



### **About this publication:**

This publication describes the “Small Grants Programme 2008-2009” conducted under the UNDP/GEF Project, “Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem.” In co-operation with partner organisations, including local governments and NGOs, the Project has implemented five activities from 2008 through 2009 to encourage participation from all stakeholders and strengthen their capacities to deal with marine environmental issues that affect the local livelihood. The publication contains the reports prepared by the partner organisations, that summarise the processes and results of the activities.

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**Small Grants Programme 2008-2009  
Final Reports**

UNDP/GEF Project entitled  
“Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem”

United Nations Development Programme/  
Global Environment Facility

Ansan, Republic of Korea

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**I. Establishing preliminary guidelines, processes and basic designs for the enhancement, restoration and “Wise Use” of the “Mokpo Urban Wetland” *Birds Korea***



# **Establishing preliminary guidelines, processes and basic designs for the enhancement, restoration and “Wise Use” of the “Mokpo Urban Wetland”**

## **Birds Korea**

### **1. Summary**

The project has established preliminary guidelines, processes and basic designs for the enhancement, restoration and “Wise Use” of the Mokpo Urban Wetland. The 52ha “Mokpo Urban Wetland” (N 34°47’26.72”; E 126°24’50.52”) is the largest remaining relict area of inter-tidal and adjacent modified wetland in the historically extensive Yeongsan Estuary, located in Mokpo City, Jeollanam Province. Work conducted for the project during the project period (June 2008-February/March 2009) has been divided into three main overlapping areas: Research (including site-monitoring), Planning and Design, and Education and Public Awareness. During the project period, daily monitoring of waterbirds has been conducted; the data has been organised into a database; and guidelines have been developed to improve the monitoring methodology, and to monitor disturbance elements at the site. A survey has also been conducted on the wetland vegetation at the site. National and international experts have been invited to the site, and have advised on the process of restoration and on certain elements to consider in later planning and design phases. Images of wetlands from other countries that can assist in improving the planning and design process have also been gathered, and have been presented on our websites (“Nature Reserves”). Education and Public Awareness materials have been developed, including several Powerpoint presentations and symposia proceedings, containing data and examples of wetland wise use and wetland restoration. A 60-slide Powerpoint presentation on “Steps Towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and For People” has also been produced in English. This Powerpoint is now being translated into Korean for presentation to decision-makers in Mokpo (as proposed, in early April 2009). Further Public-Awareness activities have also been conducted as part of the project, including media coverage; on-site visits with local stakeholders and decision-makers; meetings and symposia, both within Mokpo and at the national level (and even overseas).

Ongoing research and the project confirm that the Mokpo Namhang Urban Wetland has high potential for biodiversity conservation, for environmental education, and for use in raising public awareness of the benefits of conserving coastal wetlands of the Yellow Sea. Throughout, this project has been conducted in line with, and aiming towards, best practice (as outlined by the Ramsar Scientific and Technical Review Panel, and e.g. outlined in our Powerpoint materials). It is anticipated that the process underlying the project, which has included the development and publication of clearer guidelines on the steps required for monitoring and restoration, will long-term have a significant influence on the environmental policies of Mokpo City, and also on the future restoration of other reclaimed coastal wetlands in the Republic of Korea – many of which have no management plan for biodiversity conservation in place despite their great international importance, and despite existing national commitments to domestic conservation laws and international conventions, such as Ramsar and the Convention on Biological Diversity.

### **2. Background of activities**

There are two major scales of background to the activities of the project: local and national/international.

The Mokpo Namhang Urban wetland is a small wetland (c.52ha), within a highly modified estuarine system (Figure 1). The wetland has high avian biodiversity value (over 137

species recorded to date, including several waterbird species of global conservation concern), and its size and location make the site potentially extremely valuable for environmental education. Before Birds Korea's work at the site, the wetland was very poorly-valued by local people and by decision-makers. There had been, based on meetings held in 2006 and early 2007, no open discussion on the development of a management plan aiming to enhance biodiversity or other site-values. Access to most of the site, and human-uses of the site, have been largely unrestricted, leading to high levels of disturbance (and presumably the loss of the most disturbance-sensitive species). Furthermore, a major part of the site was earlier impounded by sea-walls, in preparation for conversion to land (as part of a decade-old plan) and some of the area is now undergoing further infilling (accelerated it seems, perversely as a result of the success of this project). Those with jurisdiction over part of the site consider that the impounded areas are no longer wetland, despite the presence of water and wetland species and partial tidal-flow to the site. Without management and improved conservation-directed planning and design, the site can be expected to lose much of its biodiversity and other values.



Figure 1: Mokpo Urban Wetland.

It is apparent that there are numerous challenges to the conservation and restoration of this wetland, as with many other coastal wetlands in the Yellow Sea. This is especially so, as there is little domestic experience of conservation management and restoration interventions and few opportunities for learning from experiences at other sites within the Republic of Korea.

However, the Mokpo Namhang Urban Wetland is small, and located within an urban setting with jurisdiction primarily under two government bodies (the national Ministry of Land, Transport and Maritime Affairs [MLTMA] and Mokpo City). The restoration and future management of this site could be achieved more easily here than at any many other larger wetlands that fall under a wider range of jurisdictional bodies. Its small size also means that the successes and failures of the intervention are likely to be easier to measure with confidence, and within a shorter timeframe, than interventions at a larger site.

Conservation of wetland (and an analysis of the processes and decisions required for successful restoration interventions) has become an increasingly urgent conservation

priority at the national level as many of the nation's wetlands continue to be degraded and reclaimed, causing declines in biodiversity and fisheries. The response to wetland loss has often been inappropriate for biodiversity conservation, including the introduction of species counter to the guidelines provided by the International Union for the Conservation of Nature (IUCN) and the Ramsar Convention, and construction of often huge buildings ("Eco-centres"), walkways and viewing platforms in easily disturbed internationally important wetlands. At the same time there has been almost no investment in habitat management, restoration or creation. Much "Green Development" is therefore being undertaken without any site monitoring programs in place; without much public consultation; and without detailed Management Plans for habitats and biodiversity.

Site management has therefore come to be perceived by many decision-makers, and even by some in the NGO community, as the development of "hard" infrastructure (such as buildings). During the initial stages of our work at Mokpo, there were also several calls by meeting participants for large-scale construction as the key element of conservation of the site, with almost no time given to discussion on the training of wetland managers, the development of appropriate monitoring protocols, or on designs that are based on natural processes and existing values (as advocated by the Ramsar Convention).

The hosting of the Tenth Conference of the Parties to the Ramsar Convention in the Republic of Korea (October 28th - November 4th, 2008); the development of Ramsar Resolution X.27 (urging "all Contracting Parties to review the state of their urban and peri-urban wetlands and, where needed, to put in place schemes for their restoration and rehabilitation so that they can deliver their full range of ecosystem services to people and biodiversity"); and the formation in 2008 of a team convened by the MLTMA and charged with Wetland Restoration under the National Wetlands Management Act (2007) have, in combination, provided the best opportunity to date to raise awareness about the Mokpo Namhang Urban Wetland, and to influence the approach taken to restoration of other Yellow Sea wetlands by national government bodies.

### **3. Objectives of activities**

In line with IUCN and Ramsar Resolutions and guidance (e.g. as outlined in Ramsar Resolution 8.16), the project has been and continues to be developed in a series of steps, that aim to build the scientific knowledge of the site through research; conserve the existing values of the site (including the maintenance or enhancement of its ecological character: Ramsar Res. 9.1); divide the enhancement and restoration measures into stages that can be achieved through the implementation of ecosystem approaches; and involve local communities and decision-makers in order to "raise awareness and influence the behaviours and practices that led to the degradation of the ecosystem." (Ramsar Rec. 4.1).

### **4. Target audiences**

The project has multiple audiences, as it aims to empower the process of collaboration and consensus-building that is essential to wetland conservation and restoration.

We have involved researchers from different fields in the research and site-monitoring; we have aimed to involve specialists in Planning and Design; and in the recognition that "Restoration interventions should be coupled with measures to raise awareness and influence the behaviours and practices that led to the degradation of the ecosystem" (Ramsar Res. 4.1) the project has contained numerous Education and Public Awareness components. These have been aimed at a wide range of stakeholders, including schoolchildren and educators; people living and working near the wetland; and most

especially decision-makers within Mokpo City and relevant sections of national government. The final Project Output is a 60-Slide Powerpoint presentation, which is aimed at this broad range of stakeholders.

## **5. Activities implemented**

Supported by the YSLME project grant, the Birds Korea project team has as part of this project, between April and the present (mid-February 2009) conducted numerous activities in the overlapping field of Research, Planning and Design and Education and Public Awareness.

Research activities have included:

- (1) Conducting research at and relating to the site. This has included gathering existing data primarily on birds (such resources are extremely limited pre-2006) and on other biota –though such resources remain limited.
- (2) Conducting regular counts/monitoring of waterbirds (on a near-daily basis, and still ongoing).
- (3) Organising the waterbird data by group (e.g. Shorebirds and Anatidae), by site (P1-P4) and by date/season, to assist in assessment of waterbird usage of the site.
- (4) Subcontracted experts from Mokpo National University to survey vegetation;
- (5) Gathered images and materials on other sites with potentially similar management issues, (Appendix 3 and various website postings) and discussed the site with the Ramsar Secretariat (July 2008; October 2008; February 2009) and other specialists.

Planning and design activities include:

- (1) Reviewing available guidelines on wetlands restoration;
- (2) Developing site description;
- (3) Identifying potential steps towards site enhancement and restoration;
- (4) Inviting Mr. Graham White, Senior Ecologist, the Royal Society for the Protection of Birds (UK), to Mokpo, September 7th-15th, to assess the site's potential values and management issues and to meet with decision-makers.
- (5) Discussing the site with members of the national coastal wetland restoration committee, with Mokpo City councillors, and in meetings with officials of both the local (e.g. on September 11th, 2008) and the national MLTMA (various occasions – October/November 2008).

Education and public awareness activities include:

- (1) Providing updated information on the Mokpo Namhang Urban Wetland and the project on our websites (Korean language, <http://www.birdskorea.or.kr>; English language, <http://www.birdskorea.org>: with c. 500 unique visitors per day), and at the Birds Korea booth at the Ramsar Convention conference.
- (2) Inviting media to the site and Project event. Media coverage included:
  - a. KBS Mokpo, broadcast nationally, May 2008;
  - b. Mokpo and Gwangju local newspapers, May 2008;
- (3) Making presentations on the project at appropriate venues, including:
  - a. Mokpo University, August 20th, 2008;
  - b. *Getbol Forum Korea* Symposium, Seoul, September 1st, 2008.

Symposium supported by the National MLTM and Ministry of Environment, and attended by 30 national wetland experts;

- c. Symposium hosted by the MLTMA on September 8th at Seoul National University Hoam Faculty House. Presentation contained in Pp 125-148 in Recent Progress on the Coastal Wetland Restoration, Proceedings of an International Symposium. Attended by over 100 government officials and wetland experts from Korea and overseas;
- d. The Mokpo Namhang Urban Wetland Workshop and Symposium, September 10th. With morning workshop for city officials held in Mokpo City Hall, and afternoon symposium in the Mokpo Natural History Museum, attended by 85 local people, with presentations by experts from Mokpo, from Jeollanam, from the YSLME project, and from overseas;
- e. The International Symposium on Urban Wetlands and Restoration, October 30th, 2008, hosted by Changwon City, and Organised by Korea Wetlands Institute as a Ramsar side-event. Attended by c.85 national and international experts, as well as decision-makers from Changwon City and the province;
- f. Third Annual Yellow Sea Partnership meeting, November 2nd, Changwon City, attended by 30 specialists concerned with the conservation of the Yellow Sea (including staff from the Ramsar Secretariat, from BirdLife International, Wetlands International, WWF-Japan, YSLME PMO and other leading organizations);
- g. Broome Bird Observatory, Australia, December 15th, 2008.
- h. A specially convened meeting in Mokpo City on April 6th was attended by Vice Chair of Mokpo City Council and other invited persons, at which various materials from the project, including the Korean-language version of the Powerpoint presentation, were presented and also "handed over" on CDs. The meeting was extremely positive. It was essential for disseminating the lessons learned during the YSLME project in Mokpo, and for identifying the next steps for the long-term conservation of this nationally important wetland. Participants recognised the challenges inherent in trying to alter existing development plans, and also some of the challenges entailed in developing consensus among potential stakeholders. Various strategic/tactical suggestions were made which will be responded to by Birds Korea in our ongoing follow-up work to this project.

(4) Conducting site visits/education programs, including with members of the Mokpo City council.

## **6. Produced outputs and outcomes**

The project has produced several online articles (in Korean and English); datasets on bird usage of the site divided by section of the site, by species group, and by season; reports on vegetation, on waterbird monitoring; and restoration possibilities; a published Symposium Proceedings (September 10th, 2008); and a 60-slide Powerpoint Presentation, presently (February 2009) in English, and to be translated into Korean (March 2009) for presentation to decision-makers in Mokpo (April 2009). The presentation material, "Steps towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and People," is attached as Annex I to this report.

All of these outputs have aimed to assist a better understanding by stakeholders of the Mokpo Urban Wetland, its biological diversity and its conservation status.

The Powerpoint especially has been developed to outline guidelines and planning considerations towards enhancing and restoring the component parts (estuarine area, tidal lagoons and reedbed) of the Mokpo Namhang Urban Wetland in a context that is useful for developing conservation interventions for the important wetlands in adjacent areas, and for other wetlands in the South Korean part of the Yellow Sea/the Yellow Sea Large Marine Ecosystem.

Outcomes are more difficult to assess at this stage. No public response has yet been made yet on the future of the site by the national coastal wetland restoration team/the national Ministry of Land, Transport and Maritimes Affairs. A decision to conserve and restore the wetland by the Ministry would be the most effective and straightforward process by which the local office of the same ministry would be enabled to modify their existing plans, away from reclamation and towards conservation of the site. The same local office of the MLTMA has already stated that it will work to conserve the estuarine part of the wetland (P1), at a meeting in September 2008.

## **7. Evaluation of implemented activities**

Achieving genuine wetland conservation of coastal wetlands in the Yellow Sea can be extremely challenging, and the Mokpo Namhang Urban Wetland is both degraded and part-included in a development plan (Mokpo office of the MLTMA) that was not public at the time of the project's inception (even now, details of future end use of the site remain unclear).

Especially in consideration of this start point , we believe that the project has been very successful in its main aims of helping to raise awareness of the value of the Mokpo Namhang Urban wetland within Mokpo City and within relevant bodies of specialists at the national level; and in contributing to increasing awareness of the restoration process and related Ramsar guidelines (NOTE: apparently the only presentation to clarify Ramsar guidelines at a Side Event on wetland restoration and urbanisation at the 2008 Ramsar Convention was our presentation on the Mokpo Namhang Urban wetland). Raising awareness of the various tried-and-tested components of wetland conservation and restoration interventions is part of an ongoing and long-term process.

