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BRIEFING

ENG

2014

THIS PUBLICATION HAS BEEN PUBLISHED IN PARTNERSHIP BY:

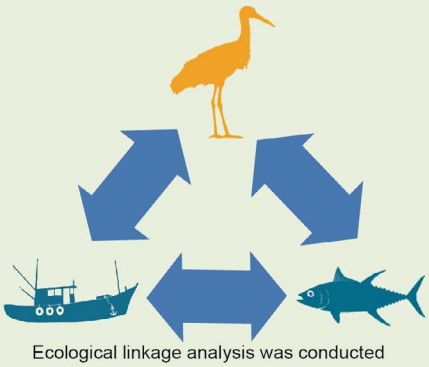
Panasonic

KIOST
KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY

Marine

The Yellow Sea Ecoregion Support Project 2007-2014

EBM and CBM approaches were applied to improve management effectiveness of high conservation value wetlands in the Yellow Sea which the biodiversity conservation effortsand the sustainable use of resources could be generated and good practices delivered.



Ecological linkage analysis was conducted at Yalu River Estuary Coastal Area, China.

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Regional development orientated conservation activities were conducted at Muan Tidal Flat, Republic of Korea.

Ecosystem-Based Management (EBM)

EBM takes human and ecosystem into consideration and comes out to address the increasing dilemmas in environmental protection and economic development. EBM regards humans as part of ecosystem and plans ecosystem building and socioeconomic development as a whole, to guide major stakeholders to engage and cooperate in the course of management. The objects under management are not limited to ecosystem itself, but more importantly include human activities. Management units are divided by the border of each individual ecosystem instead of administrative demarcation.

Community-Based Management (CBM)

CBM is known by a number of different names, including "community-based conservation" and "community-based natural resource management." It has been applied in a variety of areas, including marine resources, farming, forestry, land and water resources. The concept was first formulated by Dr. Elinor Ostrom of Indiana University, who reasoned that public assets such as forests, irrigation systems and marine resources could be depleted by overuse if left to management under market functions, and that this problem could be averted by an approach of collaborative, autonomous management by the community rather than government controls.

Published by WWF, KIOST

This publication has been made by funding from Panasonic Corporation.

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Front cover photo: A young girl digs for shellfish in the tidal flats off Korea's western coast © Image Today

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Published in September 2014

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1. Project Background

The Yellow Sea Ecoregion (YSE), including the Bohai Sea, the Yellow Sea and part of the Yangtze River Estuary, is a high priority for environmental conservation. YSE supports not only large populations of marine life and migratory species, but also local communities relying on its well-functioning ecosystem as well as the neighboring countries. Over the past fifty years, more than half of the wetlands around the Yellow Sea Ecoregion have disappeared because of land reclamation for construction projects, real estate development, industrial park building and the development of aquaculture industries in shore areas.

In 2006, WWF in close collaboration with the Korea Institute of Ocean Science and Technology (KIOST, previously KORDI) and the Korea Environmental Institute (KEI), has identified 23 Potential Priority Areas (PPAs) of the YSE as the result of the biological multi-taxa assessment conducted by the Yellow Sea Ecoregion Planning Programme (YSEPP). In 2007, with financial support from Panasonic Corporation, WWF launched another transboundary project, namely, the Yellow Sea Ecoregion Support Project (YSESP), whose mandate was to improve the effectiveness of habitat management to help conserve the biodiversity of the 23 PPAs.

The seven-year project was composed of three stages. During the first stage from 2008 to 2009, a small grant-awarding scheme was created that supported the activities of 16 conservation research groups within the PPAs with such activities as environmental education and civil monitoring, to help enhance the capacity building of each group and to provide the opportunity to reconfirm the importance of networking in terms of ecology and society. Project participants were also able to gather a variety of information about the status of areas having high conservation value, key stakeholders, conservation methodology and its overall effectiveness once applied.

During the second stage, two demonstrations were carried out both in China and the Republic of Korea (ROK) to improve the management effectiveness of two existing MPAs within the PPAs. Ecosystem-based management (EBM) and Community Based-Management (CBM) approaches were applied in the Yalu River Estuary Coastal Wetland Nature Reserve, Liaoning Province, China (PPA No. 14), and the Muan Tidal Flat Wetland Protected Area, South Jeolla Province, the ROK (PPA No. 20), respectively, as management options upon which the YSE biodiversity conservation efforts and the sustainable use of resources could be generated and good practices delivered. The Yalu River Estuary Coastal Area Ecosystem-Based Management Demonstration Project (hereafter referred to as the YSESP Yalu Project) has a lifespan of 3 years, from 2010 to 2013. It was implemented in 2010-2012 with 15 million Yen (equivalent to USD 150,000) funded by Panasonic through WWF. OFDLP also contributed the same amount of funding to the project,and technical support and guidance were mainly provided by YSLME. The Regional Development Orientated Coastal Area Management Demonstration Project (hereafter referred to as the YSESP Muan Project) has a lifespan of 3 years, from 2010 to 2013. The implementation was from 2010 to 2012 with 15 million Yen (equivalent to USD 150,000) funded by Panasonic through WWF.

