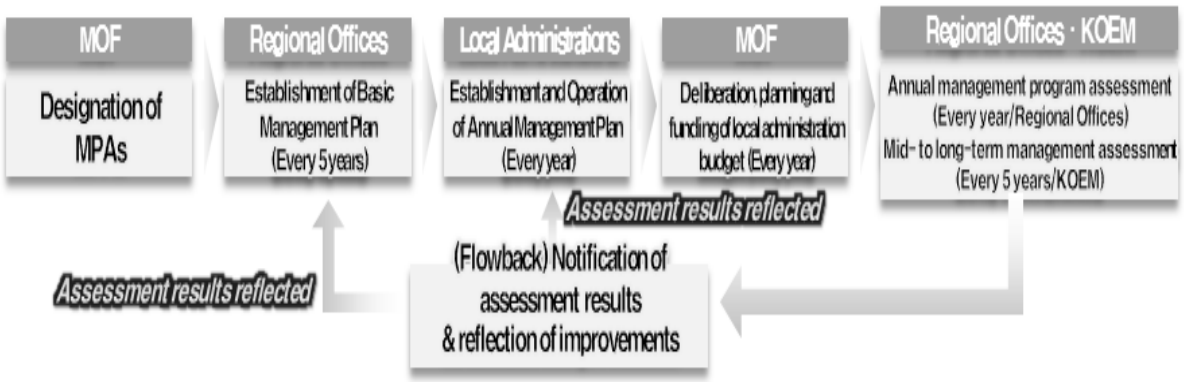


Figure 8. Management Process of WPA

2.3 Links between monitoring/assessment results and management

2.3.1 Use of monitoring data: How it used for assessment, how monitoring results are followed up or reflected in the future plans / strategies

In ROK, monitoring data are the most important fundamental data for policy maker, such as central government and related organization, and have used various ways. As shown in table 20, in accordance with assessment and evaluation of monitored data, central government decides directions of related policies, design new policy, establish related strategies and plans, etc.

Table 20. System for Assessment and Evaluation of the Monitored Data

Category	Contents	Output
Support Policy for Marine	Publish scientific data for Policy enforcement	1) Consultative body and establish plan

ecosystem and Environment	and effect analysis	2) Designate MPA and information support
		3) Proactive and manage emergency monitoring team
		4) International Cooperation Support
PR Diversification of Marine Ecosystem and Environment	Global action for marine ecosystem change and analyze effect of Policy	1) Provide regular press briefings
		2) Publish Regular Policy report
		3) Reinforce PR·Education on Marine ecosystem

2.3.2 Institutional aspects: Parties involved in the management of MPAs (implementation of plans, monitoring the implementation, etc.)

To promote systematic conservation and wise use of excellent marine ecosystem, WPA is operated based on the regional autonomous type of management system. The central government implements tasks concerning support, evaluation, and awareness enhancement of the management projects, while the regional offices of MOF establish. The local government implements management project plans through governance by organizing regional management committees with participation of various stakeholders in conservation management of WPAs.

In accordance with national ecosystem monitoring program and related monitoring conducted by the local administration, MOF assesses and evaluates the status of MPAs.

3. Feedback of assessment results to management plans and practices

As shown in figure 8, in WPA of ROK, similar to many countries which have MPAs, management basic concept is adaptive management system (WWF, 2008). Regional Office of Oceans and Fisheries (ROOF) establishes conservation plan of MPA and sets the management goal. In accordance with conservation plan, local administration implements projects concerning conservation and management and MOF/KOEM conduct monitoring and assessment of every MPAs in ROK.

①MOF designates MPA and sets the management and conservation goal. ②ROOF establish mid-term management plan. ③Local Administration implements various projects to manage and conserve MPA site. ④MOF/KOEM survey the status of MPA sites. ⑤MOF/ROOF/KOEM conduct annual assessment and mid-term management effectiveness evaluation. ⑥ the assessment and evaluation results apply to MPA's conservation and management, various management plan establishment.