Our (positive) evaluation of this project is based largely on the positive responses to date by decision-makers and stakeholders in Mokpo City, who actively participated in several meetings and symposia, and by the response of members of a national team for coastal wetland restoration which was established under the auspices of the MLTMA. Prof. Hong Jae-Sang, the Representative of this team, visited the site in December 2008, and has submitted a report to the Ministry on potential sites nationwide for restoration. Although we do not have access to the report, he informs us that it identifies the Mokpo Namhang Urban Wetland as one of the most suitable nationwide for restoration.

The success of the project so far, we believe, is based on a combination of the design of the project and ongoing work by Birds Korea and others on behalf of the site; by the timing of the project (coinciding with the nation hosting the Tenth Ramsar Conference of the Parties); and through the increased prestige of the project due to its funding through the YSLME.

However, there are several elements that require further significant input, which Birds Korea will continue to address beyond the present (mid-February 2009).

Within the Research component, an invitation (in July) was made and initially accepted to conduct a survey of water quality and of benthos by a local academic body. This research, however, was not undertaken. Nor was research on human-use of the site. Both elements still require research effort.

Further, a symposium in Mokpo City, to be held jointly with a leading environmental NGO, in order to present the project findings (and other opinions about the site) has twice been postponed – both times by the other environmental organisation. This has required a major shift in the end-timing of the project. This symposium is now planned for the end of March. It remains our aim to use this meeting to present our Powerpoint, and to measure attitudes to the wetland, through informal interview, and/or through a simple questionnaire.

## **8. Conclusions and recommendations for future work**

Birds Korea will remain involved in promoting the conservation and restoration of this important coastal wetland. In March 2009, as part of the project's final phase, we will translate "Steps towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and People"; In late March 2009 (as presently proposed by the other organisation) we will present this Powerpoint to decision-makers and subsequently conduct interviews of local stakeholders to assess their attitudes to the wetland. Through the year we will continue to monitor waterbirds at the site, and conduct, as proposed, more detailed research on site usage by key species. We will also collect data on disturbance, in line with disturbance monitoring proposals. We will continue to communicate about issues at the site with Mokpo City officials and with officials/ technical experts working under the auspices of the MLTMA. In late 2009 or in 2010 we aim to produce a further publication, promoting the site's conservation and further clarifying the steps that need to be taken to achieve wise use at the site. The site will also be included in a review we are preparing on the conservation of the avian biodiversity of the Korean Part of the Yellow Sea, in time for presentation at the Tenth Conference of the Parties of the Convention on Biological Diversity (October 2010).

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**II. Ecological pre-warning assessment on environmental quality in the core area in Yancheng Biosphere Reserve: Heavy metal pollution status of macrobenthos caused by economic development in recent years *Nanjing University***



# Ecological pre-warning assessment on environmental quality in the core area in Yancheng Biosphere Reserve: Heavy metal pollution status of macrobenthos caused by economic development in recent years

Nanjing University

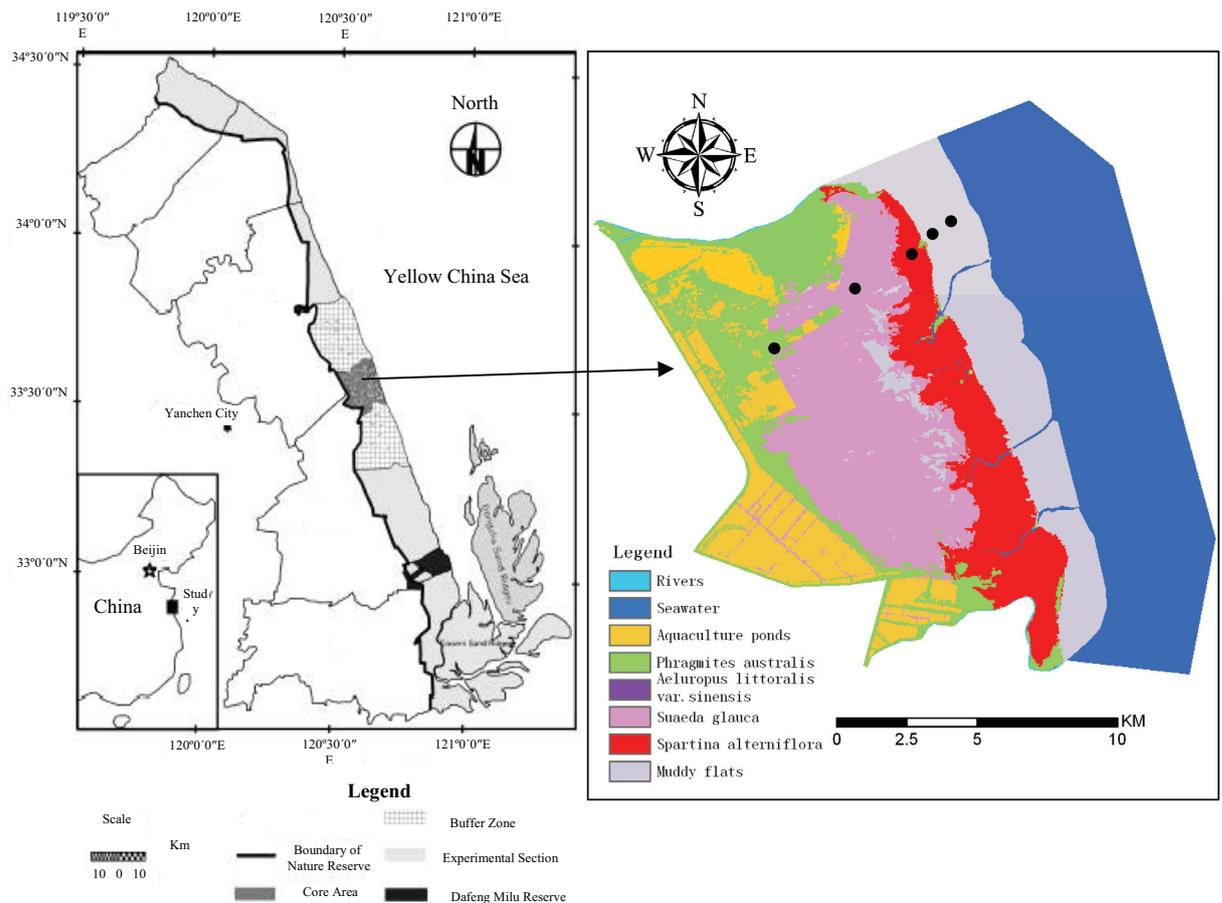
## 1. Summary

Just as WWF, KORDI & KEI published (2006), the Yellow Sea is under serious threat from industrial and agricultural waste, extensive economic development in the coastal zone, the unsustainable exploitation of natural resources, and unsustainable fishery practices, although it is an important global resource. This has resulted in the loss of biomass, biodiversity and habitat. This project aims to evaluate heavy metal pollution in some economically important macrobenthos species in North Jiangsu coast. Several industry parks have been set up here, with huge industrial waste draining to the Yellow Sea. The waste water might have caused some pollution to local macrobenthos due to water fluidity along the coast. Thus the project wants to provide the pre-warning information of heavy metal pollution status to local stakeholders, managers in Yancheng Biosphere Reserve (YBR), governors and those seafood consumers based on scientific data, which is defined as ecological pre-warning assessment calling for both public attention and adaptive environmental management for current environmental protection and biodiversity conservation along North Jiangsu coast.

## 2. Background of activities

The project chooses the core area (18,700 hm<sup>2</sup>) of Yancheng Biosphere Reserve as the study site, which is an enclosed area aiming for rare species protection with less human intervention than any other parts along Jiangsu coast. It is also the last original coastal wetlands with typical flora succession from the land to the sea. However, daily pickup of economic macrobenthos in the core area is permitted as a household income. Three important macrobenthos are collected by local stakeholders for almost 9 months (From March to November). There are quadrangularis (*Macra veneriformis* Reeve), muddy clam (*Bullacta exarata*), clamworm (*Perinereis aibuhitensis* Grube), which provide food directly or act as semifinished product for human beings. Therefore the project chooses the three macrobenthos for heavy metal data analysis. Each price of the aforementioned macrobenthos is RMB 2-4  *yuan*, 5-8  *yuan* and 20-30  *yuan* per kg from those collectors. Quadrangularis are collected mainly in the lower part of subtidal zone and intertidal zone. Muddy clam grows well along the intertidal zone and subtidal zone. Clamworms distribute mainly in *Spartina alterniflora* and *Suaeda glauca* salt marshes. Their ecological niche nearly covers all the original wetlands in the core area in YBR.

As for Yancheng Biosphere Reserve (YBR), it is the first and largest tidal flat nature reserve in China, which is located in Jiangsu Province along the coast of the Yellow China Sea with a 900 km long (Figure 2). It is recognized as one of the most important MPAs in China since 1980s. It was established in 1983 with the major aim of protecting an endangered bird species, the red-crowned crane (*Grus japonensis*) and its habitats. It is one of the stopovers for more than 200 species of migratory birds, including saunder's gull (*Larus saundersi*) from northeast Asia and Australia. It was approved as an international biosphere reserve in UNESCO's Man and Biosphere Program in 1992.



Note: The right map is extracted from Landsat TM data of 2007. Dots in the right map shows sampling sites.

Figure 2: Yancheng Biosphere Reserve

### 3. Objectives of activities

Ecological pre-warning assessment aims to provide a clear information on how the heavy metals pollution are influencing the coastal ecosystem along the Yellow Sea in North Jiangsu coast to all stakeholders during the rapid economic growth along the Chinese coastal zone in recent years. It is supposed to be with high pollution according to the increase of nitrate and phosphorus loading in annual environmental monitoring data in the main estuaries, which are also hinted by increasing human activities of both agriculture and industry along the coast. The assessment will be of great help to managers in YBR, governors in both Yancheng city and Jiangsu province for making right decisions and adaptive polices. What's more, information transparency is much important for local stakeholders and seafood consumers in this area to know if the food is safety enough and other basic problems.

The objective of the project focuses on public awareness improvement on how environmental pollution is affecting their daily lives, even their health. The assessment based on scientific data proves the exact effects caused by industry parks and other related economic activities. What's more, even the staff in YBR also needs this kind of data since it is closely related to the coastal ecosystem health which may impact other rare species which feed on those macrobenthos. Usually all of these kinds of data are excluded to any others except environmental bureaus. If the staff in YBR knows what's going on in the core zone, they can take strong measures to change or stop some establishment of heavy pollution factories or the location of industry parks, or improve the

standard of sewage treatment.

The present proposal was in direct response to an information request from YBR last year since they are in urgent need to know the environmental status in the core area, which is the most important habitat for biodiversity conservation. The reserve needs information on the environmental pollution status of macrobenthos, which are the favorite food of many tourists. The project will be in close cooperation with YBR for any information exchange during the whole process.

#### **4. Target audiences**

Public health is not only interested by every person in his/her daily life, but also being considered as a responsibility of our government. Nearly all things can be related to public health in order to build a safe, healthy, vibrant and environmental friendly society. However, no one would like to deny that food safety is of the most importance for public health. The target audience focuses on local stakeholders, policy makers, scientists, managers, whose area of interested are in YBR, especially to those who are living in the surrounding areas of the core area of YBR, and feed on some seafood produced in the tidal zone. The most efficient way of public information transfer is by public media, such as newspapers, TVs.

- Government officials. Managers possess much information as distribution of industry parks in YBR, discharge of industry waste water, seafood production in the tidal zone, etc. They not only work on public health policy and decision makers but also act as seafood consumers in local county level.
- Local stakeholders. Local stakeholders are the direct beneficiary from seafood collection in tidal zone. They are also the direct consumers of the seafood. They are very interested in the contents of heavy metals in economic macrobenthos. They have the right to know in what level those heavy metals will cause trouble to their body health.
- Information transparency to public. Environmental friendly society need information transparency about environmental issues related to all society. The protection status of YBR should be known to everyone who cares about the biodiversity and ecosystem health in the largest tidal zone in China coast.

#### **5. Activities implemented**

To achieve the objectives described in Session 3, the Nanjing University team conducted a number of activities as follows.

Data collection: The content of Cu, Pb, Zn, Cr, Ni, Cd, Hg, As in economic macrobenthos, sedimentary, wetlands plants was examined. Data of seawater in the study area is not acquired because of the some contents of heavy metals are lower than the limit of detection equipment. We only got the data of mercury and arsenic of water in the study area.

Ecological pre-warning assessment: Comparison was made with national standard of seawater, sediments and marine animal products, and historical data, which acts as background data, for both food safety assessment and negative environmental impacts caused by economic development in recent years.

Information exchange and awareness to public media: Information exchange was

conducted with governments, local stakeholders, and information transfer to public media, such as newspapers, TV, especially Jiangsu Environment and Jiangsu Environmental Reports, contributing much to public awareness on environmental protection. One thousand copies of pamphlets with widely distribution from local stakeholders to provincial bureaus had been distributed.

Four paper related to the contents of heavy metals in the core area of Yancheng Biosphere Reserve has been submitted. One was published in *Environment and Ecology in the Three Gorges* (2010, (3)1: 19-21). Two papers were accepted in *Marine Bulletin* and *Environmental Protection Science*. One paper is in review. All were written in Chinese version with English abstract.

Some of the major activities are listed chronologically as follows.

- Jul. 01 - Jul.25, 2008. Reference collection, preparation for sampling and other preliminary work for project inception.
- Jul. 27 - Jul. 30, 2008. Site visiting, and face to face talk with local stakeholders (people living in Xinyanggang Town, where the core area of YBR locates) and staff of YNR.
- Jul.29 - Aug. 02, 2008. Sampling:
  - Plants with both underground and aboveground parts (*Phragmites communis*, *Suaeda glauca*, *Spartina alterniflora*)
  - Water from *Phragmites communis* wetland, *Suaeda glauca* wetland, *Spartina alterniflora* salt marsh, *Macraa veneriformis* Reeve tidal flat, *Bullacta exarata* tidal flat
  - Sedimentary from *Phragmites communis* wetland, *Suaeda glauca* wetland, *Spartina alterniflora* salt marsh, *Macraa veneriformis* Reeve tidal flat, *Bullacta exarata* tidal flat
  - Three macrobenthos (*Macraa veneriformis* Reeve, *Bullacta exarata*, *Perinereis aibuhitensis* Grube)
- Aug. 03 - Oct. 20, 2008. Samples analysis with preparation, such as freeze drying, sedimentary mortaring and sample measuring.
- Oct. 20 - Nov. 31, 2008. Data processing with ecological pre-warning assessment. paper writing, and site visiting to local stakeholders for results.
- Dec. 01 - Dec. 30, 2008. Pamphlet preparation, designing, printing and paper writing. See annex 2 and annex 3 for pamphlet and paper related to heavy metals assessment in sedimentary in the study area. 1000 copies of pamphlet were prepared for distribution in order to improve the public awareness of all stakeholders.