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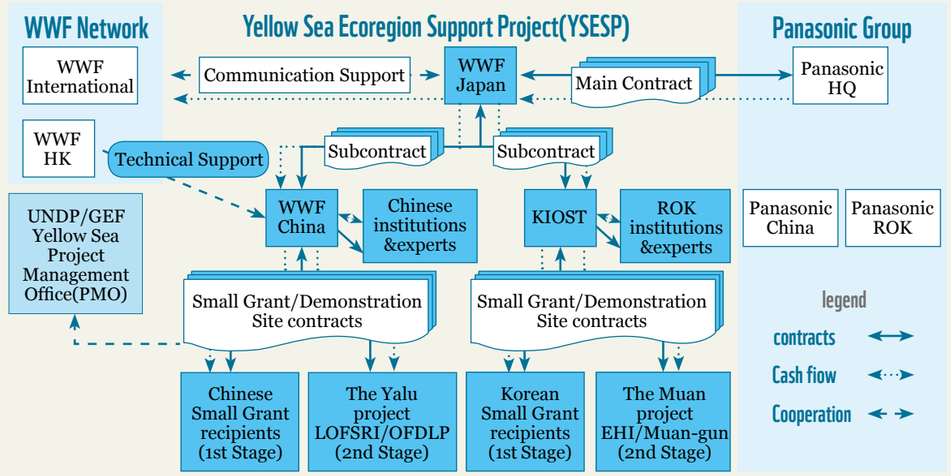
The YSESP implementation structure is shown in Figure 1.



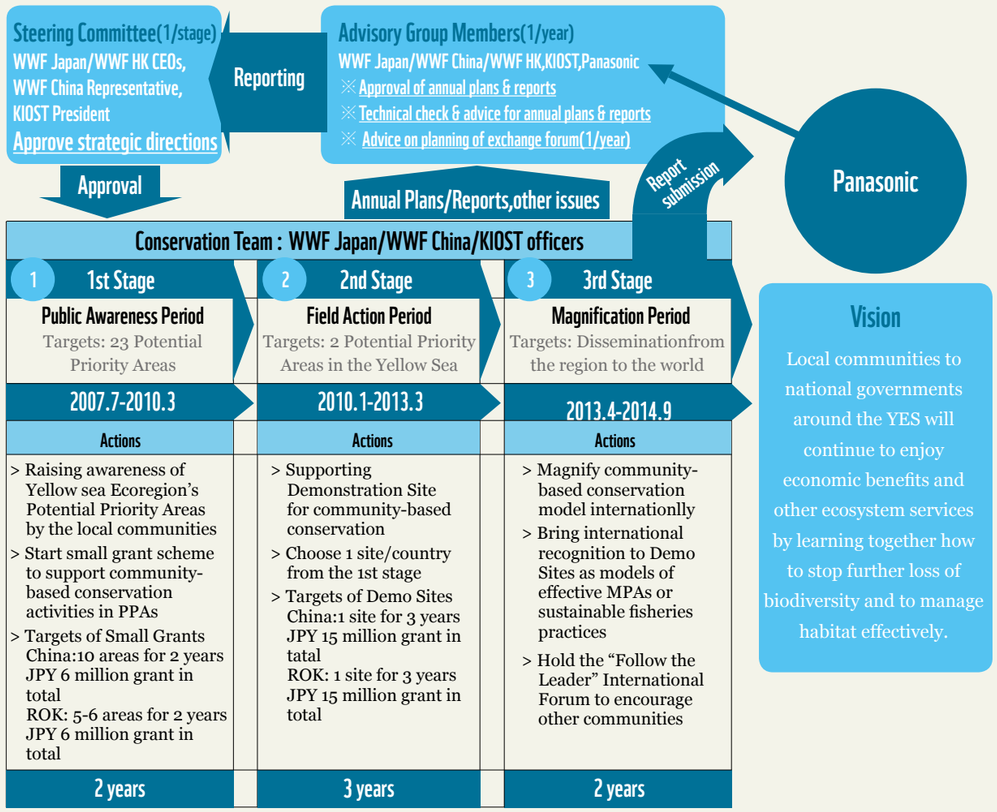


Figure 1 The YSESP implementation structure

Disseminating and sharing lessons regarding the two conservation models were carried out during the final two years of the third stage in China and the ROK, working with national stakeholders as well as the international conservation community. All the affected countries surrounding the YSE have agreed with the Convention on Biological Diversity's (CBD) Aichi Target 11, which states that at least 10 percent of coastal and marine areas need to be effectively and equitably managed by 2020.

The YSESP is expected to contribute to achieving objectives, serve as a platform that connects governments, research institutions, local communities and NGOs, and cooperates with them in order to conserve internationally important species and habitats in the YSE. The vision is that the local communities and national governments around the YSE will sustainably benefit from economic and other ecosystem services by learning how to prevent any further loss of biodiversity and to manage the habitat effectively. The goals are to significantly increase the capacity of local managers and practitioners for MPAs management and biodiversity conservation with advanced knowledge, new policies, sustainable financing and operational network. The objectives are to raise the public awareness with improved skills, to improve and use a zoning scheme by two visionary local leaders of the demonstration sites committed, to improve management effectiveness of demonstration site MPAs, and to sustain the learning center with commitment to policies/mechanism.

2. Yellow Sea Ecoregion Biodiversity and Issues

2.1 Biodiversity and Ecological Functions in Yellow Sea Ecoregion

The YSE used to be dry land but the last glacial cycle brought dramatic environmental changes to the area, such as the Holocene marine transgression, which flooded the region and creating the Yellow Sea. At present, the YSE is a large semi-closed sea surrounded by mainland China and the Korean peninsula, has a total area of 458,000 km² and an average depth of 46 m, and is located between longitudes 117° and 126° and latitudes 31°and 41°, with mean temperatures in July of 24°C in the north and 28°C in the south and in January of -8°C and -4°C, respectively. This vast sea is mainly composed of water from the Yellow River, Yalu River and Yangtze River from China, and the Keum (Geum) River and Nakdong River from the Korea peninsula, as well as sand, mud and other types of sediment as a result of water influx. The Yellow River in particular, which is the second longest river in China, has the largest amount of sediment loading in the world and accounts for the majority of the sediment accumulation in the Sea. These sediments also form a large number of intertidal flats on the Yellow Sea, covering an area of approximately 20,000 km². In total, the annual amount of influx from rivers is 1,500 billion tons of water with more than 460 billion tons of rainfall and 1.6 billion tons of sediment.