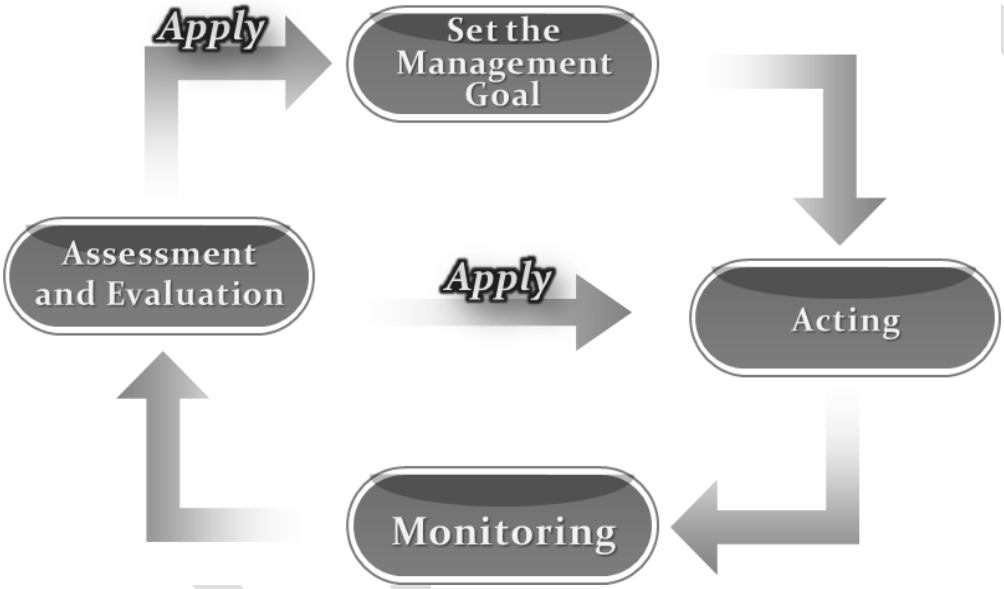


Figure 9. Concepts of Adaptive Management in WPA

MOF together with ROOF are conducting annual management assessment and Mid-term management effectiveness evaluation by mandating and consigning KOEM for the purpose of reflux of management of Marine Protected Area conservation. The annual project evaluations conducted since '08 are aimed at evaluation of whether the foundations for regional autonomous management system have been established by checkup of management projects for MPA performed by the local administration in the relevant year. Evaluation results in the form of a checklist are being utilized by the method of conferring differentiation for the additionally required projects for management of Protected Area conservation along with reflux so as to be reflected in the next year's management projects. Annual MPA (WPA) management evaluation process and annual MPA management assessment form is shown in figure 10

and table 21.

* LA: Local Administration
MA: Metropolitan Administration
ROOF: Regional Office of Oceans and Fisheries
MOF: Ministry of Oceans and Fisheries
KOEM: Korea Marine Environment Management Corporation

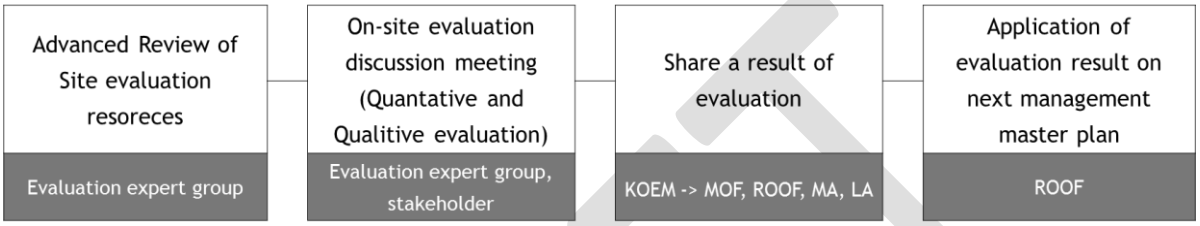
Figure 10. Annual MPA Management Evaluation Process

Table 21. Annual MPA management assessment form

Management Category (Score)	**Evaluation Indicator**	**5 Score**
Management base (2)	Composition of Regional Management Committee	Composition: 1 None: 0 *Establishment of Regional Regulation: 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 annual detailed project plans 3. Evaluation of management project results	Twice: 1 Once: 0.5 None: 0
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 Normal: 2 Insufficient: 1
Budget Execution (3)	Annual Rate of Budget Execution	90%~: 3 80%-90%: 2.5 70%-80%: 2.0 60%-70%: 1.5 ~60%: 0
Participation (2)	Did MPA Manager (Local Administration manager) participate workshops or capacity building programs?	participation: 1 None: 0
	Did MPA Stakeholders (residents, NGO) participate workshops or capacity building programs?	participation: 1 None: 0

Mid-term management effectiveness evaluation that has been incorporated since '12 through development of 11 indicators, is aimed at evaluation of effectiveness for fulfillment from the mid- to

long-term viewpoints on basic plans for Marine Protected Area management. Evaluations are conducted in every 5 years after new establishment and re-establishment of basic plans for management and conducts qualitative/quantitative evaluations by advance written reviews for fulfillment items and holding of field evaluation meetings with participation of regional stakeholder. By evaluation of 5 areas such as management foundation, management plan, resource incorporation, management process, management result, etc. for fulfillment of management plans and derivation of improvement directions, they are made to be reflected in establishment and fulfillment of next basic plans for management. Mid-term MPA (WPA) management effectiveness evaluation process (quinquennial) and management effectiveness evaluation form are shown in figure 11 and table 22.