Jan. 07 - Jan. 15, 2009. Distribution of Pamphlets to Jiangsu Provincial Environmental Protection Agency (50 copies), Jiangsu Environmental Protection Publicity & Education Centre (20 copies); Jiangsu Yancheng National Nature Reserve (Yancheng Biosphere Reserve); Jiangsu Yancheng Environmental Monitoring Center (50 copies); Yancheng Normal University (50 copies, only distributed in Department of Geography).; Jiangsu Yanchen Huangshagang Town Government (30 copies); Jiangsu Sheyang County Government (30 copies).

More than 200 copies of pamphlets were distributed in the wedding ceremony. The banquet lasted more than 4 hours in the cold evening. Many people are very interested in the information provide by the pamphlets since most of them lives in the town and surrounding area.

- Jan. 15 - Mar.31, 2009. There is a report about the result of this project, by Xinhua News Agency, is published in Internal Reference which is only distributed to high officials in order to attract the attention of the government actions to stop those environmental pollution activities along the coastal zone in Yancheng Biosphere Reserve.

## **6. Produced outputs and outcomes**

As a result of the activities described in Section 5, the following outputs were produced:

- Site visiting with possible pollution sources survey.
- Data of heavy metal contents (Cu, Pb, Zn, Cr, Ni, Cd, Hg, As) from plants, sedimentary, macrobenthos and seawater. Each was measured with six parallel samples. There are 36 samples of plants, 30 samples of water, 30 samples of sedimentary, and 20 samples of macrobenthos were measured in Nanjing University.
- Encourage the participation of local fishermen and Nature Reserve staff in this project by involving them in sample collection and further group discussions on the results from the samples collected with their help. One Local fisherman, Mr. Zhou, also acted as a driver of a microbar to help us take samples and one staff, Mr. Yin Peng, in YBR helped us to collect samples. With the results, we have connected with two staff in YBR, Mr. Chen Hao, and Mr. Yin Peng for their opinion with our data analysis. Mr. Chen Hao emailed me that the directors of YBR, Mr. Sun Ming, and Mr. Deng Jindong and other staff in YBR had a meeting to discuss our results.
- Informal meetings with local stakeholders and decision-makers were organized to present the information as well as to provide advice on the potential management direction for the area. Informal meeting was held on Jan. 13, 2009. Two local stakeholders and two managers in YBR, two consultants had attended the meeting.

The results of ecological pre-warning assessments are summarized as follows.

### *Seawater*

The average content of Hg in the core area of YBR belongs to 1st class of GB 3097-1997 Sea Water Quality Standard, which also was lower than the background value masured in 1978-1979. The average content of As in the core area of YBR belongs to 1st class of GB 3097-1997 Sea Water Quality Standard except that in *Spartina alterniflora* wetland, which belongs to 2nd class of the Sea Water Quality. However, the average content of As was much higher than the background value, which calls for much attention to the influence of anthropogenic activities in recent years.

### *Sedimentary*

The contents of Hg, As, Cr, Pb, Cu belonged to 1st class of sediments, while the contents of Cd belonged to 2nd class comparing to the GB 18668-2002 Marine Sediment Quality. The average contents of metals in the sediment samples all exceeded the background

values measured in 1978-1979 in the coastal zone of Jiangsu Province except Hg, which indicating lighter pollution caused by the ongoing human activities since 1980.

### *Plants*

Results indicate that heavy metal content tended to be higher in the roots of plants compared with the data in leaves. The contents of Hg, As, Cr, Zn, Ni were highest in *Phragmites communis*, *Suaeda glauca*, and especially in the aboveground part of *Spartina alterniflora* compared with other plants. The Contents of Cu and Zn were highest in the leaves of *Suaeda glauca* than that in other parts of the plants. The levels of Cr in the roots of *Phragmites communis* was the highest. Local people pick up the buds of *Suaeda glauca* for vegetables. However, the potential pollution to human being is below the warning level since with less induction of those 3 plants.

### *Macrobenthos*

The contents of Hg, As, Cr, Cu, Pb, Ni in *Bullacta exarata* (snail) were the highest, which might indicate higher pollution by environments. The contents of Cd in *Macraa veneriformis* Reeve (Clam), was the higher than that in other animals. The snails and clams are consumed locally and both of them are economically harvested by local stakeholders who pick them up during low tides. Analysis showed that nearly all the concentrations of heavy metals in the three macrobenthos were far higher than the background value. Some of them exceeded the limit for pollution-free food according to 'NY5073-2006 Pollution-free Food at Seafood Toxic Substances Harm Limited'. Heavy metal pollution caused by economic development has threatened the health of those seafood consumers by food webs. Therefore, food safety is very important for those seafood consuming people, especially local stakeholders.

For details of the ecological pre-warning assessments, see Annex II.

The results of the contents of heavy metals in the core area have warned the public that pollution was mostly caused by industry development in recent years. Pollution from heavy metals has been validated with accumulation in the coastal protected areas. If there is no further prohibition on waste control along the north Jiangsu coast, the pollution will threaten the health of local stakeholders by polluting macrobenthos following the food chain in biology. Pollution control should be strengthened by controlling the sewage discharge from different industries. What's more, public awareness of environmental protection and ecosystem health should be propagated widely for a cleaner coastal zone in the near future.

One report described the results of our study with pre-warning of the tendency of future pollution along Yancheng coast has been published in Internal Reference. It is a magazine owned by Xinhua News Agency, the only national official news agency, which providing official news and reports in national level. The internal reference report is confidential to public besides higher officials by warning high managers the bad news or actuality and urges them to make better policy decisions. It has pre-warned higher officials and managers on aftereffects of building so many industry parks and chemistry factories along the coastal zone of YBR.

Till now four papers have been submitted soon. All data has shown that the sources of heavy metals are mainly from coastal water transportation. It pre-warned that only forbidden of human entry to the core area cannot meet the ecosystem conservation of YBR. Scientists have to work for new theories of core area protection of an open ecosystem, especially those ecosystems with intensive communication with open parts.

## **7. Evaluation of implemented activities**

YBR staff and local stakeholders are all very interested in the results of those heavy metal contents, and are eager to know if the seafood they are consuming is healthy or not.

Sampling in the core area of YBR is very successful, which is given permission and supported by the management station of YBR.

Samples analysis goes well except of seawater with lower contents, which are lower than the detection limits of equipment.

Pamphlets distribution in XinyangGang coincides with a wedding held in Jinhong Hotel, which nearly half of the local residents in that town attend that ceremony, together with local people from recent areas. It is an efficient way to distribute the pamphlets by those local organized activities.

Four papers have been submitted to professional journals (in Chinese with English abstract) for improving public awareness in scientific field.

The report about the result of this project, reported by Xinhua News Agency, is published in Internal Reference which is only distributed to high officials in order to attract the attention of them and may call for government actions to stop those environmental pollution activities along the coastal zone in Yancheng Biosphere Reserve.

The pre-warning ecological assessment is very useful for further ecological planning and environmental resources management in Yancheng Biosphere Reserve, which should facilitate the biodiversity conservation in surrounding Yellow Sea ecosystem.

All the samples have been reserved for other usage.

## **8. Conclusions and recommendations for future work**

We conclude that the project is very successful since we have carried out a lot of work for basic scientific analysis.

The results of all measurement go well with the actual situation well, which can provide useful information for scientists, managers, local stakeholders.

The propagation for public awareness covered from high officials to local stakeholders, including the staff working in the Reserve. The information might call the attention of environmental protection than only paying much attention to industry development.

Phenolic compounds pollution happened on Feb. 20, 2009 had caused 3-day-delay of drinking water in Yancheng City, by the leakage from Biaoxin Chemical Limited. However, all pollution was directly discharged to Xinyanggang, which is to the northern boundary of the core area of Yancheng Biosphere Reserve by rinsing the watercourse using substantial water. Thus the potential threats of PCBs to the ecosystem health and biodiversity conservation calls for further study.

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**III. Surrounding Communities' Economy's Reliance on the Resources of Binzhou Shell Dyke Island and Wetland National Natural Reserve and Their Participation in the Reserve's Management *Ocean University of China***



# **Surrounding Communities' Economy's Reliance on the Resources of Binzhou Shell Dyke Island and Wetland National Natural Reserve and Their Participation in the Reserve's Management**

**Ocean University of China**

## **1. Summary**

“Surrounding Communities' Economy's Reliance on the Resources of Binzhou Shell Dyke Island and Wetland National Natural Reserve and Their Participation in the Reserve's Management” is a small grant programme under UNDP's Yellow Sea Large Marine Ecology (YSLME) project. Undertaken and implemented by the school of economics, Ocean University of China, this project was conducted from August 2008 to October 2009. The aim of this project is to enhance the stakeholders' capability of participating in the management of marine natural reserves and promote the optimal long-term benefits the stakeholders can enjoy from the non-expendable and sustainable usage of the reserve's resources.

During the operation of the project, Participatory Rural Appraisal (PRA) method is used to investigate the production and life style of the 3 sample villages surrounding the reserve, in order to guide the surrounding villagers to acknowledge the sustainable usage of the reserve's resources and win their support for the reserve's management. Local villagers are encouraged to actively participate in the management of the reserve. Public educations on the reserve are conducted in the surrounding areas, investigation results are publicated at hearings for broader information distribution.

By using participatory rural appraisal method, through organizing the participation of local stakeholders, this program will investigate the level of reliance of villagers' traditional production and living style on the reserves' resources, analyze the internal relations between the traditional production, living style and the destruction of wetland resources, guide the change of local residents' ways' of resource usage, organize local villagers in the active participation of wetland protection, and provide suggestions on more efficient and scientific management methods for the reserve.

Based on the above activities, we have finished the report on “Surrounding Communities' Economy's Reliance on the Resources of Binzhou Shell Dyke Island and Wetland National Natural Reserve and Its Sustainable Development Plan”. The report's suggestion on changing the local villagers' economic growth mode was submitted to the Binzhou City government as a decision-making base for the local government to solve the conflicts between the reserve and local economic development; the surrounding villagers have a better understanding of the resources in the reserve and management of the reserve. The reserve has earned broader community support, the level of public participation in the management of the reserve has also being improved; public hearing provides a platform for the reserve's stakeholders to express different opinions on the reserve's resource values and management implementation methods. It attracts the representatives of the stakeholders to address problems and provide possible solutions, and eventually reach common knowledge and understanding, which enhances the social foundation for the reserve's management.

## **2. Background of activities**

Binzhou Shell Dyke Island and Wetland is the world's best kept and only new and old co-existence shell Dyke Island (Figure 3). It is an important base to study the evolution of environment such as change of the Yellow River and coastal lines, formation of the shell

dyke island, etc. as well as the types of wetlands. It holds an extremely important position in the study of marine geology and wetland in China as well as in the world. In order to protect Binzhou Shell Dyke Island and Wetland, in 2006, the state council officially approved it National Natural Reserve. It is a marine natural ruin style of natural reserve which mainly protects shell dyke islands and coastal marine wetland's ecological system.

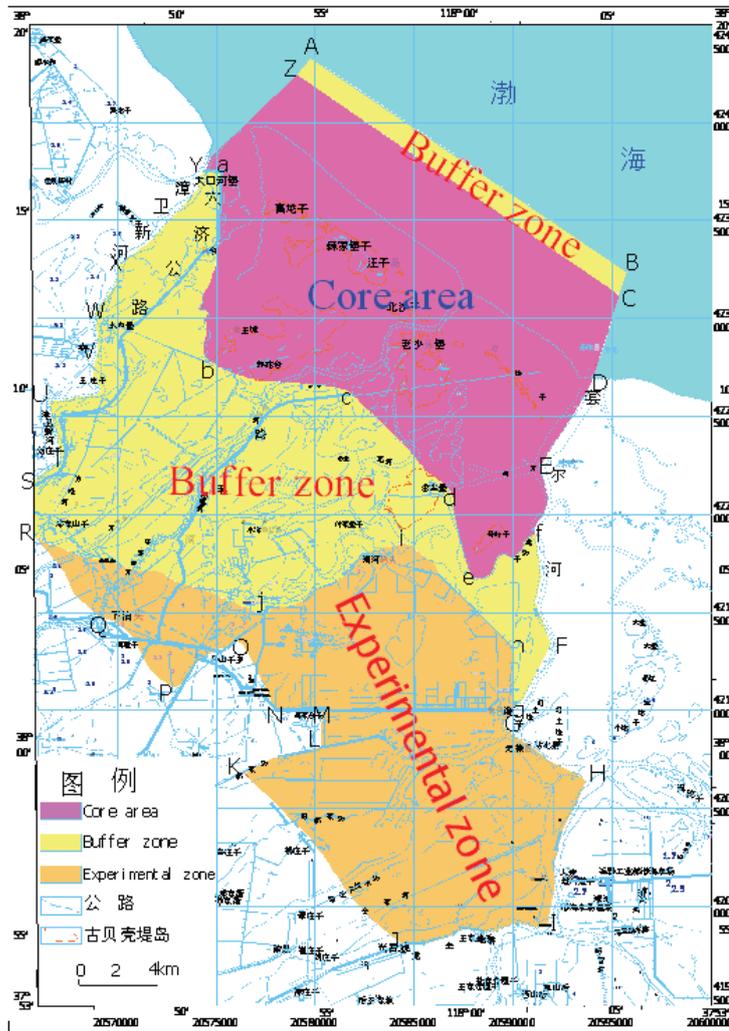


Figure 3: Binzhou Shell Dyke Island and Wetland National Natural Reserve

The reserve is located in less-developed area. Over the years, villagers from the reserve's surrounding areas have been heavily relying on the resources of the wetland. They open salt-production yards, dig ponds for mariculture, directly obtain sandstones containing shells for construction or simply obtain firewood from harvesting the wetland's plantations. After the establishment of the national reserve, which stipulates core areas, buffer zones and experiment zones, the local residents' production activities were restricted and their traditional life-styles have changed, this eventually affected the villagers' direct economic interest.

As a matter of fact, due to the low income level and pursuing of economic interest, from time to time villagers from the surrounding areas entered into the buffer zone and conducted cultivation and chemical industry activities. This has created great pressure on the sustainable usage and management of the reserves' resources. Therefore, the key to

the success of the reserve is the participation, cooperation and efficient management of the stakeholders including local villagers and organizations at the primary level.

### **3. Objectives of activities**

The goals of this project were to:

- Clarify the current social and economic situation of the surrounding areas of Binzhou wetland, especially the relationship between local communities and wetland resources;
- Promote the participation of local villagers and primary level organizations in the programme, in order to emphasize the participation of locals in the business of coastal wetland natural reserves; improve the local residents' capability of managing the reserve; and
- Guide the local residents' in the change of ways of resource usage, coordinating the relationship between economic development and resource sustainable usage, in order to help the stakeholders benefiting from the long-term interest of sustainable usage of coastal wetland natural reserves.

To achieve the above goals, activities were conducted to

- Clarify the level of reliance of villagers' traditional production and living style on the reserves' resources;
- Analyze the internal relations between the traditional production, living style and the destruction of wetland resources;
- Guide the local residents in the change of ways of resource usage through supervision of the local residents' employment plan;
- Assist in the establishment of village level non-governmental organizations, and organize the local villagers' participation in the protection of wetland resources; and
- Conduct public education on the protection of reserve's resources and provide suggestions on more efficient and scientific management, improving the capability of the reserve.