The YSE is rich in types of ecosystems which include estuarine ecosystems, island ecosystems, saltmarsh ecosystems, upwelling ecosystems and gulf ecosystems. It has also a great deal of variability in its local organisms such as fish, birds, mammals and invertebrates and living marine resources for local people. The diversity of its fish population is particularly high, and 339 species have been recorded, which are 45 percent warm water species, 46 percent warm temperate forms and 9 percent cold temperate forms. Furthermore, around 100 species of polychaete, 171 species of molluscs, 107 species of crustaceans and 22 species of echinoderms have been recorded in the region. In this ecoregion with such rich biodiversity, marine mammals are integral. In particular, Finless porpoise (*Neophocaena phocaenoides*) plays an important role as a keystone species. Other mammals such as Minke whale (*Balaenoptera acutorostrata*), Grey whale (*Eschrichtius robustus*), Spotted seal (Phoca largha), and Eurasian otter (*Lutra lutra*) greatly influence the YSE.

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Furthermore, the YSE is essential for migratory birds passing through this area for wintering and general travel. The region is a bottleneck of sorts, and there are 12 and 8 avian stopovers in China and the ROK, respectively, 5 and 6 of which are terrestrial stopovers, respectively. 173 species of shorebirds and 9 species of seabirds in China, and 162 species of birds such as long bills, sandpipers, ducks and geese, sea gulls, swans and Japanese cranes in Korea utilize these stopovers. It is estimated that about 200 million birds moving northward, which is 40 percent of all birds, pass through the region by the East Asian-Australasian Flyway (EAAF), and about 100 million other birds pass through when moving southward.

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2.2 Issues in YSE

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The pristine habitats and ecosystems in YSE have greatly deteriorated because of environmental destruction. Tidal flats in China have decreased by 37 percent in comparison to those of 1950s. In Korea, 43 percent of coastal tidal flats have been lost since 1917. The major reasons cited are reclamation due to human development in coastal areas and the expansion of the aquaculture industry. The original coastlines have been converted to farmlands, saltpans and farm operations for fish, shrimp and shellfish because of land reclamation by drainage. Sixty-three million hectares of the YSE's coastal areas have been covered by farms and 30 percent of the area's tidal flats have been turned into saltpans. The degradation of the natural environment caused by various developments is now a serious problem, not only for plants, shellfish, shrimp and invertebrates, but also for their predators such as birds and mammals.

The exhaustion of fish resources by overfishing is now a critical consideration. Though the living marine resources were abundant, there is a high probability that the industrialized fishery has exhausted stocks. The nations surrounding the YSE not only consume its marine products but also generate profits by selling the seafood overseas. In particular, Japan imports and consumes a large quantity of the products such as manila clams, common orient clams and octopuses, and is deeply implicated in this matter. If the populations of such species have decreased, there is a high possibility that Japan's consumption has had an influence on the changes of the environment. Such excessive use of resources is also a key factor in the degradation of the YSE's ecosystem. Furthermore, overfishing creates demand for large-scale fishing practices such as drift net fishing, which has been used in both coastal waters and in the estuary of Yangtze River. This practice also leads to the exhaustion of resources due to the bycatch of untargeted fish and mammals.

In addition, red tide is another issue that cannot be ignored because of its role in causing the widespread deaths of fish and shellfish. In the coastal areas of the YSE, the number of red tide events has been increasing since the mid-1980s, and the scale has also expanded in recent years. Such huge outbreaks of phytoplankton are most likely caused by human activities in the coastal areas and the corresponding decrease in tidal flats. For example, one of the causes is the discharge of domestic and industrial wastewater into the ecosystem at high temperatures with high concentrations of nitrogen and phosphorus which are both essential for plankton growth. Likewise, the decrease in manila clams resulting from the loss of many tidal flats is also an important factor, because they feed on plankton. Some species of plankton causing red tide are known to contain toxins. As a result, there is a long-term risk to the health of humans and shorebirds who consume toxic-plankton-fed shellfish and fish.

3. Yalu River Estuary Coastal Area Ecosystem-based Management Demonstration Project

3.1 Ecological Linkage of Interested Targets

The Coastal Wetland at the Yalu River Estuary (CWYRE), which is within Dandong City, starts from the sea boundary between China and the Korean Peninsula, conjoining Zhuanghe of Dalian City to its west and extending in zonal arrangement along the coastline in Donggang City (Figure 2). The wetland is a complex ecosystem consisting of inland wetlands, waters, oceanic and coastal ecotypes. The coastal wetlands cover an area of 1010 km^2, including 20% of intertidal zone. The bottom materials in the intertidal zone are mud, silt, fine sand and sand from bank to sea. Such bottom materials are in general more suitable for the growth of annelids and molluscs. The wetlands are located at the Yalu River Estuary and Dayang River Estuary, both of which have abundant water with an annual net flow of over 30 billion cubic meters. The two rivers carry a large amount of organic matter, allowing the sea area to contain more nutritive salt and phytoplankton than other waters in Liaoning's coast along the Yellow Sea and constituting the material base for productivity in offshore waters.

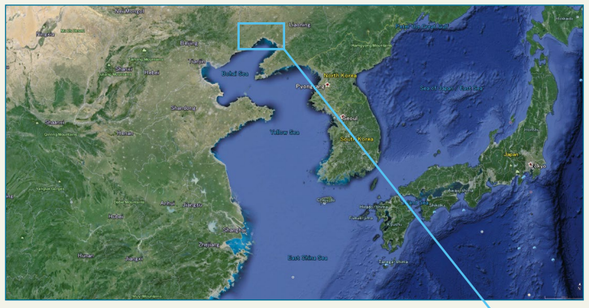

Figure 2 Location of Coastal Wetland at the Yalu River Estuary

A nature reserve was established in the CWYRE in 1987, and in 1997 it became a national-level nature reserve approved by the State Council, mainly protecting the coastal wetland ecosystem and rare wild fauna and flora. In 2007, the adjusted area of the nature reserve was 101,000 hectares (81,400 hectares after the adjustment in 2013). Almost all of the coastal wetlands are located in the nature reserve. In July 1999, the Nature Reserve was named one of the seven component wetlands of the East Asia-Australasian Flyway (EAAF) network. Recognized by many Chinese and international experts and researchers as the largest migrant bird stopover in the world, as well as the most important supply stop along the EAAF, it has a significant influence worldwide.