* LA: Local Administration
MA: Metropolitan Administration
ROOF: Regional Office of Oceans and Fisheries
MOF: Ministry of Oceans and Fisheries
KOEM: Korea Marine Environment Management Corporation

Figure 11. Mid-term MPA Management Effectiveness Evaluation Process (quinquennial)

Table 22. Mid-term MPA Management Effectiveness Evaluation form

Management Section	**Question**	**Score (Likert Scale, 1-5)**
Management base (3)	MPA regulation	
	Secure of MPA information	
	Level of stakeholder awareness	
Management plan (3)	MPA Goal	
	Understanding of status of use and threat factors	
	Establishment of Conservation and Management plan	
Input of Resources (3)	Research and Monitoring	
	Management human resources	
	Securing of budget	
Management process (5)	Stakeholder communication	
	Management and supervision of regulation observance	
	Education and Awareness increasing Program	
	Education and capacity building of Management staff	
	Supplement of public relations (PR) and information resources	
Management result (3)	maintain of purpose of MPA designation	
	Management of conflict factors	
	Appropriateness of charging management price and input of income	

4. Case studies – monitoring and assessment results and corresponding measures in the selected MPA

4.1 Muan Tidalflat Wetland Protected Area

4.1.1 Monitoring and assessment results

From the analysis of monitoring the measurement network for marine environment implemented by MOF and KOEM from 2011 to 2014, it was found that T-P and T-N exceeded the water quality standard which was surveyed for worsened water quality with nitrogen and phosphorus. At Muan-gun, pollution sources discharged from livestock farms flow down to the tidalflat along the small streams and worsen the pollution in the form of deposits. As a result, benthos has tended to decrease continuously to a level of serious threat. Most pollution in the coastal area is caused from the land. The harmful substances present in living sewage water, industrial wastewater, and agriculture & livestock industry wastewater largely affect lives in the marine area. Environmental hormones have been causing a fatal effect on the marine ecosystem as time passes by.

As shown in table 23 and figure 12 and figure 13, according to the average volume of sewage water and the generated amount of feces and their treatments in Muan-gun, it has been surveyed that the population that did not apply the treatment was 39.7% compared to the total population, and the treatment outside of the sewage water treatment zone was 33.7% compared to the generated amount of sewage water. However, Hyeongyung-myeon and Haejae-myeon, where the WPA is located, have been surveyed to have higher ratio of nontreatment than the average treatment ratio in Muan-gun.

Table 23. Area Standard of WQI (Water Quality Index)

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

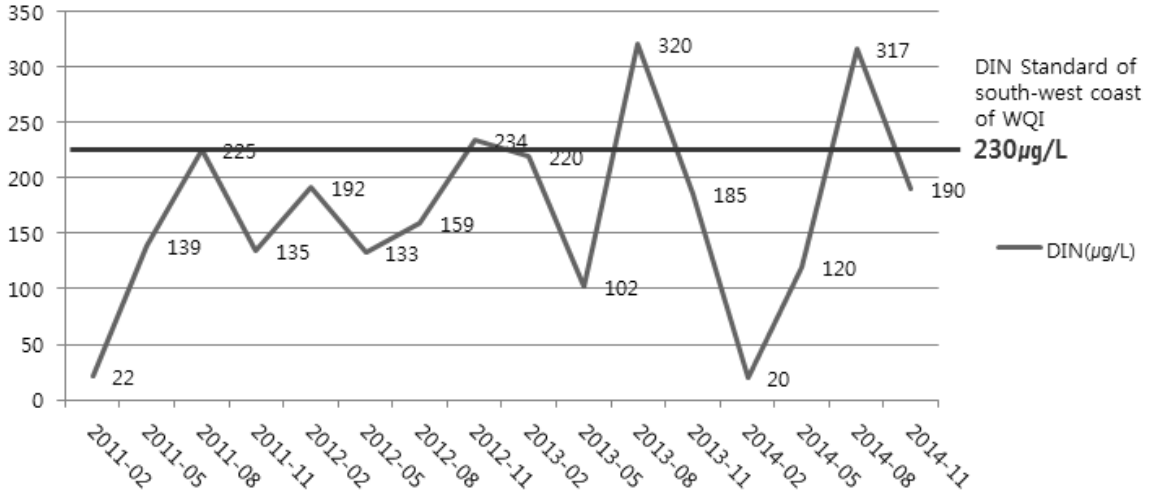


Figure 12. Dissolved Inorganic Nitrogen (DIN) concentration of Hampyeong-bay (2011-2014)