### **4. Target audiences**

Target audiences were all relevant local stakeholders, including:

- Reserve's management staff;
- Reserve's villagers;
- Enterprises located within the reserve; and
- Primary and secondary students from the reserve's surrounding areas.

### **5. Activities implemented**

Through execution of the project, the project team has accomplished the activities as follows.

#### **5.1. Participatory methods and PRA tools using**

##### *Introduction of PRA*

PRA is a method widely used in international rural development projects for design, implementation, appraisal as well as examinations. It is a systematic, semi-structural investigation research method used by a multi-discipline team which includes the locals to

understand rural life, rural social economical activities and obtain other information through a series of participatory working techniques and skills. It emphasizes drawing up sustainable development plans with villagers as the principal part, obtaining information from the villagers, and understanding the village from the villagers' perspectives. The most outstanding characteristics of this method is that it emphasizes on villagers' participation during the whole working process, therefore its results are more feasible and easier to be accepted by the farmers.

### *Implementation of PRA*

From November 6 to 7, 2008, accompanied by the reserve's management staff, Mr. Wu Bingtai and Mr. Wu Songbo, the project team members conducted field investigation at the core zone of the reserve, and made preliminary visit to Cha Jian No.1 Village, which is located in the buffer zone. Contents of preliminary investigation include the reserve's resources and their distribution, allocation of the infrastructures, types of production activities conducted by the villagers and enterprises within the reserve as well as possible mishandling of the resources.

In February 2009, after Chinese New Year, the team members visited 3 natural villages (Shui Gou Village and Meng Village in Chengkou Township, Cha Jian No. 2 Village in Ma Shan Zi Township). 18 person time semi-structural interviews were conducted to villagers, relevant enterprises, government departments, and other stakeholders. Total of 150 questionnaires were distributed during the investigation.

## **5.2. Hold training classes for the reserve's management staff**

Time: November 2008 and February 2009

Location: The Administrative Bureau of the Reserve, Wudi County

Trainee: Working staff of the reserve's management bureau, total of 16 person times

Training Experts: Training experts are from School of Economics, Ocean University of China: Dai Guiling, Li Jingmei, Gao Jingtia, and Zhang Likui.

Training Subject: "Marine Reserve – Concept and Application"; "Establishment of the Community Joint-Management System for Marine Natural Reserves".

Contents: Functions and Importance of Marine Reserves; Planning and Design of the Marine Reserves; Operational Management and Evaluation; The Concept of Community Joint-Management of Marine Reserve and Its Application.

## **5.3. Public education for the reserve**

### **5.3.1 Public education for the villagers and enterprises in the surrounding areas of the reserve**

#### *Public education during the interviews to the villagers*

We started communication with and education to the villagers during the interviews on the resources in the reserve. Under the guidance of the interviewers, older villagers could still remember the richness of the resources in the reserve 20 years ago. About 7-8 years ago, a large amount of waste water (above the emission standard) from the upstream was discharged into the Bo Hai Sea, causing the vast death of fish, shrimp, crab, etc. At that

time, over 50% of the fishing boat couldn't operate as usual, over 10,000 fishermen's life and production were affected severely. Subconsciously, the villagers have realized the effect of resource depletion and environment pollution to their lives. Catching this opportunity, the interviewers introduced the function and importance of the reserve, as well as its potential economic benefits. They have also conducted on-the-spot investigation on how to utilize the resources in the reserve to develop ecological economy and listened to villagers' suggestions.

#### *Public Education Products*

300 calendars were printed and distributed to the villagers and enterprises in the reserve. The calendars have pictures of the reserve's resources as well as knowledge on the reserve's protection and management in Q&A form. Three purposes are served through this form of public education:

- Villagers are happy to receive them, rather than throwing them away after they have read it.
- Duration of this form of education is expected to be 1 year.
- Integrate education through fun of enjoying pictures and words.

The calendars were distributed in February 2009 to villagers in the 3 sample villages and enterprises which received interviews and are greatly welcomed by them.

#### **5.3.2 Public educations targeting at the local primary and secondary students on the reserve**

Time: September 2009

Place: No. 1 Middle School of Wudi County

Subject: Human Beings and the Ocean; Ocean – Our Future

Activities:

- Drawing competition on: "Human Beings and the Ocean", with 56 students participated in the competition.
- Writing competition on: "Ocean—Our Future", with 80 students participated in the competition.

Awards:

- Drawing competition: 2 first prize winners were awarded with a day tour in Qingdao (due to the swine flu in Qingdao, the day tour was postponed); 2 second prize winners were awarded with Ocean Knowledge Book Series; all participants were awarded with notebooks.
- Writing competition's awards are the same as above.
- Public education products
- Booked 300 notebooks
- 1800 bookmarks
- Many books on ocean knowledge

#### **5.4. Hold public hearings for the stakeholders and publicized relevant Information**

### *Composition of Stakeholders*

2 villager representatives from the reserve, 2 enterprise representatives from the reserve, 1 from the reserve administration, 1 from the Environment Protection Bureau of Binzhou City, 1 from the Marine Fishing Industry Bureau of Binzhou City, 3 from the Science and Technology Bureau of Binzhou City, 2 from the Information Industry Bureau of Binzhou City, 6 from the Ocean University of China.

### *Public Hearing*

Time: September 21, 2009

Place: Science and Technology Bureau of Binzhou City

Activities:

- Project leader Professor Dai Guilin introduced the project's background, aim and activities conducted.
- Project member Prof. Zhang Likui from the Geology College of Ocean University of China introduced the importance of the reserve and its resources.
- Administrator, engineer Mr. Wu Songbo from the reserve introduced the administrative regulations of the reserve.
- Enterprise representative (Mr. Wu Jianquan from Shandong Chengkou Salt and Chemistry Company Ltd.) made his speech on the effects of the reserve to the enterprises' growth.
- Project leader Professor Dai Guilin made his speech on the contents of the investigation report, including the sustainable development planning for the villages, production styles which need adjustments; credit support from the local government; land policy, etc. How to realize the long-term participation of the villagers to the reserve, etc. He also asked for suggestions on the above-mentioned contents from the representatives of the villagers and enterprises as well as other stakeholders.

## **6. Produced outputs and outcomes**

### **6.1. Investigation findings**

The major findings of the PRA include the following:

- Obtained the social economic information regarding the villages within the reserve, including the sample villages' total households, population, level of education, income level, source of income, etc;
- Learned the effects of villagers' (within the reserve) production and living activities on the resource of the reserve;
- Learned the effects of enterprises' (within the reserve) production activities on the reserve;
- Obtained villagers' suggestion for the reserve management and their livelihood development plan making.

For details, see Annex III attached to this report.

## **6.2. Principles for community plan making**

As a result of the research, it became clear that there was a need for the community to create a plan for sustainable development. Three principles as guidelines for preparing the development plan were provided as follows.

### *Principle of economic development*

The drawing up of community sustainable development plan shall base on the principle of promoting local economic development. Only with the development of local economy, the villagers changing to substitute lifestyle, improvement of economic conditions, and stability of occupation and income structure, the reserve can have a solid economic and social foundation.

### *Principle of sustainable usage of resources*

The drawing up of community sustainable development plan should help the villagers to get out of their current condition of living on local natural resources, in order to realize the aim of non-expendable usage of marine resources.

### *Principle of reserve management efficiency*

If the drawing up and implementation of the community's sustainable development plan can base on the community's economic growth and resource sustainable usage, there will be a great decrease of conflicts in resource usage and a great increase of resource users' obedience to management's administrative plan. In addition, the local and county community's capability of organization of participation in the reserve will also be greatly improved. Therefore, the principle of reserve management efficiency should be followed when drawing up the community's sustainable development plan.

## **6.3. Suggestions to improve the marine reserve**

To improve the reserve, a set of recommendations was provided as follows.

- Reasonable planning of the reserve's coverage area
- Development of eco-tourism around the reserve
- Ecological compensations to the villagers who have made scarification to the reserve.
- The government should provide capital, technology, information support to the villagers in transferring period.
- Recruit qualified villagers as management staff for the reserve
- Encourage the enterprises located within the reserve to undertake social responsibilities of resources sustainable use and environment protection
- Set up community joint-management committee
- Public education for a long period of time

#### **6.4. Training project members and administrative staffs of the reserve**

##### *Project members after training*

This project is mainly composed of young lecturers and graduate students. The organization and implementation of the project has provided the young scholars opportunities to gain experience in participating international projects, especially the implementation of public education.

##### *Administrative staff of the reserve after training*

Binzhou Shell Dyke Island and Wetland National Natural Reserve has problems with technology and supervision measurements in the reserve's planning, R&D, usage of diversified biological resources, tourism development, coordination with the surrounding areas, etc, among which lack of talents is the major factor. Through this project, we have conducted training twice for the reserve's administrative staff, and have changed their knowledge structure and updated their management concepts.

#### **7. Evaluation of implemented activities**

##### **7.1. Enhanced the stakeholders' understanding and support to the reserve.**

Enhanced the villagers' understanding and support to the reserve. During the past management of the reserve, the villagers are passively being educated rather than active participants; they are resource destroyers rather than protectors. This project believes that the villagers understand the resource conditions and potential problems imbedded in their families and villages, they are keenly aware of the constraints for development, they are most concerned with how to solve these problems and how to effectively utilize the current resource's potentials. The implementation of PRA is to invite the villagers' active participation, therefore, promote the locals' constant improvement of their understanding on self economic conditions and resource environment as well as the reserve's management, and enhance the recognition and support of local community to the reserve. Many villagers said: establishment of the reserve is a great thing. The resource in the reserve belongs to the state. As long as our losses are compensated and there are better ways of living, we certainly support the reserve and are willing to become the protectors of the reserve.

Inspired students' sense of mission and responsibility for environment protection. Through drawing and writing competitions, the students pay more attention to the reserve and come to realize that the reserve is not only their homes but also the treasure shared by the world. Therefore, these activities greatly increased the sense of environment protection of the students and teachers and inspired the students' sense of mission and responsibility for environment protection.

##### **7.2. Strengthened capacity building for the reserve management**

The reserve has wined the trust from the local communities. Previously, there was tense relationship between the reserve and the local community. The reserves administrate through simply adopting regulations and punish those who violated them through imposing a fine or detention. From the perspective of fostering local communities' economic development, this project wins the trust of the reserve from the community and improves the relationship between the reserve and the surrounding enterprises and villages through paying respects to the villagers' right based on the investigation, providing suggestions on

how to solve the conflicts between the reserve's protection and the villagers' economic development.

Through "Marine Reserve – Concept and Application" themed training, the administrative staff of the reserve improved their knowledge structure by systematically learning the development status of the domestic and international reserves as well as methods for operation management, supervision and evaluation.

Through "Establishing Community Co-management Mechanism for Marine Natural Reserve" themed training, the administrative staff of the reserve learned the new management style of international reserves, which emphasizes the villagers participation and community co-management. As the result, the reserve's administrative bureau initiated the draft for the community co-management plan.

### **7.3. Involved local community in decision-making process**

Villagers participated in the drawing of the sustainable community development plan, which becomes more feasible; based on their own experiences, villagers provided suggestions to their own economic development and the reserve's management, part of which has become an important component of the sustainable development plan. For instance: suggestion on development of eco-tourism based on the reserve; suggestion on hiring the villagers as administrative staffs of the reserve.

The held public hearing provide information exchange platform for the conflicting stakeholders (villagers on one side and the reserve's administrative bureau as the other) where they communicated with the necessity of the reserve, the problems of the reserve and the possible development plan.

As the member of community co-management committee, the local community have the opportunity to ask for the capital and technology support from the government in order to reduce the dependence on reserve's resources, According to the principle of protection and sustainable development.

Expand the scope of local effect of this project.

### **7.4. The project's overall achievement**

Villagers actively participated in the project. For years, the villagers have tried every means to take advantage of the opportunities provided by the current resources, therefore, accumulated many experiences and lessons. They understand the resource status and potential problems, and they care the most as to how to solve these problems. Traditionally, the local villagers are considered as the destroyers of the reserve, therefore, are totally excluded from the decision-making process of the reserve. Based on the PRA investigation, 79.4% of the farmers said that they are willing to but denied the change to participate in the management and decision-making process of the reserve. From the very beginning, this project focuses on respecting to villagers' rights and exploring development opportunities for the villagers. Therefore, during the process of its implementation, the project has always been stressing on the villagers' participation.

Reinforced the stakeholders' participation in the reserve's management. Previously, educations on the environment were mostly done by the reserve's administrative departments through pure legislation propaganda, putting the local schools, students and farmers in passive positions. On the contrary, activities conducted in this project (such as

interviews with the villagers, public hearing, drawing and writing competitions in local secondary schools) focused on encouraging the community's active participation.

Accomplished the investigation report on "Surrounding Communities' Economy's Reliance on the Resources of Binzhou Shell Dyke Island and Wetland National Natural Reserve and Their Participation in the Reserve's Management", which provides decision-making basis for the local government to guide the villagers' transformation of their production and living styles.

## **8. Conclusions and recommendations for future work**

The purpose of establishing the marine reserve is to protect and promote the growth of shell dyke islands, prevent the degeneration of coastal wetland's ecological environment, resume and promote the eco-functions of coastal wetland and proliferation of rare birds. However, the reserve will become inefficient or a failure if its daily management can not solve the conflicts among the different users and obtain support from the public for the establishment of the marine reserve. Economic development is the root problem causing the conflicts in the reserve. The reserve will become a "castle in the air" if it does not solve the sustainability of the surrounding villagers' production. Therefore, this project has always been paying attention to the survival and development of the people living in the reserve. It encourages ordinary people's participation in order to improve the utilization of the local resources and establishes sustainable substitute industries, therefore, the community people can obtain real economic benefit from nature protection and wetland resumption, realize attitude change from "being asked to protect" to "I want to protect", eventually reaches the long-term target of harmony between nature protection and economic development.

Although the activities in the project are ended for the period, we have the following suggestions for the project:

- (1) Use this project as seed project to attract more international projects' attention towards reserves' management and development.

As the reserve's administrative bureau's first international cooperation, the outputs and achievement of the project will be shared by both parties. If condition allows, the effects of this research should be further expanded to attract the attentions of more international organizations.

- (2) Establishment of the Reserve's Community Co-Management Mechanism.

Community Co-Management is a brand new management mode of natural reserves. It is intended to protect the biological diversity and improve the community residents' living standard through the community and the reserve's joint participation in the management decision-making, implementation and evaluation of the reserve's natural resources. We suggest that the community co-management mechanism should cover the following areas:

- Member composition of the community co-management committee;
- Action plan for community co-management, including specification of the industries that need support and the mode of support
- Inspiration and rewarding mechanism for the community co-management. An inspiration and rewarding mechanism is necessary for long-term existence of a

community co-management mechanism. Especially, the participation of international organizations and programs are very important.