The conservation target is the ecosystem service of CWYRE, which is an integrated, well-managed hybrid system of the inland wetlands and aquaculture ecosystem with a marine ecosystem featuring stable functions and a complicated structure. In general, the CWYRE has a typical estuary-coastal wetland (i.e. YRE temperate wetland) ecosystem, which consists of a number of sub-ecosystems, including an inland ecosystem, a reed-marsh ecosystem, a tidal flat ecosystem, a shallow sea ecosystem and an island ecosystem. In the context of the global environment, CWYRE has a significant impact on the research of structure, functions and productivities of humid wetland ecosystems.

Due to the combination of its natural conditions, including terrain, weather, soil and tide, CWYRE is known for its abundant biological resources and numerous species; put simply, it is a large, natural gene bank capable of providing valuable flora and fauna today and in the future. At the same time, as one of the few well-protected, integral natural gene banks left in the world, CWYRE does not only serve the purpose of preserving a vital ecosystem, but also meets the demands for the sustainable development of human society.

The ecosystem at the YSESP Yalu Project site consists of three major elements (where people are considered to be a component of the ecosystem, Figure 3): benthos, birds (primarily wading birds) and people (primarily those engaged in shellfish farming). It is a big challenge to coordinate the relationships among people, the benthic ecosystem and birds by using EBM. These three elements are interconnected from an ecological point of view as follows:

Figure 3 Key elements of CWYRE ecosystem

① Tidal flat species: There are more than 100 benthos species across CWYRE, or the YSESP Yalu Project site, including almost all shellfish species that carry an economic value. As a key link along the coastal wetland food chain, benthos converts energy into organic debris, microbes and algae into food sources for higher life beings, including birds and human. As a result, it plays a critical role in the physical matter and energy circulation of the ecosystem.
② Birds: Sitting at a higher position on the coastal wetland food chain, birds, primarily shorebirds, are among the prime targets for protection at CWYRE. In spring and autumn each year, hundreds of thousands of shorebirds come to CWYRE to seek food to replace energy lost during their migrations. A healthy, integral benthos system is the basis for the survival of the shorebirds, which, on the other hand, play a unique role in maintaining a stable population of the benthos species through their feeding activities. For CWYRE (from the standpoint of mankind), the existence of birds has an important significance in three aspects: 1) birds can be an intuitive indicator of the health and integrity of the ecosystem, as well as one for the harmony between mankind and nature; 2) with notable aesthetic value, birds enable a range of tourist activities; and 3) as a global citizen, migratory birds have improved the popularity of both CWYRE and the YSESP Project in China and globally.

③ Human activities: At the top of the coastal wetland food chain are people engaged in shellfish farming at CWYRE. According to initial estimates, each year, approximately 300,000 tons of shellfish are collected from CWYRE. Through artificial farming, human activities have significantly improved the production of shellfish, which have both positive and negative impacts on the benthos species. In the meantime, shellfish collection activities have a considerable impact - again, both positive and negative - on benthos and bird species.

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3.2 Practices

3.2.1 Finding the Relationship and/or Connectivity

The results of a series of surveys on the benthos ecosystem, shorebirds and shellfish farming activities indicate that benthos species, birds and cultivated shellfish are interconnected.

(1) Ecological link between benthos ecosystem and shellfish farming
A significantly positive correlation (r=0.964, p<0.01) has been found between the average species density in the survey sections and the total output of cultivated shellfish of local towns, indicating that, to a large extent, the density of benthos species would affect the site selection for shellfish farming. Currently, interruptions of the benthos species by shellfish farming activities remain the biggest challenge of the YRE ecosystem.

(2) Ecological link between benthos ecosystem and shorebirds
The results show that the shorebirds' prey species in the YRE intertidal zones have high resilience, with both abundance and biomass recovering to normal levels shortly after the peak days of shorebird migration. Due to the continued decrease of food supply sites and stopovers by conversion to other aquaculture activities, it must be considered whether shorebirds could find enough places to stop by and whether they could find enough food in the future.

(3) Ecological link between shorebirds and shellfish farming
Major cultivated shellfish species in the YRE intertidal zones include Razor clams (*Sinonovacula constrica*), Hard clams (*Meretrix meretrix*), Oriental cylcina (*Cyclina sinensis*) and Duck clams (*Mactra veneriformis*) Manila clams (*Ruditapes philippinarum*) are the prime cultivated species in low tide zones. Currently, none of these shellfish farming sites is of a mass scale. The threat of shorebirds is primarily realistic for their larvae (shell height<15 mm), especially with thin shells and adequate sizes (shell height <5 mm), Razor clam (*S. constrica*) larvae are the preferred prey of shorebirds. The decrease output of cultivated Razor clams (*S. constrica*) was caused by intensive seacucumber aquaculture. This would inevitably drive the expansion of Razor clam (*S. constrica*) farming sites toward the intertidal zones, leading to a sharper conflict of interest between the farmers and the shorebirds.

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3.2.2 Management planning

(1) Identification of issues

Based on the research, the following issues have been recognized: a) a significant substitution of dominant species in the intertidal zones has been observed over the last three decades; b) significant changes to the dominant species of shellfish farming in the tidal flats have been observed in recent years; c) coastal habitat fragmentation; d) deteriorated ecological conditions and environment; e) regulations and management mechanisms need to be revised; f) weak publicity and education, etc.