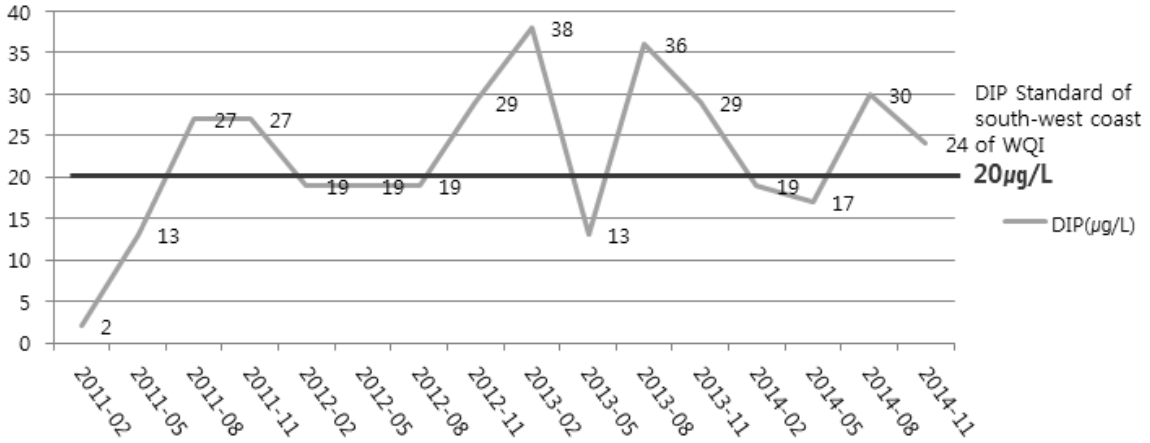


Figure 13. Dissolved Inorganic Phosphorus (DIP) concentration of Hampyeong-bay (2011-2014)

4.1.2 Corresponding measures and outcomes/expectancy effects

Through the analysis on monitoring results during the establishment of a management plan for the WPA at Muan tidalflat in 2015, the level of seriousness of pollution in the marine area has been identified. To enhance the diversity of species and to recover the healthiness of the Muan tidalflat's ecosystem, general surveys were implemented for the environment of water quality in Hamhae Bay: a survey project was carried out to assess water quality in Hamhae Bay to establish management measures for the marine environment of the WPA; and another survey project assessed non-point pollution sources near small streams flowing into the WPA. The inflow status was identified for non-treated sewage water flowing into Hamhae Bay from Hyeongyung-myeon and Haejae-myeon. A plan for a sewer has been established and expanded at the place to have treated water flow into Muan tidalflat. As non-treated sewage water is discharged from the livestock farm and farming area, the discharge path was surveyed for non-point pollution source in the hinterland of Muan tidalflat, and management measures were established. A treatment project for waste deposited at the coastal area (waste fishing tools and net) has also been reflected on the management plan (2017-2021) for the WPA at Muan tidalflat.

Reflecting on the management plan to establish and manage preventive measures for pollution in the marine area, it is expected to induce healthiness of fish and shellfish and an increasing effect on fishery resources through improvement in the water quality of Hamhae Bay, and also facilitate the reinforcement of wetland protection through management of surrounding agricultural area and livestock farms and the treatment of waste in the marine area.

4.2 Suncheon Bay Tidalflat Wetland Protected Area

4.2.1 Monitoring and assessment results

Monitoring results

Suncheon-bay tidalflat is a popular place for the hooded crane wintering site. The hooded crane, which is the bird that symbolizes Suncheon City, is a winter migratory bird that visits the Suncheon Bay wetland every year in October, winters for about 6 months, and leaves at the end of March of the following year. And also, the hooded crane was designated as the Endangered Species Grade II and the 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 figure 14 and 15, since about 70 cranes wintering at Suncheon Bay have been observed for the first time in November 1996, the number of wintering population of cranes is 219 in 2006.