(3) The reserve should draw up detailed long-term plan for public education.

- Edit and publish reading materials to introduce the reserve's resources.
- Produce video materials to introduce the importance of shell dyke island and wetlands, broadcast the videos in primary, secondary schools, villages and enterprises.
- Establish showroom or sand plate model for Binzhou ancient shell dyke bank, which holds an important position in the research of marine geology and wetland styles in China and the world. Open a specified area in the buffer zone to attract education and leisure tours.

## **9. Contact information**

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**IV. Living with black-faced spoonbill, the symbol of peace  
in the Yellow Sea *PGA Wetland Ecology Institute***



**Living with black-faced spoonbill, the symbol of peace in the Yellow Sea:  
Programme of CEPA (Communication, Education, Public awareness) for black-faced  
spoonbill in Ganghwa**

**PGA Wetland Ecology Institute**

**1. Summary**

Ganghwa is an island on the Yellow Sea. Surrounded by tidal flats of ecological importance, the island is also famous as a tourism site with its historical remains. As many species of birds take a rest or breed there, the island is regarded as an important point along the East Asian - Australian migratory birds flyway. Especially, Black-Faced Spoonbills (BFS below), *Platalea minor*, has drawn international attention to this island, as the fact is known that more than 50% of worldwide breeding pairs of BFS is breeding in this island every year.

This project aimed at conservation of BFS through developing and executing CEPA (Communication, Education, Public Awareness) activities. We researched the food of BFS on the rice paddy and tidal flats with the residents. Through these activities, we communicated with the residents in order to find solutions together with the residents to protect BFS.

We will designate an exemplary rice paddy in Choji-ri village in the island in order to find a way of wise use of rice paddy. In the rice paddy, where the local farmers are cultivating rice by organic methods, we will research the biodiversity and organism amounts. And by naming the rice paddy as a "Spoonbills Rice Paddy," we made a guideline of managing an organic rice paddy.

We also communicated with the fishers near the BFS breeding sites in order to find a way of wise use to protect the breeding site.

**2. Background of activities**

**2.1. Ganghwa island**

Ganghwa island is situated at Han-river estuary. It is 5th biggest island in South Korea with its area of 411.24 km<sup>2</sup>, and 65,000 population. It is bordered by Yellow Sea on the south, Gimpo-si Gyeonggi Province on the east and Yeonbuk-gun Hwanghae-do, Kepong-gun Gyeonggi Province on the North Korea (Figure 4). Rice paddy (166.718 km<sup>2</sup>) takes 40.53% of the island. Swampy place rice paddy such as sandy rice paddy, immature rice paddy, wetland rice paddy, salt rice paddy charges 75% in Ganghwa-gun. Most of rice paddy using pesticide and chemical fertilizer, only 1.2% (146.3ha) of all rice paddy is organic rice paddy. (Ganghwa- Province Agricultural Technology Center, 2004). Rice paddy of spoonbill breeding is organic and lower pesticide (exceedingly part of all rice paddy ) and is in villages of Oakrimri, Nupsungri, and Chojiri in Ganghwa is natural monument that has 448,159,835 m<sup>2</sup>. However, Gaksi-rock (main breeding site, a small rocky islet) isn't natural monument.



Figure 4: Map of Ganghwa Island

## 2.2. Threats to the Spoonbills breeding site and countermeasures

Black-Faced Spoonbill, *Platalea minor*, is an endangered species (IUCN Red List CR A2c) with worldwide population of around 1700 individuals. Its major breeding site is the uninhabited islets and rocks near the Ganghwa island, including Yu-do islet, Suk-do islet, Bi-do islet, Yo-do islet, Gakhe-do islet, Yi-do islet, Suri-bong islet, Gaksi rock, Suhaham islet, and Hambak-do islet.

During the breeding season, Spoonbills need food from fresh water (Malcom Coulter, 2005). The Spoonbills who breed in Yudo islet use rice paddy in the southern part of Ganghwa island to feed the young birds. They collect snails, mudfish (*misgurnus*), and tuber of plants (*Eleocharis kuroguwai*) in the rice paddy. And the parent birds collect shrimps, mudskippers, and mullets in the tidal flats to feed themselves. In 2005, at least 100 pairs among the 325 pairs who bred in the islets of Yellow Sea, were confirmed to use rice paddy to collect foods. (Kim Inchul, 2006) But, in the breeding season of 2006, spoonbills failed breeding in Yudo islet, requiring countermeasures (Lee Kisup, 2005).

By the research, it was confirmed that spoonbills who breed in Yudo islet use rice paddies in Chojiri village and Neopseongri village. In order to protect the spoonbills who breed in the Yudo islet, cooperation and participation of the farmers in the villages are essential.

Tidal flat in the southern seashore of Ganghwa island was designated as a Natural Monument, its importance for spoonbills and other migratory birds being considered. But, the Gaksi Rock in the middle of the tidal flat is not included in the area of Natural Monument. Regulation is needed as people who fishes as hobby enter the rock frequently. And cooperation with the fishers in the tidal flat is essential to protect the spoonbills who breed in the rock.

### **3. Objectives of activities**

This project was based on the need to reduce the threats to the Black-Faced Spoonbills, a flagship species of Yellow Sea, who breed in the islets near Ganghwa island. More specifically, we were intended to find ways to protect spoonbills who use rice paddy in Choji-ri village, Gaksi rock, and Seondu-ri tidal flat. The objective of this project was to produce guideline on management of Black-Faced Spoonbills habitats through civil monitoring and CEPA programs for the local residents.

*Necessity of Guideline on management of rice paddy in the spoonbills breeding habitat.*

The number of Black-Faced Spoonbills who breed in Gangwha area was about 110 pairs in 2004, 180 pairs in 2005, and 100 pairs in 2006. It is about 50% of worldwide population.

According to the research, BFS collect food in tidal flats, estuary, and flooded rice paddy, of which distance from the nest is shorter than 20 kilo meter. For 40 days from May to June, when the parents raise the young birds, most of the food for the youngs are collected in the rice paddy. The reason they collect food only in fresh water is supposed that the young need food with low-level of salt. (KIM In-chul, 2006)

The most favorite paddy is located in Okrim-ri village, Neopseong-ri village, and Choji-ri village. As the young grows up, the parents begin to collect food from tidal flat. The most favorite foods from rice paddy, according to the study of Kim, are carps (*Carassius carassius*, *Pseudorasbora parva*, and *Abbottina rivularis*), mudfishes(*Misgurnus mizolepis*), tadpoles, dragonfly larvae, and tuber of plants (*Eleocharis kuroguwai*). And the favorite size is 5 cm.

We researched the biodiversity of the organic rice paddy. We tried to find why organic farming is important to provide food to the spoonbills. In this procedure, we conducted awareness program with the local farmers and make guideline on management of rice paddy in the spoonbills breeding habitat.

*Necessity of Guideline on use of tidal flat in the spoonbills habitat*

Black-faced Spoonbills collect mullets, mudskippers, shrimps, and craps in the tidal flat of southern Ganghwa island. But the breeding in Gaksi Rock in the middle of the tidal flat was disturbed by human activities, especially by the leisure fishers. And we didn't know how the local fishers' activities are affecting the breeding of spoonbills.

To find a solution of coexistence of people and wild animals, we researched the ecological features of the area and food of the spoonbills, and made a booklet, "Food of Black-Faced Spoonbills."

### **4. Target audiences**

*Researcher for scientific interchange*

PGA wetland ecology institute studied the way of ecological tourism and methods of protecting BFS with SAVE international, an international BFS network group. The result of such studies was provided to the local interest groups.

PGA Institute also studied the biodiversity of rice paddies with Seoul National University Plant Ecology laboratory. The result of such studies was used in making biodiversity management plan for rice paddy, and was provided to the local farmers, too.

### *Local fisherman*

PGA Institute communicated with local fishermen. We shared the importance of protecting BFS with the fishermen, and we persuaded them to participate in monitoring the habitat and in making the conservation plan. We also made a guideline of driving boat for ecological tourism with them.

The communication was made mostly with fishermen from 4 villages including Dong-mak ri and Sun-Do ri, which is close to Gaksi Rock, an important breeding site of BFS. Public awareness program for the fishermen included monitoring of shellfish, rescuing BFS in danger, and participating in advertising BFS.

PGA Institute made Guideline of ecological tourism and fishery with fishermen for BFS. The guideline include: Rule of driving boat for bird-watching, preventing leisure fishers from landing on Gaksi Rock, and preventing illegal fishery.

### *Local Farmer*

In order to reduce the breeding failure of BFS, attention and participation of the farmers in the breeding site is essential. Especially PGA Institute communicated with farmers in Choji-ri and Neopseong-ri village where BFSs use intensively

We monitor the biodiversity and biota amount of the organic rice paddy in Chojiri village, and made a guideline of managing organic rice paddy as a feeding ground with the farmers.

In addition, to prove that the organic agriculture is much better than habitual agriculture, we researched the biodiversity of habitual rice paddy, too.

## **5. Activities implemented**

### **5.1. Research and monitoring activities**

#### **5.1.1 Cooperative research**

##### *Cooperative research activity with UC Berkeley/SAVE International*

We conducted joint research with UC Berkeley Department of Landscape Architecture and Environmental Planning, and SAVE International which are supporting the international BFS network activities. The cooperative research was conducted until June 2009 from January 2008. Professor Randolph T. Hester and 21 students of the UC Berkeley Department of Landscape Architecture and Environmental Planning participated to the cooperative research.

Result of cooperative research includes: (1) BFS breeding ground and geometries, specifics about the habitat requirement, (2) Existing agriculture, eco-tourism, and potential for island wide tourism, (3) Precedents for such tourism in similar context, (4) Precedents for farmer incentives to manage rice fields for spoonbills (5) Trends in land use development and infrastructure/land use controls and species protection as well as threats, (6) Existing island ecosystems, projected changes, given warming and sea-level rise and impacts on culture and wildlife sties, existing protection, enforcements and alternatives for resources protection, and (7) Lands most critical for spoonbill survival, present and future projections.

### *Cooperative research activity with Seoul National University*

We thought rice field is important as BFS's habitat. PGA wetland Ecology Institute researched characters of rice field in Ganghwa island's BFS habitat with Plant Ecology Laboratory at Seoul National University. The cooperative research was conducted at rice paddy in Chojiri village from January to December 2008. To this research participated 7 experts.

Results of cooperative research include: (1) Rice field's physical and chemical character in Choji-ri and (2) Biodiversity of rice field in Ganghwa island eastern area.

### *International BFS workshop based on cooperative research*

Date: May 24th, 2009 ~ May 26th, 2009

Place: Ganghwa tidal flat center conference room

PGA wetland Ecology Institute held International BFS Workshop based on result of cooperative research. The International BFS Workshop subject was the BFS and Ganghwa Island Eco-tourism. The workshop was organized by PGA wetland ecology institute, with the help from Ganghwa People's Network, UC Berkeley, and SAVE International. At this workshop, the research result was discussed and 27 participants shared their knowledge and experience on BFS.

International BFS Workshop discussed the followings:

- Spoonbill Geometries - the spatial needs of *Platalea minor* relative to climate change, international relations and people. This includes land area and land use requirements for breeding, flyway and wintering.
- Randolph T. Hester, Professor of UC Berkeley and SAVE International representative, announced the Partnership for endangered species and economic development and the successful cases of cooperative efforts to provide income and habitat protection simultaneously. This includes case studies in the U.S. and elsewhere, government programs, private-public partnerships, financial and land use aspects of how the case works.
- Plans for Ganghwa island - the present and proposed comprehensive plans, economic development and infrastructure plans. This includes land form, ecological system, vegetation, history, cultural and landscape uniqueness, transportation, economic forces, land use regulations, habitat and cultural conservation. The focus is an analysis for proposed and alternative plans relative to local economy and endangered species and culture.
- Demonstration studies on rice farming in southeast Ganghwa Island - Plans for small area around Choji-ri. This includes site and social analysis at the microscale, synthesis of local people's needs and critical habitat dimensions, a socio-ecological need matrix, an financial analysis and detailed proposals for income supplement, new and value added farm products, and habitat conservation from the International BFS workshop.

## *Cooperative research presentation and proposal to Ganghwa County*

Date: May 26th, 2009

Place: Ganghwa county office public relations room

PGAI and Cooperative organizations(Ganghwa People's Network, UC Berkeley, SAVE International) presented and proposed the Cooperative Research to Ganghwa County. Many governmental officials from various departments participated: Ganghwa County Mayor, Culture and Tourism Division, Eco-Agriculture Division, Fisheries and Afforestation Division, and Environment and Health Division.

UC Berkeley and PGA institute suggested comprehensive plan for ecological tourism and protection. Firstly, UC Berkeley indicated threatening elements of BFS's breeding place and habitat in Ganghwa island. It proposed BFS preservation and Ganghwa Island development plan that considered Ganghwa tourist and a threatening element.

We presented conservation and development direction based upon culture and biodiversity of Ganghwa Island. We also presented preservation and development plan for beach and tidal flat of Dongmak-ri and Buno-ri. UC Berkeley proposed local economic activation by Eco-tourism with BFS habitat and announced the Ganghwa tidal flat center situation, role accomplishment, developmental plan as hub of Ganghwa island Eco-tour.

### **5.1.2 Monitoring of BFS feeding material and habitat in breeding season**

PGAI monitored BFS feeding material and place in breeding season (March - May). The monitoring period was until May 2008 from July 2007. It was aimed at finding the feeding resources in tidal flat and rice field. Fishes, benthos, Amphibian/Reptilia and biodiversity of feeding place was monitored. Especially, the six times of monitoring were conducted with local farmers and fishermen (Table 1)..

The monitoring was especially meaningful because local farmers and fishers participated. As the protection of habitat depends on the local farmers and fishers, participating them in the monitoring will contribute to the protection of the habitat. And the wisdom and experience of the local farmers and fishers could be shared with the scientific researchers.

PGAI made the biological information on BFS habitat by six times of monitoring with experts and local resident. Firstly, PGAI made the biological list of rice field in Choji-ri Ganghwa Island as BFS feeding place. The biological list of rice field in Choji-ri contained the plant, land insect, Invertebrates, fishes, amphibian, reptiles, mammals and etc.

The Institute drew up the biological list based on investigation of Dongmak-ri and Buno-ri tidal flat. It also made the biological list of tidal flat which contained the plant, crustacea, bivalvia, gastropod, decapod, fishes, and birds in Dongmak-ri and Buno-ri. Especially, decapod and fishes was confirmed as the BFS food resources by monitoring the feeding activity in tidal flat.