(2) Setting up long-term goals for conservation

The long-term conservation goals are: a) continuous maintenance and protection of the environmental quality of the Yalu River Estuary; b) maintenance and recovery of the local marine ecological system; c) protection of wildlife resources, especially to maintain the stability and diversity of the ecological environment in the habitat of migratory birds; and d) balance between human activities and nature conservation.

(3) Biodiversity and habitat conservation

Further surveying has to be conducted and a genetic resource bank has to be established to collect plant species with distinct local identities. Effective ways need to be developed to eliminate environmental pollution from the aquaculture sector, providing migratory birds with sufficient food and restoring and optimizing the aquaculture environment. Technologies include wetland saltern reclamation technology, wetland substrate restoration technology, wetland pollution control technology, artificial plant breeding technology, artificial plant seeding technology and plant community health maintenance technology. The overall plan for fishing and aquaculture in the Yalu River Estuary wetland must be enhanced.

(4) Ecological Protection from Perspective of Comprehensive Management of Yalu River Basin

In order to protect the ecological environment in the Yalu River Basin and promote economic sustainable development in the basin, it is advised to set up an Integrated Administration Committee for the Coordination and Cooperation of the Yalu River Basin Ecological Protection and Development, which is to formulate a plan for ecological protection and development along the Yalu River Basin, coordinate between the upstream and downstream and between right bank and left bank, and to communicate, exchange ideas, consult and cooperate for resource development and utilization, environmental monitoring, administration, treatment, ecological protection and development.

3.2.3 Policies and Regulations

(1) Functional zoning scheme revised. The Natural Reserves in CWYRE have modified the function zoning schemes (Figure 4) to adaptive management especially for the core zones (red area) and experimental zones (green area), to strengthen the conservation of habitat.

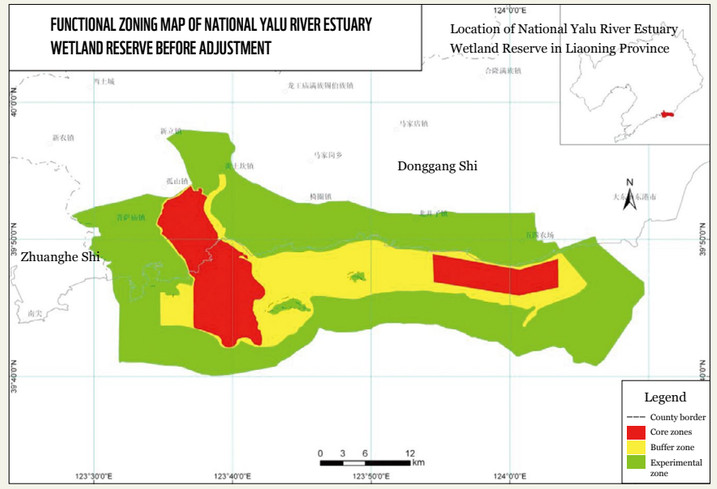


Figure 4 Functional zoning schemes revised (above - before, below - after)

(2) The regulations and management mechanisms are being developed, such as local coastal wetland protection standards and shell aquaculture standards, clear rules and regulations to standardize the existing fishing and aquaculture activities, temporal and spatial restrictions for no-fishing, redline management system[1] for CWYRE, explicit provisions on kinds and dosage of fishing medicines, and law enforcement system.

[1] *Drawing a "red line" for ecological protection: In November 2013, the 18th Central Committee of the Communist Party of China (CPC) approved a decision on "major issues concerning comprehensively deepening reforms". "Xinhua Insight" listed the ten points of the communique.*

"Drawing a red line for ecological protection", one of the ten points, implementing a system of paid use of resources and ecological compensation, and reforming the system for the protection and administration of ecological environment. Establish a sound system to protect the country's ecological environment." In constructing eco-civilization, it is imperative to build a sound system and to protect the ecological environment through the system". The system concerning property rights of natural resources as assets and the administration of their use should be improved". (source: http://english.people.com.cn/90785/8458156.html)

3.2.4 Partnership between Businesses & Administrative Departments

Establishing environmental partnerships between businesses and administrative departments is a newly developed pattern beneficial for coordinating relations between development and protection. The partnership between businesses and administrative departments helps bring into full play business initiatives and provide their expertise and management efficiency. On the other hand, businesses are able to acquire opportunities to make investments in the environment. This is not only beneficial for environmental treatment and ecological recovery, but also good for the development of new eco-friendly industries, driving regional industrial structure adjustment and emerging industries.

To address the ecological problems existing in CWYRE, one of the most effective approaches is for large-scale aquaculture and port enterprises to participate in the ecological environment management of estuarine waters. In addition, in order to improve the recovery and protection of the ecological environment of the estuarine, enterprises in this area should be encouraged to develop toward eco-friendly enterprises.

3.2.5 Publicity

To a large extent, any improvement to the effective conservation and reasonable exploitation of the CWYRE resources would depend on the public and decision makers' awareness and mindset of the importance of the wetland. The activities for public awareness show that it is necessary to organize a series of effective education and training programs to improve public awareness regarding wetlands, particularly in terms of their functions and benefits, as a way to increase the sense of urgency about wetland conservation and resource exhaustion, and to shape a positive environment or atmosphere for wetland conservation. Preferred actions include: a) routine knowledge-delivering programs; b) ecological valuation programs; c) curriculum schemes in schools; d) training courses especially for officers and administrative staff; and e) inter-national or intra-national training workshops.