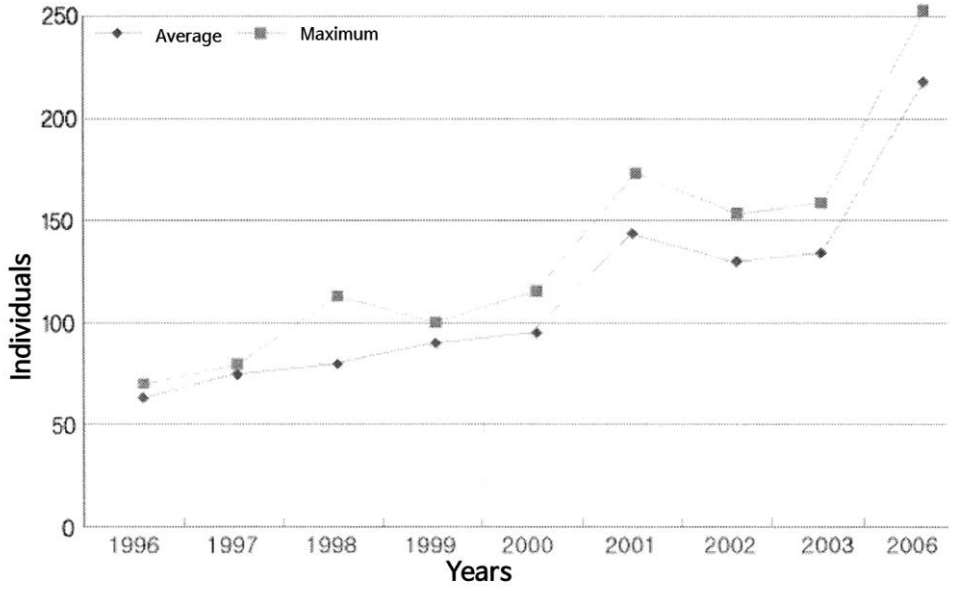


Figure 14. The number of Individuals of Hooded Cranes in Suncheon bay (Suncheon city, 2008)

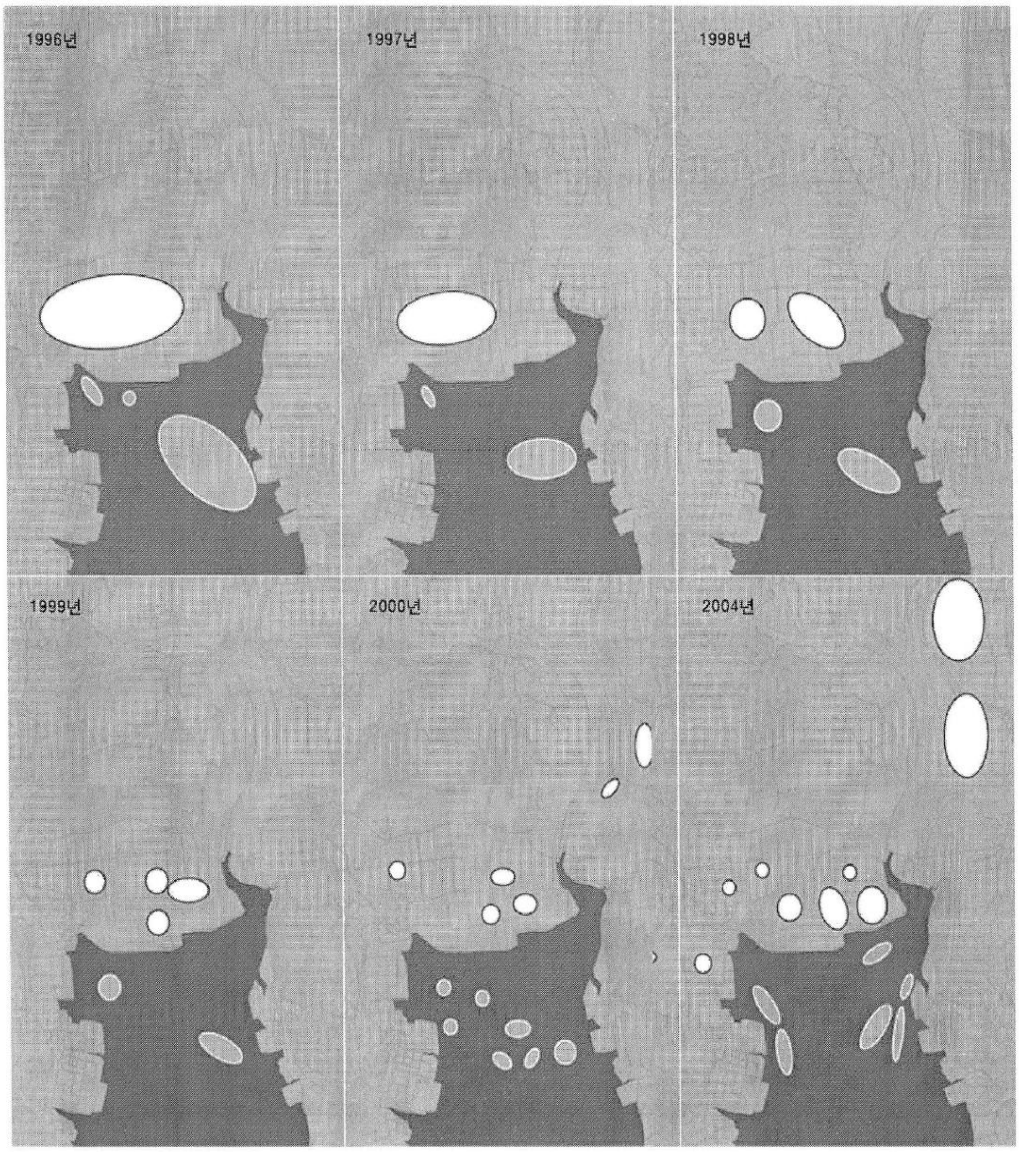


Figure 15. Distribution of Hooded Cranes in Suncheon bay (○ Feeding Place, ● Resting Place)