Table 1: Monitoring activities to investigate feeding and habitat of Black-Faced Spoonbills

No.	Date	Place	Purpose
1	March 13th, 2009	Maewhamarum rice field in Choji-ri, Ganghwa Island	<ul style="list-style-type: none"> <li>To survey winter water-rice field in Ganghwa Island and Monitoring about birds</li> </ul>
2	April 10th, 2009	Maewhamarum rice field in Choji-ri and tidal flat in Dongmak-ri, Ganghwa Island	<ul style="list-style-type: none"> <li>To research about fishes resource of tidal flat in Dongmak-ri where BFS habitat</li> <li>To monitor biodiversity of rice field in Choji-ri</li> </ul>
3	April 15th, 2009	Dongmak-ri beach and Maewhamarum rice field in Choji-ri	<ul style="list-style-type: none"> <li>To monitor fishes on biodiversity of BFS Maewhamarum rice field in Choji-ri</li> <li>To interview for a social environment investigation in Dongmak-ri and monitoring about BFS habitat</li> </ul>
4	April 23th, 2009	Gaksi Rock and tidal flat in Dongmak-ri where BFS habitat  Maewhamarum rice field in Choji-ri, Ganghwa Island	<ul style="list-style-type: none"> <li>To research on BFS feed resource in Dongmak-ri and monitoring Gaksi Rock where BFS habitat</li> <li>To monitor Benthos on biodiversity of BFS Maewhamarum rice field in Choji-ri</li> <li>To conduct Biological monitoring and Education with The National Trust of Korea Choji-ri Maewhamarum rice field activists</li> </ul>
5	May 6th, 2009	Gaksi Rock and tidal flat in Dongmak-ri where BFS habitat  Maewhamarum rice field in Choji-ri, Ganghwa Island	<ul style="list-style-type: none"> <li>To monitor amphibian/reptilia on biodiversity of BFS rice field in Choji-ri</li> <li>To conduct cooperative monitoring with The National Trust of Korea Choji-ri rice field activists</li> </ul>
6	May 25th, 2009	Gaksi Rock where BFS habitat in Dongmak-ri, Ganghwa Island	<ul style="list-style-type: none"> <li>To monitor the habitat of BFS.</li> </ul>

## 5.2. Partnership/Network building

*First Workshop (for BFS protection Network construction with Ganghwa island fisherman)*

Date: December 8th, 2008

Place: restaurant in Ganghwa island Dongmak-ri

PGA wetland ecology institute decided that the substantial activity is important for BFS protection through the network building with local resident. So the institute held the 1st Workshop for BFS protection Network building with Ganghwa island fisherman. With the

help of Ganghwa People's Network, PGA Institute communicated with the local fishermen and farmers.

Fishermen suggested many good ideas for the protection of BFS breeding in the area. But they did not like designating the area as a protected area, because their livelihood may be restricted by such designation.

*Second Workshop (for BFS protection Network building with Maewhamarum with Choji-ri rice field activist)*

Date: March 13th, 2009

Place: restaurant in Choji-ri Ganghwa island

PGA wetland ecology institute held the 2nd Workshop for BFS protection Network building with farmers in Choji-ri village of Ganghwa island.

The Institute and farmers agreed on the joint monitoring of rice field. The institute and farmers promised to make the winter water rice field for BFS. The institute and farmers agreed on application of biodiversity management contract after Ramsar site registration.

*Local fisherman networking (for Local resident's BFS network building)*

Date : April 15th, 2009

Place : restaurant in Ganghwa island Dongmak-ri

For BFS Network building, PGAI met the chief of Dongmak-ri fishing village cooperatives who led small-scale eco-tourism in Dongmak-ri Ganghwa island. The institute understood the situation of the local fishermen about the Gaksi Rock BFS habitat.

The Institute and fisherman strengthened the network about BFS conservation. We agreed to make endeavor to share BFS information for the economic improvement of fisherman life.

### **5.3. Stakeholder Involvement/Public Awareness**

*BFS public awareness Poster and sticker produce Activity*

PGA wetland ecology institute produced BFS public awareness posters and stickers. The posters and stickers were made by Hobakkot publishing company with the materials provided by the PGA institute. BFS stickers were produced with 3 different versions: Korean, English and Dongmak-ri fishing cooperatives version. BFS stickers were produced in order to attach on the car and boat.

The posters and stickers were donated to local people, shops, and BFS related groups and agencies. BFS posters were distributed to the Conference of the contracting parties and visitors in Ramsar COP10, too. BFS posters and stickers were delivered to fisherman for BFS conservation and public information at the Ganghwa island fisherman workshop. BFS posters and sticker were delivered to the participants at the Ganghwa island farmer meeting. And they were distributed to various schools, and citizen organizations.

*Farmers Education (for BFS and Maewhamarum rice field biodiversity)*

Date: April 23th, 2009

Place: Maewhamarum rice field in Choji-ri Ganghwa island

PGA wetland ecology institute executed an education for BFS and Maewhamarum rice field biodiversity with Maewhamarum Choji-ri rice field activist and farmer. The institute and farmers agreed the joint monitoring with expert and Maewhamarum rice field activist. The institute educated Benthos monitoring method and biodiversity of rice field with Maewhamarum rice field activist and expert. The institute distributed the BFS posters to the farmer in education.

*Local fisherman meeting(for Ganghwa Island Eco-tourism with BFS)*

Date: May. 25th, 2009

Place: restaurant in Ganghwa island Dongmak-ri

PGA wetland ecology institute had the Local fisherman meeting for public awareness. Subject of meeting was Ganghwa Island Eco-tourism with BFS focused on Dongmak-ri tidal flat and Gaksi Rock. The meeting was held with the cooperation from Ganghwa People's Network, UC Berkeley, and SAVE International.

The institute announced the BFS present condition. UC Berkeley presented Ganghwa island Dongmak-ri Eco-tourism connected with BFS to local fishermen. Fishermen agreed the discussion for BFS protection and local fisherman's economic profit increase through eco-tourism. Fishermen requested BFS habitat expansion and preparation for bird watching space. The institute distributed the BFS posters and stickers to the Dongmak-ri fishermen.

*Local farmers meeting (for Ganghwa Island Eco-tourism with BFS)*

Date: May 26th, 2009

Place: Choji church in Choji-ri Ganghwa island

PGA wetland ecology institute had the Local farmers meeting for public awareness. Subject of meeting was Ganghwa Island Eco-tourism with BFS focused on Choji-ri rice field. The meeting was held with the cooperation from the National Trust of Korea, UC Berkeley, and SAVE International.

Farmers presented about reclamation of Gangwha Island and history of agriculture. UC Berkeley presented Ganghwa island Choji-ri Eco-tourism connect with BFS to local farmers. Farmers requested the sale marketing method about the Choji-ri organic rice. UC Berkeley and the institute informed an overseas cases of Eco-tourism. The institute distributed the BFS posters and stickers to the Choji-ri farmers and the National Trust of Korea.

## **6. Produced outputs and outcomes**

### **6.1. Guidelines for eco-friendly rice farming**

The booklet, Guidelines for management of rice paddy includes the following contents.

- Put water into the rice field after harvesting and reaping.
- Connect the rice field sluice gate with the waterway naturally.
- Don't use the pesticides and the insecticide.
- In the BFS feeding time, don't act any disturbance by intent.
- Protect the rice field living things which are the food resources of BFS.
- Bird watching should be maintained at the distance farther than 50m in rice field.

## 6.2. Guidelines for eco-friendly fishing

The booklet, Guidelines for management of rice paddy includes the following contents.

- Put water into the rice field after harvesting and reaping.
- Connect the rice field sluice gate with the waterway naturally.
- Don't use the pesticides and the insecticide.
- In the BFS feeding time, don't act any disturbance by intent.
- Protect the rice field living things which are the food resources of BFS.
- Bird watching should be maintained at the distance farther than 50m in rice field.

## 6.3. Guidelines for eco-tourism

The booklet, Guidelines for eco-friendly fishing, includes the following contents.

BFS is an endangered species of birds belonging to Family Threskiornithidae, order ciconiiformes. Their breeding sites and wintering sites are located in the East Asia locally. Most of BFS make nests in uninhabited island of the Korean Peninsula west coast in springtime, migrate for wintering to Taiwan, Hong Kong, Vietnam and the Chinese southeast coast and Japan. They have unique catching method: They open the bill, shake the bill and catch the fish with a sense of touch. When they look for food, their bills shaped like a spoon stirs in low water. Because of bills shaped like a spoon, they are named 'Black-Faced Spoonbill'.

BFS mainly keep on living with shrimp, Gobiidae, young flathead mullet etc in tidal flat. But BFS use intensively the rice field and waterway which is fresh water from early April to the middle of June in the breeding time. BFS feed crucian carp and Chinese muddy loach, dragonfly larva in the fresh water to the young which cannot digest salty food. BFS also eat the bulb of water plant like *Sagittaria pygmaea*.

### *Meeting and the BFS “ Slowly, lowly, Quietly” – Rule of Birds Watching*

- Don't make a noise, don't speak  
Birds are sensitive to a sound, when you make a noise and speak loudly, they fly away
- Don't run, move slowly.  
Birds always feel insecure with the existence of threats.
- Don't do anything that may frighten the BFS  
Birds do not like being gazed.
- The cloth must avoid a primary color, put on cloth with natural color.  
Remember that you are visiting the place where the BFS lives.

## 6.4. Materials for raising public awareness

### *BFS poster produced for BFS Public Awareness*

PGA wetland ecology institute produced BFS public information posters of 2000 copies. The posters were distributed at the Ramsar Conference in 2008. The posters were also delivered to fishermen and farmers at workshops held for BFS conservation and public information. The posters were also distributed to schools and citizens organizations.

*BFS sticker produced for BFS Public Awareness*

PGA wetland ecology institute produced BFS stickers, too. Its size was 100 × 100mm and 1000 copies of Korean version, English version, and Dongmak-ri fishing village cooperatives version each were printed. The Institute distributed to Dongmak-ri fishing village cooperatives and local shops. Stickers were delivered to Choji-ri farmers, local restaurant, church for BFS conservation, schools and citizens organization.

## **6.5. BFS cooperative research activity outcomes**

The cooperative research activity with the UC Berkeley and the SAVE International procuded a number of information with respect to the status and use of the ecosystem of Ganghwa Island to conserve the habitat in a sustainable manner. Some of the major outputs include the following:

- Ganghwa Island Eco- Design with BFS
- Ganghwa Island Eco-tourism with BFS and overseas example
- Ganghwa Island Eco-system
- Tourism on Ganghwa Island
- Tourism on Ganghwa Island Past in spires future
- Characters of rice paddy wetland in Choji-ri Ganghwa island BFS habitat

For details, see Annex IV attached to this report.

## **7. Evaluation of implemented activities**

### **7.1. Network constitution for BFS habitat management**

PGA wetland ecology institute established a network for BFS, which includes NGOs and research groups. The network agreed in sharing information, cooperative research and activities for protection. The network includes: SAVE International, Plant Ecology laboratory of, Seoul National University, Ganghwa Maewhamarum committee of National Trust, JAWAN, Hobakkot Publishing Co., Dongmak-ri fishing village cooperatives in Ganghwa island, and Choji-ri young men's association in Ganghwa island.

### **7.2. Recognition increase activity based on Ganghwa island local resident and communication**

PGA wetland ecology institute produced the BFS public relations poster and contributed widely. The institute produced BFS stickers and contributed to public awareness. The institute presented the Ganghwa Island Eco-tourism plan connected with BFS. Also Maewhamarum rice field monitoring activity with Choji-ri young men's association was conducted. The institute developed public awareness material and Eco-tourism guide book focused on BFS. Workshop held for BFS recognition increased activity with farmers and fishermen.

### **7.3. Supporting registration of rice paddy in Choji-ri as a Ramsar site**

Rice paddy in Choji-ri was designated as a Ramsar Site. The institute offered the biodiversity of Choji-ri rice field 's research result and consultation to the related governmental officials. The institute is working as a member of management committee of this Ramsar site, and making effort to establish an educating institute for the Ramsar site.

#### **7.4. International workshop and Ramsar COP10 participation**

PGA wetland ecology institute participated to international workshops as mentioned below and presented about the conservation activity and biodiversity of rice paddy and tidal flats in Ganghwa island as a BFS breeding place.

- 2008. 7. 9 - 7.10: International BFS Workshop plan
- 2008.7.30 - 8.1: Presented the biodiversity of rice paddy in Japan 2008 International Environment Education Symposium
- 2008.10.2 - 11.5: Presented the importance of Choji-ri rice paddy in International Maewhamarum Symposium
- 2008. 10.23 - 26: Participation and Presentation in World NGO Conference of wetlands
- 2008. 10.27 - 11.4: Participated and Exhibited the Ramsar COP10 and Side Event

#### **7.5. Presentation of BFS conservation and Eco-tourism plan**

PGA institute proposed an ecological tourism plan to the local government. Such a plan was focused on protecting BFS and was made with the help from UC Berkeley and SAVE International. The institute held workshops with local residents from Choji-ri, Dongmak-ri, and Ganghwa tidal flat center. The institute announced Ganghwa island Eco-tourism plan focused on BFS to Ganghwa County Mayor and officers.

### **8. Conclusions and recommendations for future work**

#### **8.1. Conclusion**

Community-based monitoring together with local resident is a very effective method of increasing public awareness. The institute executed monitoring the Black-faced Spoonbill(BFS)s' feeding resources in tidal flat with fisherman, and executed the rice field biological monitoring with farmer. Especially the field knowledge of farmers and the fishermen was very valuable information, and the project activities became important opportunities for the scientific researchers to share the traditional knowledge. And also, the information provided by the scientific researcher was helpful for the farmers and fishers, too.

#### *Local network for BFS strengthened*

BFS stakeholder list was made through the project. The list includes NGO, researchers, and many other individuals and organization. Through this network, the stakeholders will continue to share knowledge and information on BFS and its habitat

#### *Making vision for sustainable agriculture and ecological tourism in Ganghwa island*

Through the project, environment-friendly agriculture was strengthened, which will provide more food for the BFS. Ways of ecological tourism using the fisher's boat was discussed with the fishers. Conclusions from such discussion was transferred to the local government, and a good response from the government was obtained.

## **8.2. Recommendations for future work**

### *Necessity of BFS conservation network active program*

Network for monitoring the BFS habitat is needed. Monitoring technologies and information on the breeding and wintering habitat can be shared through such network activities. BFS habitat management program may be developed through the network, too. And finally, all the interest groups can work together through the network for the wise use of the ecology.

### *Program for the local residents participation*

Programs that will involve the local residents should be developed. Fishermen can participate in ecological tourism related with BFS. The rice produced at the spoonbills feeding ground may be branded as BFS' rice. In these courses, the local residents participation is essential.

### *Participation of International network*

International network for monitoring BFS is needed. For this purpose, human network is needed. Researchers and bird watchers from South Korea, Japan, China, Hong-kong, Vietnam, Thailand, Laos, Cambodia and the United States, Russia can participate in this network.

Project to protect BFS may be organized with other international groups such as SAVE International, Birdlife International, or WWF. Habitat management program may be developed with Korean Water Birds Network, Incheon BFS Network, Japan BFS Network, Japan Ramsar Network etc. YSLME program, if extended, will contribute to supporting all these activities.