3.3 Experiences and Lessons

The experiences and lessons learnt from the YSESP are as follows:
(1) Long-term biodiversity monitoring and assessment plan should be established for the conservation of biodiversity and key species in CWYRE and other major coastal wetlands;
(2) A governmental decision-making support system should be developed, which mainstreams biodiversity conservation in CWYRE into different sectors and local development plans, and coordinates the connectivity among humans, birds and benthic ecosystem services;
(3) The CWYRE should be included in ecological redline management, which involves the Natural Reserves of CWYRE, to ensure food sources for birds and the harvest of the fishermen;
(4) The results of the YSESP Yalu Project could be disseminated to MPA networks in China and abroad, which could be an example for conducting capacity-building courses regarding EBM in MPAs;
(5) Adaptive standards and a local coastal wetland conservation and management system should be established. In addition, it is suggested to create and issue local wetland and aquaculture standards, including coastal wetland conservation standards and shellfish health and farming standards, to build an integral mechanism for coastal wetland conservation;
(6) Detailed rules should be developed, to regulate commercial fishing and aquaculture activities, to prohibit illegal activities such as the setting of nondiscriminatory nets, threats to the survival of migratory birds, the unreasonable use of fish drugs, etc.;
(7) National and international cooperation should be encouraged to create more environmental education opportunities for local people and staff, and also to enlarge the jointly scientific research fields.

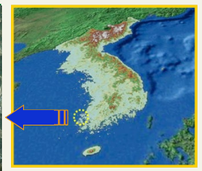
4. The Regional Development Orientated Coastal Area Management Demonstration Project in Muan

4.1 Challenges for Coordination of Development and Conservation of Mud Flats

As recently as the 1990s, the ROK was losing much of its tidal flat environment to reclamation efforts. The flats themselves were seen as useless, and many believed that they would better serve the national economy if they were filled in to become “useful land” for the nation. Muan was the subject of one of these plans, carried out in the form of the Yeongsan River Reclamation Effort. Launched in 1972, this was a five-stage plan to fill in 335.60 km² of land in the areas of Mokpo, Muan, Hampyeong, Yeonggwang and Sinan at a total cost of KRW 1,960 billion. The government plan triggered a campaign of opposition by Muan residents, and as environmental issues in other reclamation zones rose to the fore, the Ministry of Agriculture finally decided to cancel the efforts in 1998.

Following the cancelation in 2001, the Muan Tidal Flat was designated as the nation’s first Wetland Protected Area. In January 2008, it was named a Ramsar wetland; and in that same year, it received the status of Provincial Park, a recognition that made it a proud asset of South Jeolla Province. In 2009, the Muan Ecological Tidal Flat Center was founded to provide a venue for conservation research and education. It was also incorporated as a Potential Priority Area in the Yellow Sea Ecoregion. All of this served as recognition, at home and abroad, of the natural state, biodiversity, and conservation value of the Muan Tidal Flat.

MUAN TIDAL PLAT WETLAND PROTELTED AREA



Notice of Designation

- Muan Tidal Flat Wetland Protected Area
- Ministry of Land, Transport and Maritime Affairs Notice No. 2001-109 (First Wetland Protected Area)
- Date of Designation: December 28, 2001
- Relevant Statute: Wetlands Conservation Act, Article 8
- Supervisory Agency: Ministry of Oceans and Fisheries
- Administrative Division: Haeje Township and Hyeongyoeng Township, Muan County, South Jeolla Province
- Area: 35.6 km²
- Chart: Nautical Chart No. 343 of the Korea Hydrographic and Oceanographic Administration

Figure 5 The YSESP Muan Project Wetland Protected Area

Muan covers a total area of 448.95 km², with a broad distribution of fertile red clay soil and pure wetlands covering an area of 211.1 km² along a 231.8 km stretch of coast. The townships of Haeje and Hyeongyeong, the two YSESP target sites in Muan County, occupy 64.44 km² and 55.35 km², respectively, making up 26 percent of the county's total land mass. Because of the effects of naturally eroded soil and dunes, the Muan tidal flat has a distinctive geology. It is an example of an infant tidal flat where both formation and destruction can be observed simultaneously. Its shallow depths, abundance of sandy sediments, ria coasts and a mixture of various forms of flats make it an ideal spawning ground and habitat for a wide range of species. The location and geomorphologic feature of the Muan Wetland Protected Area is shown in Figure 5.

Muan County is divided into three towns and six townships. As of October 2013, its population stood at 78,929 inhabitants in 33,351 individual households. Hyeongyeong and Haeje, the target sites of the YSESP Muan Project, had populations of 5,599 and 6,039 inhabitants, respectively. Together, they accounted for 14.7 percent of the county's total population. The monitoring results from 2012 documented 236 macrobenthic animal species in the ecosystem. The largest group was mollusks (76), followed by 70 species each of annelids and arthropods. The region was also found to be a habitat for the Land snail (*Ellobium chinense*) (a type of saltmarsh snail) and Fiddler crab (*Uca lactea*) (a type of sand crab), both listed as Type II endangered species by the Ministry of Environment. Their presence can be seen as a sign of the cleanliness of the local tidal flat environment. Monitors also observed 48 species of shorebirds. The dominant species was the dunlin, followed by the greater scaup, common shelduck, black-tailed gull and mallard. According to the findings, the tidal flat serves as both a wintering site for many shorebird species as well as a stopover site on international migratory routes. A total of 22 fish species have been identified to date. Other than those noted above, at least 153 species of small invertebrates, 95 species of large invertebrates, 79 species of plant planktons and 45 species of halophytes have been discovered.

Agriculture and fishing are the largest industries in Muan County, accounting for 45.6 percent of all employed individuals. Muan provides 300,000 tons of commercially caught fish every year, a major contributor to the local economy. One of the biggest and most valuable species is the Long-legged octopus (*Octopus minor*), which live in the naturally pure and gemanium-rich tidal flats and can be caught year-round. Due to its local significance, an octopus festival is held in Muan County almost every year. Mullet and oyster are also important, and are mainly caught and harvested from winter to early spring.