Assessment results

Suncheon city implemented 'Study on efficient conservation and sustainable use of Suncheon-bay' to establish the image of high technology eco-environment city through conservation of nature environment of suncheon-bay and sustainable use in 2008.

According to the results from the present study, in 2017 more than 80% of entire population of hooded cranes (about 8,000 birds) were wintering in the Izumi area of Japan. It has been evaluated that problems such as increased death rate and spread of infectious diseases appeared as the overcrowded population was concentrated on one area.

In addition, regardless of the intake of the allowable limit by Izumi, the population of hooded cranes at Suncheon Bay has been increasing continuously. Hence, it has been judged that improvement in the inhabitation environment of hooded cranes may contribute to the importance of Suncheon Bay and bring

in international recognition.

Accordingly, to prepare a framework to improve and preserve the inhabitation environment for hooded cranes, it was studied how hooded cranes were distributed within the area of Suncheon Bay and what characteristic they showed. Examining the results since the time when a local environmental group started the observation on hooded cranes, it was seen that they actively move from tidalflat area to reclaimed farming area. The range of activity by hooded cranes has widened on account of the population increase.

From the results of surveys held in 2000 and 2004, it was noted that the activity range was expanded up to Haeryongdeul (near the sewage treatment plant). The expansion of activity range by hooded cranes has been interpreted to lead to an increased possibility of conflict with humans and the necessity of efficient management through the division of the ecosystem preservation zone.

4.2.2 Corresponding measures and outcomes/expectancy effects

Suncheon city have taken various measures to protect and manage the habitats of migratory birds and the hooded crane.

4.2.2.1 Tidalflat conservation

The Suncheon Bay tidalflat is the important sleeping and resting place for hooded cranes and the place of life for the residents living in 11 fishing villages as well. The 11 fishing villages near Suncheon Bay are participating in the coastal management by performing the environmental cleanup activities from time to time. They are making efforts to maintain clean coastal waters by collecting the marine garbage that is flowed into Suncheon Bay due to typhoons, tsunamis and intensive summer rainfall. They have set and managed a close season for fishing from July to August every year in order to prevent depletion of fish stocks since 2000. However, the reed colonies in the wetland conservation area are expanding and encroaching on the area of tidalflat every year as time goes by. The expanded reed colonies inhibit the growth and development of phytoplankton by blocking the penetration of sunlight on the surface of the tidalflat.

The members of Fishing Village Fraternity have promoted the reed management project in 2010 and from 2015 to 2017 in order to secure the habitat space for benthic organisms that become food for the migratory birds and to prevent the decline in landscape value caused by the waste flowing into the rainy season. The project has also contributed to the increase of income of the residents living in the surrounding area of Suncheon Bay and participating in the project.

4.2.2.2 Farmland Management

The main sleeping and resting places of the hooded cranes are the areas near salt marsh and the paddy fields. Their main feeding places are the rest areas and the nearby farmlands. Policies to create various habitat environment for the winter birds including the hooded cranes are being implemented from (year). Especially, the paddy fields created in the farmlands adjacent to the tidalflat are used not only as the rest place but also as the places for sleeping of the cranes. The Biodiversity Management Contract projects have been implemented annually since 2005 for the farmlands adjacent to the tidalflat in order to stably supply the migratory birds with food. *It has been conducted according to 'Act on the conservation and*

use of biological diversity' since 2005 and it is being conducted by Suncheon city and Ministry of Environment. The Biodiversity Management Contract refers to the system that the local government leases the farmlands on a seasonal basis. According to the system, the local government compensate the farmers living around Suncheon Bay for their providing the migratory birds with food by leaving the rice straws on the field after harvest or seeding the field with barley. In addition, the city designated the Inantteul,paddy field which feeds hooded crane, area as a scenic agriculture zone and removed 282 electric poles in the agricultural land in order to protect the hooded cranes from being caught in the electric wires and injured. In the Hooded Crane Huimang Agricultural Complex, the hooded crane farming group has cultivated rice with eco-friendly farming methods along with the landscape farming since 2009. Backed by Suncheon City's agricultural compensation to the farmers, they cultivate rice with the eco-friendly farming methods and store about 50 tons of grain every year to feed the migratory birds. With the arrival of the winter migratory birds, they scatter about 250kg of grain a day around the farmlands. The scale of the hooded crane farming group paddy field is about 59 ha, and they have created 10ha of paddy field with a water. In addition, the hooded crane farming group is conducting migratory bird protection activities by controlling the access of general tourists into the farmlands in order to maintain stable habitats for the migratory birds during the wintering period.