## **9. Contact information**

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UNDP / GEF Yellow Sea Large Marine Ecosystem Project

为了我们的未来更美好，让我们共同努力保护海草

二、什么是海草？

我们通常说的“大竹”就是海草。它们生长在浅海中的“草”，在生物学家眼中就是我们熟悉的海洋、红树林、珊瑚带、“蓝”表类藻类。

3. 海草有什么用？

世界上许多海草都有海草，只不过种类可能不同。我们所说的海草是在我国主要分布的浅海。

4. 海草为什么重要？

海洋渔业资源是海洋生物，是多种鱼、虾、蟹、贝的“居所”。对保护和恢复这些珍贵的海洋生物资源至关重要——还记得小时候在海里抓海草、捡海草和礁石的乐趣吧！

5. 海草在哪里？

海草生长在浅海，通常在潮间带以上。它们生长在浅海，是许多海洋生物的重要栖息地。海草是许多海洋生物的重要栖息地。海草是许多海洋生物的重要栖息地。

6. 海草为什么重要？

海草是海洋生态系统的重要组成部分。它们不仅为许多海洋生物提供栖息地，还可以保护我们的海岸，免受风暴侵袭。

7. 我们如何保护海草？

海草有强大的再生能力，只要给予适当的保护，加上海草的生长环境得到改善，它们就能重新繁茂。目前我们采取的措施包括：在海草床周围设立保护区，禁止在海草床上进行任何破坏性的活动。我们还可以通过人工种植海草来恢复受损的海草床。

## V. Protecting the Sea grass Bed for a Better Future Rongcheng Fisheries Association

# **Protecting the Sea grass Bed for a Better Future**

## **Rongcheng Fisheries Association**

### **1. Summary**

The sea grass beds off Rongcheng City are precise and have recently been identified among the most representative habitats in the Yellow Sea coastal zone. According to the precautionary rule, current small contract granted activities has been conducted to raise local fishing villagers' perception of the value of the sea grass beds and take preliminary protecting actions. With supporting from the small grant, the following activities have been conducted, respectively: a workshop, meetings with local farmers, interviews, volunteers' protection, and intervention with local management sectors. Through these activities, local stakeholders (mainly the adjacent villagers and local managers) have gained knowledge and raised their concerns on the status and ecological services of the sea grass bed, agreed to use prompt producing practice to avoid damaging the sea grass bed, and the sea grass bed is being protected in a preliminary mode.

### **2. Background of activities**

Sea grass bed is a type of critical habitat, hosting diverse marine lives and providing valuable services to the connected human society. In the western Yellow Sea, there used to be many sea grass beds along the coast. These sea grass beds, however, have largely disappeared in the recent decades, which is believed as a result of heavy pressures from human exploitation activities and environmental changes. The situation is so severe that distribution of sea grass beds to day is limited to the coastal shallow water of Rongcheng City, Shangdong Province, China. Nonetheless, none of these sea grass beds have been established as marine protected areas; neither have them been under dedicated and efficient protection.

### **3. Objectives of activities**

The sea grass bed off Chudao, Ningjin Town (Figure 5) is proposed as the target of protection. Here has existed a natural sea grass bed since a century ago, providing various services from provision, culture to supporting. Local residents traditionally rely on them for their living and welfare: they capture abundant fish, collect benthic animals of high market values and pick up pieces of sea grass break offs to cover their house roofs. However, as in many other areas, rapid development of economics has been attracting people to change their lives and increase their pressures to the marine ecosystem including the sea grass bed. A direct threat is the increased intensity of local fishery activities which can damage the sea grass bed and deplete the hosted resources and biodiversity. An indirect threat is that people from the village prefer modern houses to traditional ones and no longer care about the value of sea grass to their life.

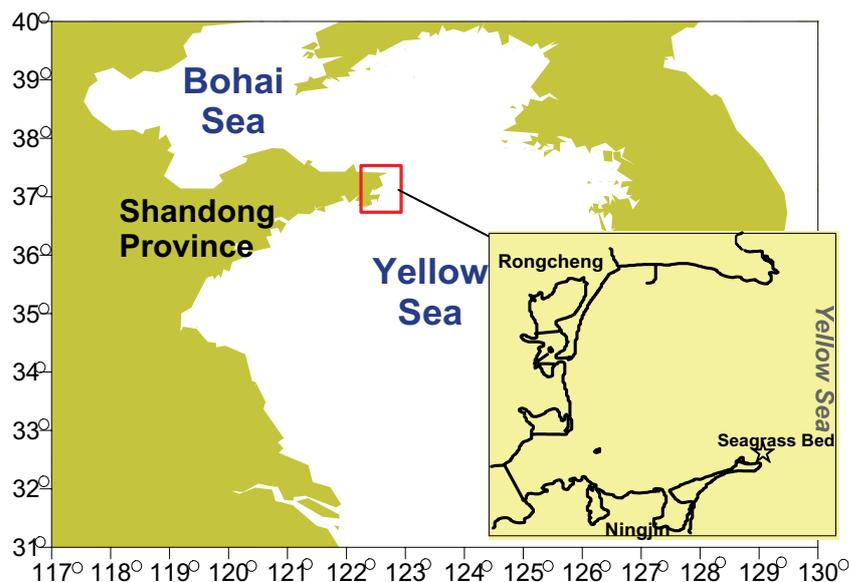


Figure 5: Location of the project site

The objectives of the propose project are to draw concerns of local stakeholders onto sea grass bed's service values and prevent the sea grass bed from damaging by improper exploitation activities.

#### 4. Target audiences

This material targets at government marine and environmental management agencies, managers of marine protected areas, aquaculture companies, marine farmers and other potential users of the seagrass and other similar habitats.

#### 5. Activities implemented

##### 5.1. Drawing stakeholders' concern of seagrass bed service values

A workshop was held at Chudao, in which people from the adjacent village Chudao, manager of the local aquaculture farm, and member of the Rongcheng Fisheries Association attended. Dr. Zhang Xuele, Prof. at the First Institute of Oceanography of State Oceanic Administration and Mr. Tang Tingyao, Emeritus Prof. at the Shandong University, gave oral presentation and printed leaflets to introduce history and current status of sea grass beds along the western Yellow Sea coast, and to introduce ecosystem services provided by the sea grass bed. Dr. Zhang introduced biodiversity concept, the significance of marine biodiversity conservation and related activities conducted by the UNDP/GEF Yellow Sea Large Marine Ecosystem Project. Dr. Zhang also described briefly the basic biology of the seagrass, the historical changes of seagrass status along northern China coastal lines, and various services provided by the seagrass to the human society, concluding that seagrass beds off Rongcheng are one type of precious marine wetland. The introduction was welcome and well received by the audience. Mr. Tang described the history of the seagrass beds off Rongcheng, with the knowledge and experience during his work of decades at the local fishery institute. He vividly reminded participants of the happy times when people collect seafood organisms in the abundant seagrass beds and culture sea cucumbers and other valuable species in the seagrass beds. He also draw participants' concern of the seagrass by giving a lesson from an adjacent bay where improper engineering almost destroyed the seagrass therein and caused sustained huge loss of production and income to the local fishery and aquaculture. During the workshop

break in the morning session, copies of a printed leaflet (attached to this report) were distributed to all workshop participants. The leaflet contains basic introduction on the seagrass, the services it provided to the human society and the current status of seagrass. The talks of Dr. Zhang and Mr. Tang was both welcome and well received by the audience. During the discussion session, participants asked questions about the contents in both talks, commented on the design of the leaflet, expressed their feeling and concern of the seagrass. Most of the participants apparently went for the conservation of the seagrass.

To evaluate the effect of this workshop, two interviews of local village people were made before and after the workshop, on their concerns of sea grass bed and willingness to protect the sea grass bed. The survey results showed that local people's concern and willingness was both raised after the workshop.

## **5.2. Minimizing the pressure on seagrass bed from local exploitation practice**

Meetings were hold with local farmers, both individuals and the major farming company of Chudao whose activities mainly occurs in the sea area covering the sea grass bed, to help them design eco-friendly producing practice to avoid damaging the sea grass bed. Suggested practice included using the bottom releasing instead of suspension raft aquaculture, minimizing use of fed aquaculture (mainly fish cages, etc.), preventing from use of traw nets, various nets to capture fish larvae, juveniles and brooding fishes, and other destructive benthic operations (making poles for anchoring of the raft or cages, grabbing off sediment, etc.). The farmers also requested more detailed and practical guidelines that would help them with ease. The contractor of this small grant explained that scientific researches in these related fields are ongoing and hopefully will provide such knowledge in the near future. What is practical now for the local farmers is to try to adopt the eco-friendly producing practice first as a precautionary step.

A small volunteer team of six local farmers has been established. They received brief training on the sea grass importance and were willing to trying to take non-violent actions to monitor the sea grass bed area. The monitoring aimed to persuade people to give up improper activities. The monitoring team was separated into two groups working in rotation every two days. The monitoring activity was watching over the seagrass bed area both on the beach and in the shallow sea. The monitoring from on the beach aimed to prevent potential damaging by people in the tidal zone and walkable area, and the monitoring from in the sea aimed to prevent potential damaging by people that is far from the beach where hardly visible. The monitoring was done by combination of using spare time between the volunteers' own working (monitoring on the beach) and using the working hours as they frequently passed the seagrass bed and stayed around (monitoring in the sea) on the sea. The monitoring activity started in middle August and lasted about four months till in December 2008. Over this duration, these volunteers successfully recognized and prevented by persuading three potential destructive actions by individual people. These included two temptations to dig patches of seagrass for transplantation into ponds for shrimp cultivation<sup>[note]</sup> and one tempted to dig clams with destroyable large shovels. The volunteers told these people that the seagrass habitat is precious and under protection by the local community for its valuable service of marine resources provision; these temptations must be stopped because either removing the current sods as transplantation donor to the shrimp pond culture or digging the sod with shovels would destroy the existing limited seagrass bed. The temptations were then cancelled following the persuasions. The monitored potential damages were taking into consideration for

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<sup>[note]</sup> Seagrass is transplanted to shrimp ponds because the farmers believe these will improve the quality of pond culture and provide shelter for the shrimps from high temperature in summer. But these transplantations must be renewed because the ponds are dried every year thus the seagrass therein will die.

designing of the guideline of seagrass protection and provided basis for development of management plans in the future.

Meetings were made with local management sectors, Board for Chudao Village Affairs and Committee for Ningjin Community Affairs, trying to seek supports from them. The Board and Committee recognized our efforts. Although they cannot issue legal document(s) at present, they both agree to guide people toward friendship with and protection of the sea grass bed during their routine operations and support the volunteer team's activities by recognition and praising the team and providing additional assistance in case the team encounters any problems beyond its ability to resolve. The managers also agreed to adopt the temporary guideline designed by the contractor and consultants in their future functions and help disseminate the guideline to the local people.

*Summary of the guideline to protect the seagrass bed and lessons on conservation of the seagrass bed.*

A combined guideline to protect the seagrass was produced during the commission of this small contract service. This guideline can be used both for educating local farmers to adopt eco-friendly producing operations and for helping managers to design their future management. The guideline suggests people to give up making trawls, digs, raft and cage culture in or over the seagrass bed. The guideline advises people to use properly designed benthic replese culture, not to use the current seagrass bed as donor for transplant to pond culture. The guideline also reminds people take appropriate means to prevent polluting the seawater, lowering the water clarity and damaging the sea bed.

Two lessons were obtained, respectively that improper "protection" or lack of protection might both damage the seagrass ecosystem. The former is mainly represented by seagrass transplanting, because the current seagrass bed distribution is limited, in the process of recovering from decades of declines, any removal of current sods might threat the seagrass bed. The latter is mainly reflected in lack of direct legal supports to seagrass bed protection. Local management sectors failed to take effective actions because these seagrass beds are not established as marine protected areas.

## **6. Produced outputs and outcomes**

- Local communities have improved their understanding on the importance of the seagrass ecosystem of the Yellow Sea and are more willing to use such coastal resources in a sustainable way.
- Primary information of seagrass users is gathered, which helps design guideline to help them friendly use the seagrass and well tailored future management plans.
- A combined guideline to protect the seagrass was produced during the commission of this small contract service. This guideline can be used both for educating local farmers to adopt friendly producing operations and for helping managers to design their future management. The guideline is attached to this report as Annex V.
- A team of trained volunteers is established and they have undertaken successful activity of seagrass protection monitoring.
- Lessons tell us that improper "protection" and lack of protection might both damage the seagrass habitat.

## **7. Evaluation of implemented activities**

The first activity “Drawing stakeholder’s concern of sea grass bed service values” was successful. The survey results showed that around 30% of concern and willingness was raised, 68% (concern) and 51% (willingness to protect) after the workshop against 34% (concern) and 20% (willingness to protect) prior to the introductory workshop. This indicates the workshop has reached its goal.

The second activity “Minimizing the pressure on sea grass bed from local exploitation practice” was successful. The seagrass bed is being protected as it is through concert efforts of the volunteer team, the local managers and other stakeholders, who successfully prevented some temptations to damage the seagrass bed.

## **8. Conclusions and recommendations for future work**

The small contract service has been commenced according to the contract and achieved the expected results.

The produced guidelines for environmentally-friendly fishing practice in the seagrass bed remain preliminary due to lack of sufficient knowledge and experiences. These are expected to improve based on results of the ongoing related researches in this area.

The volunteer team’s monitoring of the seagrass bed appears to be good contribution in light of the status that no governmental conservation is established yet and the volunteers already made success in protection of the habitat. However, the volunteer team must make their own life and their monitoring of the seagrass currently lacks of legal support, thus sustaining and success of the monitoring is difficult to make in the long run. Regular mechanism(s) must be established to dedicate protecting the seagrass bed. Accordingly, the small project grantee is making efforts to local government and other institutions seeking to establish the seagrass bed officially as a marine protected area. As an interim alternative, the volunteers are praised and encouraged to continue activities as possible as they can.

## **9. Contact information**

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## **Annexes**

### **Annex I: Steps towards the conservation and restoration of the Mokpo Namhang Urban Wetland**

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Conserving birds - Conserving habitats

## Steps towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and People



Produced by Birds Korea as part of a UNDP-GEF/Yellow Sea Large Marine Ecosystem Project, February 2009

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## Contents

Steps towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and People

Part 1: Background  
Part 2: Case Studies



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## Part 1

Background

- Definitions
- Conventions and Agreements
- Waterbirds and Wetland Conservation

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## Definitions

**Wetlands:**  
Natural and artificial; rivers, marshes, lakes, estuaries, tidal-flats, lagoons, reedbed etc.

**Conservation = "Wise Use"** = best management, including maintaining biodiversity (See: Ramsar Resolution 9.1)

Formal definitions of Ramsar Convention agreed to all by member nations ("Contracting Parties")

**Enhancement:** Improving the values and functions of a wetland

**Creation:** Making new wetlands and new wetland values

**Restoration:** Returning in completeness a wetland's ecological character and values to a historic condition. Also used to indicate the return of certain values or potential

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## Connections

Wetlands are all connected – e.g. through the movement of water and wetland species including birds and fish

- Use of one part of a wetland affects other parts
- Use of one wetland affects other wetlands
- Use of wetlands in one nation or region (e.g. Yellow Sea) affects other regions




Management of a wetland needs to consider all component parts, its wider catchment/coastal zone & its "invisible" connections

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## Used wisely, wetlands provide multiple benefits

Wetlands are often areas of natural abundance – biodiversity and food needs of people (fisheries and rice)

Wetlands store and purify water - help reduce impacts of storm-damage and human pollution

Wetlands store greenhouse gases (c.f. Climate Change)

Wetlands are often beautiful – provide a "natural" focus for recreation and environmental education.