The ultimate goal of the YSESP Muan Project is for the biodiversity and ecological resilience in and around the Muan tidal flat to be well-maintained by capable local residents, academics and a government network. In addition, it is important that the local community continues to enjoy economic benefits through the sustainable use of natural resources. The project aimed to establish a community-based management model which brings better governance and sustainable use activities, i.e., local participation in the monitoring of benthos for biodiversity conservation, a governance center supporting the central and local government marine protection policy, and tidal flat conservation plans that help generate income for local residents who use and co-manage the natural resources. We supported the Eco-Horizon Institute (EHI) as the implementing institution of the demonstration project at the local level, through which the conservation activities of the Muan County government, local advocacy groups, and research institutions were also supported.

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4.2 Community-Based Management Practices

4.2.1 Recognizing Connectivity of Humans and Marine Ecosystem

Coastal communities' participation in the biodiversity conservation of the mud flat is critical for them to understand the connectivity between themselves and marine resources and/or the environment. For this task, the YSESP demonstration project launched a series of civil ecosystem monitoring activities. Expert monitoring is conducted by the Ministry of Land, Transport and Marine Affairs on a 10-year cycle. In Muan, the first Wetland Protected Area monitoring took place in 2008. The need for civil monitoring emerged due to the temporal limitations of professional monitoring, which makes it difficult to predict gradual environmental changes of the region. The civil ecosystem monitoring activities included the training of civil researchers, the staging of workshops and discussions with the various stakeholders regarding who will perform civil monitoring and what research methodologies will be used, actual monitoring practices in the field, and other administrative and financial support. The civil research team was formed with the establishment of the Muan Ecological Tidal Flat Center in 2011. Plans have been formulated for determining monitoring methodologies that are feasible in the Muan region and for providing the necessary support.

The local people got involved in the monitoring activities in various ways: setting up a monitoring procedure through expert and resident meetings, and participating in education programs for training Muan tidal flat ecosystem guides, monitoring workshops, and fieldwork for benthic fauna and bird monitoring. The civil

monitoring activities were evaluated as an effective tool for their scientific understanding of the status of natural resources on which they depend for livelihood. Their success also has generated a spill-over effect. Beyond Muan, other regions have begun to consider conducting civil ecosystem monitoring on a regular basis. At the national level, discussion is underway on launching a sustainable, nationwide civil monitoring system.

4.2.2 Raising Public Awareness of Tidal Flat Conservation

Raising public awareness is critical for biodiversity conservation. Different publicity methods vary in effectiveness. The Muan project undertook such activities as tidal flat education programs in the public school curriculum, ecotourism promotion programs including the Muan Tidal Flat Festival in 2012, and the launch and operation of the Muan Tidal Flat Yongsan Village Farming Cooperative. We also developed Muan tidal flat walking trails. Along the trail routes, a number of display boards with conservation information were erected.

The promotion of public awareness produces various results and outcomes. With the participation of the residents of coastal communities, new benthic fauna species were discovered in the Muan Tidal Flat, with 236 types identified in the area as of 2013—up from 209 in past years. One particularly noteworthy discovery was the presence of Land snails (*E. chinense*), a rare form of saltmarsh snail designated as a Type II endangered species by the Ministry of Environment. Thirty samples of benthic fauna were prepared for the purposes of exhibition and education.

The promotion of ecotourism prompted Muan County to build caravans for a camping ground. Establishing a more fixed ecotourism presence, however, will require multipurpose spaces offering stable and specialized community-centered accommodations, eating establishments and cultural venues. Ideas for support are being realized with the construction of a “Tidal Flat House” and the formulation of a Yongsan Village development plan.

4.2.3 Community-Based Public-Private Governance

The concept of community-based management was central in planning the YSESP Muan Project. The designation of the country’s first marine Wetland Protected Area, which came soon after the cancelation of the Yeongsan River Reclamation Project, brought mixed reactions from the local coastal communities. While they wanted to maintain the tidal flat rather than reclaim it, they were concerned that the protected area status might impede their economic activities of fishing and mariculture. South Jeolla Province being one of the most underdeveloped regions, they were also concerned that it may preclude their communities from potential opportunities of economic growth.

Participation of local communities is perhaps the single most important element of the tidal flat conservation process, because they are the everyday users as well as the managers of the tidal flat. Without their presence, the tidal flat may be seen as a ‘land of no use,’ and would be subject to the forms of development that are destructive to the marine ecosystem. Rather than treating the local villagers as a target of conservation, the YSESP Muan project aimed at standing them as autonomous actors of conservation and demonstrating a model in which the communities could economically prosper while sustainably using the tidal flat and its resources.

Education and publicity activities were carried out to promote the awareness of the residents of coastal villages including Yongsan on the sustainable management of coastal resources. One of the features of “public-private governance” is self-management of coastal resources by local residents and not by government or academics. The formation of the Muan Tidal Flat Yongsan Village Farming Cooperative brought a greater sense of community. Through the sales of seafood and environmentally friendly farm products as well as the running of ecotourism programs, it contributed to a boost in the local economy. Their success inspired the local government which began to allocate a greater budget for tidal flat conservation and coastal management activities. It became a successful example of a “bottom-up” approach to CBM in the Republic of Korea, laying the groundwork for future efforts to share and build upon coastal CBM at the national level and demonstrating the crucial importance of local participation in coastal and tidal flat conservation and administration policy.

4.3 Major Achievements

The activities of the YSESP Muan Project for conserving biologically diverse and ecologically resilient tidal flats in and around Muan by capable local residents, academics, and government network, have been lauded as a domestic and international success. The achievements have been honored with a number of awards, including one given by the Minister of Land, Transport and Maritime Affairs at a commemorative event for World Wetlands Day in May 2011. The award recognized the contributions made by the members of the Muan Yellow Sea Tidal Flat Yongsan Village Farming Cooperative toward tidal flat conservation activities and local development. The following year in May 2012, the Muan County Ocean and Marine Life Division won a President’s Award for its contributions to a resident-centered approach to preserving the Muan tidal flat. In the same month, the Farming Cooperative won an Excellence Award at the second annual Creative Tourism competition organized by the Korea Tourism Organization, for soliciting creative ideas of ecotourism.