Figure 16 Panoramic view of the Hooded Crane Huimang Agricultural Complex


Figure 17 Hooded Crane Protection Activities

4.2.2.3 Public Awareness Promotion Project

In 2007, Suncheon City changed its city bird to the hooded crane in order to attract the public attention to the hooded crane and to encourage citizens to participate in the activities for habitat preservation. In order to ensure stable financial resources for habitat conservation, Suncheon City enacted the Ordinance on Preservation of the Suncheon Bay Wetlands in 2014. It regulated 10% of the revenue from the Suncheon Bay National Park and the Suncheon Bay Wetland (about KRW 600 million; approx. USD 520,000) to be funded to preserve Suncheon Bay. Utilizing the fund, Suncheon City is promoting and implementing several projects such as citizens & students' hooded crane monitoring, academic researches, symposiums, ecological festivals and public contests with the local residents participating. As part of the activities for preservation of the Natural Monument no. 228, the city set February 28 as the Hooded Crane's Day and has held the ecological festival with the local residents every year since 2013.

4.2.2.4 International Cooperation for Preservation of Cranes Habitats

Suncheon City hosted an international symposium on the hooded cranes of Suncheon Bay in 2014 for the purposes of conservation of the hooded cranes and their habitats. During the symposium, the participants reviewed the wintering status of the hooded cranes in Korea, shared the wintering-related information with each other and concluded an agreement among Korea, China, Japan and Russia on habitat preservation. Based on the agreement, the countries have shared information of the wintering hooded cranes every year and expanded the civil exchanges through the hooded cranes such as joint filming of breeding places of the hooded cranes in Russia, and the circulating exhibitions of the hooded crane pictures painted by the children of Korea, Japan, Russia and Mongolia. The eco-friendly rice seeds produced in the Hooded Crane Huimang Agricultural Complex have been provided to the middle stopovers of the hooded crane as their food, strengthening the international cooperation to preserve the habitats.

In 2016, Suncheon City hosted an international workshop on habitat preservation for migratory birds together with EAAFP and the Ministry of Environment to share the endangered species of Korea and the experience of habitat preservation and to seek policies to conserve the habitats of the migratory birds.

In April 2018, Suncheon City hosted an international crane symposium on the themes of the dispersion of crane habitats in the Korean peninsula and the joint response to the highly pathogenic AI. The participants shared the information of crane habitats and the occurrence of AI in China and Japan as well as in the Korean peninsula. During the symposium, the International Crane Foundation, Suncheon City, Cheolwon County and Goyang City concluded an agreement in order to disperse the habitats of cranes on the Korean peninsula based on the strengthened cooperation among the local governments.

As the result of steadily efforts, Since about 70 cranes wintering at Suncheon Bay have been observed for the first time in November 1996, the number of wintering population of cranes is rising steadily, from 202 heads in 2004, to 350 in 2009; 693 in 2012; 871 in 2013; 1,432 in 2015; and 1,737 in 2016. Variation of the graph of individuals of hooded cranes by Year is shown in figure 17.

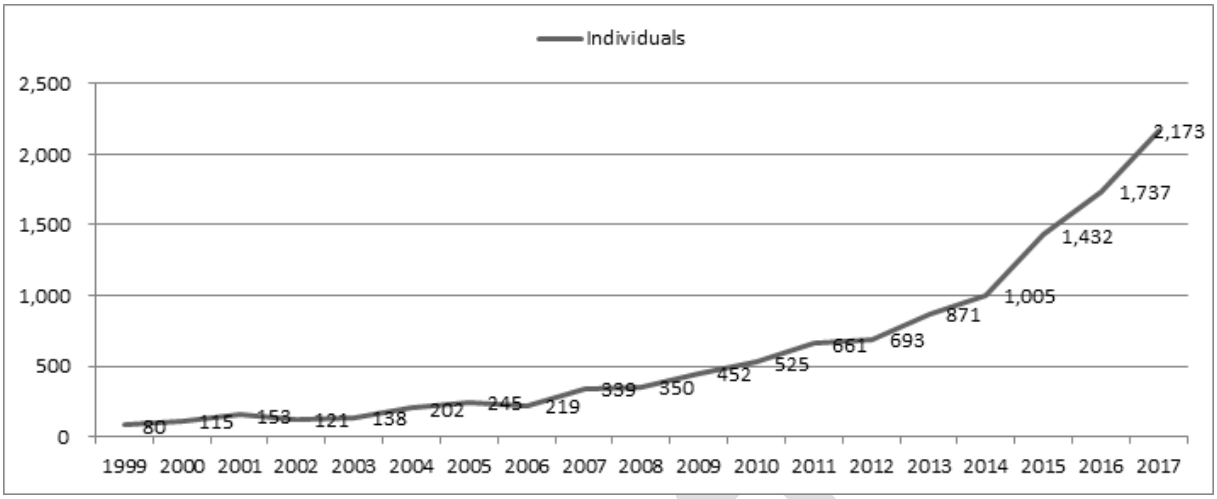


Figure 17. Variation of the Graph of Individuals of Hooded Cranes in Suncheon Bay by Year

It was the result of steadily promoting the project to preserve the hooded crane habitats in cooperation with residents, expanding the protection areas, implementing the public awareness promotion projects, and expanding the domestic and overseas exchanges and cooperation projects.

As the habitats of hooded cranes in the Korean peninsula have gradually become fragmented, however, the hooded cranes have intensively flocked into Suncheon Bay to pass winters and accordingly have been becoming more vulnerable to infectious diseases (diseases, avian influenza). Therefore, it is necessary to control hooded cranes not to be concentrated on Suncheon Bay habitat by feeding them in a wider area nearby, in consideration of the environmental capacity of Suncheon Bay to accommodate them. Together with the efforts to disperse the habitats of hooded cranes of the Korean peninsula, it is also required to promote international cooperation, such as joint research on the migration routes of hooded cranes with Izumi City of Japan and a global co-operation in response to high pathogenic AI is also required.

Reference

Ministry of Environment and National Institute of Environmental Research, 2004, Comprehensive Report on Simultaneous Census for Winter Birds, 1999-2004

Suncheon City and Green Suncheon 21 Promotion Council, 2008, Collection 1 of Suncheon Bay Ecological Conservation Activities – White Paper on Suncheon Bay

Suncheon City, 2008, Study on efficient conservation and sustainable use of Suncheon-bay

Ministry of Land, Transport and Maritime Affairs, 2008-2014, Coastal Wetland Basic Monitoring Program.

Ministry of Environment and National Institute of Environmental Research, 2009, Comprehensive Report on Simultaneous Census for Winter Birds

Suncheon city, 2009, Status of Winter Birds and Cranes Wintering at Suncheon Bay (p 69)

Suncheon city, 2010, Status of Winter Birds and Cranes Wintering at Suncheon Bay (p 107)

Korea Crane Network, 2010, Materials for the 5th Koran Crane Network Conference and Workshop on Conservation of Cranes

Ministry of Environment and National Institute of Environmental Research, 2010, Comprehensive Report on Simultaneous Census for Winter Birds

Ministry of Oceans and Fisheries and Korea Marine Environment Management Corporation, 2012-2017, Marine Protected Areas Management Assessment and Effectiveness Evaluation

Gochang-gun, 2013, Gochang Tidalflat Wetland Protected Area Conservation Plan

Ministry of Environment and National Institute of Ecology (2014), Long-term Ecology Research Series 4 – Climate Change and Survival Strategies of Neritic Organisms and Land Animals; Adaptation of Ocean and Land Organisms (p 24~39)

Ministry of Oceans and Fisheries and Korea Marine Environment Management Corporation, 2015, National Ecosystem Monitoring Program (I. Tidalflat ecosystem)

Ministry of Oceans and Fisheries and Korea Marine Environment Management Corporation, 2016, National Ecosystem Monitoring Program (I. Tidalflat ecosystem)

Ministry of Oceans and Fisheries and Korea Marine Environment Management Corporation, 2016, National Ecosystem Monitoring Program Guide Book (p 142).

Mokpo Regional Office of Oceans and Fisheries, 2016, Muan Tidalflat Wetland Protected Area Conservation plan

Hwang Seon-mi, Suncheon Bay Conservation Department, 2016, Disposal of Wintering Sites of Hooded Cranes (p 12, 15~20)

Ministry of Oceans and Fisheries and Korea Marine Environment Management Corporation, 2017, 2017 National Ecosystem Monitoring Program (I. Tidalflat ecosystem)

Yeosu Regional Office of Oceans and Fisheries, 2018, Suncheon bay Tidalflat Wetland Protected Area Conservation plan

Ministry of Oceans and Fisheries, 2019, Marine Environment Information System (http://www.meis.go.kr/)

Ministry of Oceans and Fisheries, 2019, Marine Ecosystem Information System (http://www.ecosea.go.kr/)