4.4 Experiences and Lessons

(1) The public awareness of local participation in marine environment conservation has been generated and boosted over a fairly short period of time through different ways. Moving forward, a more diverse approach will be needed, supplementing these activities with efforts to expand and regularize civil monitoring and promote sustainable ecotourism.

(2) The initiative brought a sustainable financing mechanism for marine environment conservation from the local government. An example of this is the Muan Tidal Flat Festival as an effective public awareness program. Primarily organized by the YSESP Muan Project in 2012, the local government supervised and staged the following year’s event and will continue to support it.

(3) Long-term context-specific plans and strategies at the village and county level will also need to be developed for improving and developing the current situation, contributing to the local economy and bequeathing a biologically diverse and ecologically resilient tidal flat to future generations.

(4) Muan serves as a good practice model for CBM. The outcomes and lessons of the Muan project’s approach have started to be disseminated to other regions, at home and abroad. Building an international network which would connect countries such as China, Hong Kong and the Wadden Sea countries and ensuring a stable funding stream would be the next step.

(5) Its success was helped by an organic, collaborative network of participating institutions. Over the seven years of the YSESP, Muan has benefited from the locally grounded commitment of the Eco-Horizon Institute and local partner institutions, the good governance and leadership of WWF, the efforts of the KIOST, and the financial support of Panasonic Corporation. The YSESP Muan Project has been a significant achievement in terms of international cooperation as well, with parties from the ROK, China and Japan working together to conserve the marine environment at the non-governmental, grassroots level.

5. Overall Conclusions

The EBM and CBM approaches both emphasize the recognition of ecological/social networks and the maintenance of a mutually complementary relationship. The YSESP did not choose their strategy to simply appeal to the protection of tidal wetlands as food sources or breeding grounds of vulnerable shorebirds.

Through the demonstration activity at the Yalu River Estuary in China, the YSESP connected humans, benthos, and birds together to keep benthic ecosystem services both for humans and birds with efforts of fishery management to develop a new approach of ecological-connectivity-based management, developed from EBM. The ecological and social network of shorebirds, benthic animals, and the local fishery has been established as the basis of the local fishing industry. This perspective of connectivity helped to involve a wider range of stakeholders in the promotion and scientific management of sustainable resource use.

The experiences in Muan reveal that the participation of multiple stakeholders is critical and necessary for achieving community-based management with limited resources. With the promotion of public awareness through various ways and manners, the local coastal community turned out to be willing to conserve biodiversity in the marine environment and to share their stories with other regions and countries. Regarding the network maintenance in the Yalu River Estuary, it is expected that local authorities will adopt the policy recommendations made by YSESP and help the local community to promote sustainable fishing. In Muan, the development and trial of various environmental education programs for local students are expected to help impart to the next generation the experience and know-how of co-management strategies such as civil monitoring and ecotourism.

All countries along the YSE have adopted the Convention on Biological Diversity's COP 10 Aichi Biodiversity Target 11 in October 2010, which dictates that by 2020 at least 10 percent of coastal and marine areas should be "conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider seascape". Also in September 2012, the IUCN World Conservation Congress adopted Resolution 28, which encourages governments along the EAAF to achieve effective management -- that is, to develop national and international action plans by 2014 that focus on agreeing on the key sites for endangered birds before 2020 -- of at least 10 percent of the intertidal zone, designating them as sustainably managed protected areas. Through these venues, we expect that the good practices of EBM and CBM generated from the two YSESP demonstration sites could contribute to the regional and international conservation community as models of effective management.

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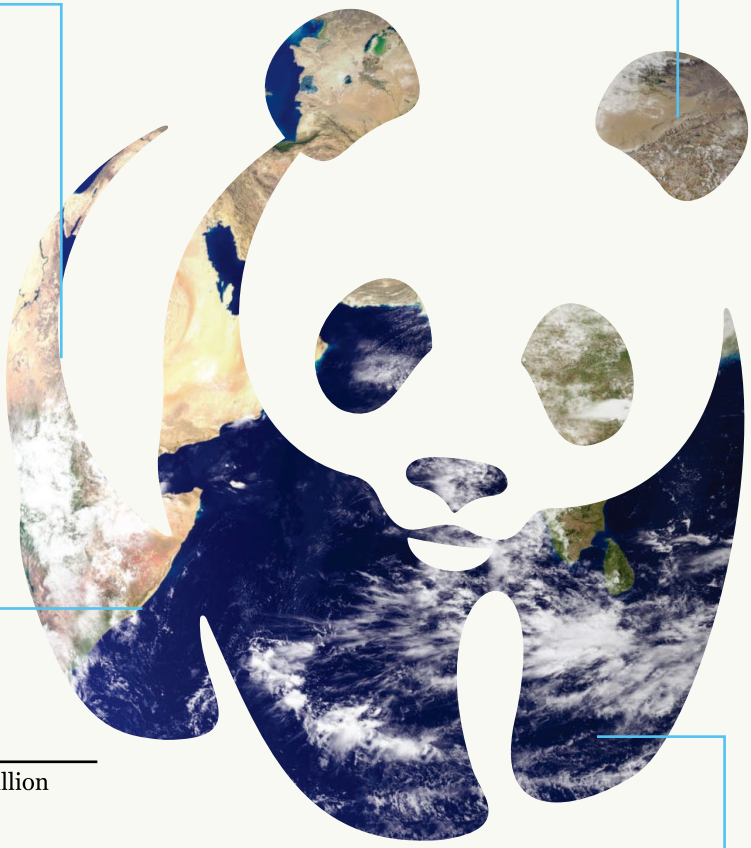

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ISBN: 978 – 4 – 915613 – 25 - 8