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### Wetland Degradation And Loss of Biodiversity



Wetland degradation and loss is a global problem: more than 70% wetland loss in some areas (See: Ramsar Rec. 6. 15)

First response :  
Change national policy to conserve existing wetlands and improve wetland management

Ramsar Rec 4.1:  
"the maintenance and conservation of existing wetlands is always preferable and more economical than their subsequent restoration"

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### National and International Agreements

Republic of Korea - multiple commitments to improve wetland and waterbird conservation, e.g.:

- Wetlands Conservation Act (1999)
- National Wetlands Management Plan (2007)
- Bilateral Bird Agreements (e.g., Republic of Korea-Australia Migratory Bird Agreement, 2007)

International Agreements:

- Convention on Biological Diversity
- United Nations Millennium Development Goals
- Ramsar "Wise Use" of Wetlands Convention

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### The Ramsar Convention

Ramsar Convention: provides global expertise and political focus for wetland conservation



The Convention works through the agreement of nations that join it – the Contracting Parties

By joining, all nations agree to "formulate and implement their planning so as to promote the conservation of [Ramsar sites], and as far as possible the wise use of wetlands in their territory" (see: Ramsar Article 3.1)

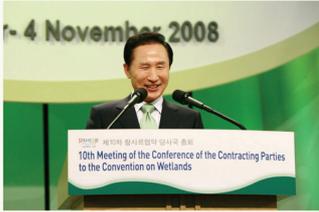
The Republic of Korea joined the Convention in 1997

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### Ramsar Resolutions (1)

Resolutions - Agreed to by all member nations in formal meetings, the Conference of the Contracting Parties (COP) held once every three years

Most recent COP was COP 10 in Changwon in 2008

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### Ramsar Resolutions (2)

Resolutions provide "Best Advice" and make clear obligations of member nations

Ramsar Convention Resolutions and obligations are international agreements that carry legal weight, even with (some) national courts

*E.g. Netherlands court has ruled that obligations under Ramsar are legally binding*

Ramsar Convention provides clear guidance on e.g.:

- The wise use of wetlands
- Integrated planning
- Wetland restoration

(See: [http://www.ramsar.org/index\\_key\\_docs.htm](http://www.ramsar.org/index_key_docs.htm))

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### Wetlands Conservation = Wise Use

Conservation = Wise Use = Sustainable Development

Conservation: a WIDE RANGE of management options

Options for wetland conservation include:

- No human use or management (e.g. Wilderness Area)
- Areas of restricted access and limited management (e.g. some National Parks)
- Intensive management (Nature Reserve)

NOTE: Intensive human use (and exploitation) without adequate management causes wetland degradation. This is NOT conservation

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### Degraded Wetlands

Poor management of wetlands, especially in populated areas, leads to:  
Loss of "Ecological Character"

Potential costs include:

- Loss of wetland function/services
- Decline in species/biodiversity and natural productivity
- Negative feelings toward the wetland by local people



Some costs can be reversed by wise use & site restoration

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### Wetland Restoration

Programmes of restoration to reverse national/regional problems caused by wetland degradation and loss:

- Restore historic functions and values or create new values
- Provide benefits to wildlife and people

(See: Ramsar Resolution 8.16: Principles and guidelines for wetland restoration)

"programmes of wetland restoration that are ecologically, economically, and socially feasible and that are coordinated with wetland protection provide substantial benefits for both people and wildlife, even though restoration of wetlands cannot replace lost natural wetlands")

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### Wetland Biodiversity

Wetland species: Key part of the "Ecological Character" of wetlands

Ecological Character = "combination of the ecosystem components, processes and benefits/services that characterise the wetland"

(See: Ramsar Resolution 9.1, Annex A)




Absence or presence of wetland species indicates the absence or presence of other species and conditions

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### Waterbirds

- Waterbirds are among the most visible species of wetlands
- Many are beautiful
- Waterbirds are valuable bio-indicators: useful in assessing health and productivity of wetlands
- Waterbirds need food, and a safe, undisturbed place to nest and sleep
- Presence or absence of waterbird species indicates particular conditions: availability of food, absence or presence of disturbance




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### Waterbirds in Decline

Main threats to waterbirds include:

- Loss of habitat (feeding and sleeping areas)
- Degradation of habitat (over-fishing, fragmentation)
- Disturbance (by people, car, lights, sound)
- Pollution



Threats to waterbirds in Yellow Sea/East Asia are among the greatest in the world

See: Resolution X.22:  
"ALARMED at the continuing decline in abundance of many waterbirds throughout the world... AWARE that waterbirds using the East Asian-Australasian Flyway are the most poorly known of all flyway populations, that the greatest number of globally threatened waterbird species occur there..."

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### Ramsar Criteria for Identifying Wetlands of International Importance

Nine criteria to identify internationally important wetlands (Ramsar Article 2.1)

- Threatened species
- Abundance
- Special conditions

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird




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### Conservation of Waterbirds

Requires local/national action and international cooperation

Conservation of waterbirds ⇨  
Conservation of habitat ⇨  
Conservation of Ecological Character ⇨  
Conservation of Ecosystem Services ⇨

Extra benefits: Eco-tourism (Nakdong Estuary) & Environmental education (Mokpo)



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### City-Level Benefits of Waterbird and Wetland Conservation

Wetland for "Re-creation", Environmental Education & Eco-tourism

Focus in city for local involvement in conservation

Step toward Sustainable Development

- Increased well-being of citizens
- Ramsar Resolution 10.23: Wetlands and human health and well-being
- Positive City Image (e.g. Vancouver)



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### National-Level Benefits of Waterbird and Wetland Conservation

Wetland conservation benefits include:

- Improved water quality in catchment
- Conservation of biodiversity
- Sustainable Fisheries Industry
- Sustainable Tourism Industry



All steps towards fulfilment of Convention obligations (Ramsar and Convention on Biological Diversity) and Millennium Development Goals (MDG Goal 7 Target 2, Reducing the rate of biodiversity loss)



Improved National Image and Brand ⇨ Green Growth

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### Selecting the Best Management Approach

Best Management ("Wise Use") depends on:

- Area
- Existing values and "Ecological Character"
- Feasibility
- Targets, including proposed end-use



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### Examples of Wetland Management and Restoration

There is much experience globally of wetland management and wetland restoration

Information is contained in specialist publications produced by conservation organisations, e.g. the RSPB (UK)



The Ramsar Convention provides extremely useful policy guidance  
e.g. Resolution 8.16: Principles and guidelines for wetland restoration

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## Part 2

### Steps towards the Conservation and Restoration of the Mokpo Namhang Urban Wetland: For Birds and People

Case Studies

- Ramsar Resolutions on coastal and urban wetlands
- Phases and Steps of Wetland Restoration
- Integrated Management of
  - Estuarine Wetland
  - Tidal Lagoon
  - Reedbed
- Summary

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### Ramsar Resolutions on coastal and urban wetlands (1)

**Key Ramsar Resolutions on planning for Coastal Wetlands include:**

**Recommendation 6.8: Strategic Planning in Coastal Zones**  
 “adopt and apply strategic planning and integrated coastal zone management principles to assist conservation and wise use of coastal wetlands ... strategic planning in the coastal zone as well as environmental impact assessments ...”

**Resolution 7.21: Enhancing the conservation and wise use of intertidal wetlands**  
 “critical economic, social and environmental values of intertidal wetlands...especially for fisheries, biodiversity, coastal protection, recreation, education, and in relation to water quality ... URGES Contracting Parties to review and modify existing policies that adversely affect intertidal wetlands, to seek to introduce measures for the long-term conservation of these areas”



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### Ramsar Resolutions on coastal and urban wetlands (2)

**Resolution 8.4: Principles and guidelines for incorporating wetland issues into Integrated Coastal Zone Management (ICZM)**

**Resolution 10.27: Wetlands and urbanization**  
 “URGES all Contracting Parties to review the state of their urban and peri-urban wetlands and... to put in place schemes for their restoration and rehabilitation so that they can deliver their full range of ecosystem services to people and biodiversity”

**Resolution X.22: Promoting international cooperation for the conservation of waterbird flyways**  
 “WELCOMES the statement by the Republic of Korea ...that intertidal mudflats should be preserved and that no large-scale reclamation projects are now being approved in the Republic of Korea, and ENCOURAGES all Contracting Parties in their efforts to protect such habitats in future and to monitor them and mitigate any past development impacts on or losses to them”



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### Developing the Best Process (1)

Successful enhancement or restoration of coastal wetlands is a LONG process

In Sanbanze, Tokyo Bay, Japan, over 100 public meetings to build consensus before restoration work

**Best Process: Series of Careful Steps in Several Phases**  
 Research – Public Awareness & Planning – Restoration Work – Monitoring & Public Awareness – Revision

At Mokpo Namhang Urban Wetland, this long process is only just beginning: Research and Public Awareness Activities conducted, vision evolving...



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### Developing the Best Process (2)

**First Phase:**

1. Identify and delineate the site
2. Participation of key stakeholders - Raise Awareness and make roles clear
3. Agree Objectives of Site Management (maintain, enhance, restore or create new habitats?)
4. Identify ways to integrate work into broader plans and targets for Sustainable Development

**Ramsar Rec 4.1**  
 “Restoration interventions should be coupled with measures to raise awareness and influence the behaviours and practices that led to the degradation of the ecosystem, in order to ensure that the causes, as well as the effects, of degradation are addressed.”



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### Developing the Best Process (3)

**Second Phase:**

5. Investigate and evaluate the site further (Research on: species, functions, values)
6. Identify constraints/issues (funding, capacity, conflicts of interest). Seek solutions
7. Refine the objectives and work approach
8. Agree clear management objectives and work plan (including roles and funding)



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### Developing the Best Process (4)

**Third Phase:**

9. Undertake work
10. Monitor and evaluate work
11. Modify objectives and work plan
12. Share lessons learned: use the process and results to improve other projects and plans



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### Step 1: Site Delineation

Identify and delineate the site:

- Define area by Physical and Ecological Values & Ecological Character
- Consider Jurisdictional and Other Issues

Mokpo Namhang Wetland

- P1 Open estuarine system;
- P2 and P3 Tidal lagoons;
- P4 Reedbed



- All connected, yet all have different values and different management needs
- Identify linkages: River catchment & coastal system (e.g. linkage to Yeongsan Barrage; Green Ways etc)

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### Step 2: Involve Stakeholders and Identify Roles

Involve decision-makers, scientific and technical specialists & local stakeholders: share knowledge; raise awareness of key issues and possible solutions



Ramsar Resolution 7.8  
"ENCOURAGES Contracting Parties, technical experts, and local and indigenous people to work together in the planning and management of wetlands to ensure that the best available science and local knowledge are taken into consideration in making decisions"

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### Step 3: Identify Objectives of Site Management

Together identify objectives of Site Management:

- Target species
- Solving threats or issues
- Maintain, enhance, restore, create new habitats?
- How to maintain management long-term?



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### Step 4: Integrate into National Planning

Identify ways to integrate plans at site to wider level, e.g. for conservation and restoration of other sites nationally and on Flyway



See: Ramsar Resolution 7.17  
Restoration as an element of national planning for wetland conservation and wise use

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### Step 5: Further Investigation and Evaluation

At the site, and adjacent sites, conduct:

- Further research on waterbirds
- Further research on wetland vegetation

Conduct research on other species' groups, hydrology and human-use



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### Steps 6 & 7: Refine the Work Approach

Identify constraints and issues (funding, capacity, conflicts of interest)

Seek solutions, through consensus on:

- Feasibility of site-management/management approaches
- Ownership of the area and the site restoration
- The benefits and costs
- The best vision for the site

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### Step 8: Objectives and Work Plan

Agree clear management objectives and work plan (including roles and funding)

Management plans need to consider:

- Values of the site
- Feasibility (cost, available expertise, and level of support)
- Management issues and Targets
- Methodology of work

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### Steps 9-12: Monitor and Evaluate Work

Measure project success through survey, questionnaire, technical and public meetings.

- Have the problems been solved?
- Have Target Species increased?
- Have local attitudes to the wetland improved?

↓

Modify Objectives, Work Plan and Methods

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### Restoration in Action: Example 1, Busan Stream

**Management:** Removed concrete river-sides, selective planting, creating a popular area for recreation in the city: very popular and good for image of the area. **Main Target:** Increased human well-being



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### Restoration in Action: Example 1, Busan Stream

**Conservation Issues:** Water quality problems remain, and area is too disturbed to be used by much wildlife  
**See:** Ramsar Resolution 7.17



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### Improved Method: Use natural processes

**WWT**



Water arrives at the Wetland Centre via a pipe from near Heston. At Boney Wetlands, about 0.5% of the water destined for the River Lee reservoir is purged daily through the Wetland Centre.

**Use reedbeds for water treatment and to encourage wildlife (e.g. London Wetland Centre)**

**See: Ramsar Rec 4.1**  
"Natural processes and existing conditions should be considered during project selection, design, and development. To the extent that is possible, ecological engineering principles should be applied in preference to methods requiring hard structures or extensive excavation."

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### Restoration in Action: Example 2, Nakdong Estuary

**Management:** Large-scale restoration and habitat creation, through purchase of agricultural areas and construction of a shallow tidal lagoon, new areas of reedbed & planting of vegetation; construction of an Eco-centre and the development of some education programs. Some success in attracting target species and developing focus for environmental education



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### Restoration in Action: Example 2, Nakdong Estuary



However: Restoration project very poorly integrated with wider catchment and development issues e.g. estuarine barrage and Miyeonji Bridge



**Key Lesson Learned**  
Successful Restoration Projects take time, effort, and the support of many stakeholders...  
Good Science & Best Policy!

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### Mokpo Namhang Urban Wetland: What of the Future?



P1 Estuarine Wetland  
P2 & P3 Tidal Lagoons  
P4 Reedbed

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### P1 - Estuarine Wetland: Present Values



- An open, near-natural area
- Used by many shorebirds, ducks, gulls and herons (used by fewer species at high-tide, when covered by water)



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### P1 - Estuarine Wetland: Conservation Issues

- Very disturbed: roads along edge
- Open access
- Tidal-flats unavailable to shorebirds at high-tide: shorebirds need to use P2 and P3 during high-tide
- Water quality needs research
- Research needed on benthos
- Vegetation community is rather simple




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### P1 - Estuarine Wetland: Possible Solutions

**Management Options**

- General access can be restricted
- Education boards can be provided
- Disturbance can be reduced through increased screening along road-side e.g. Pegwell (UK): many design options possible



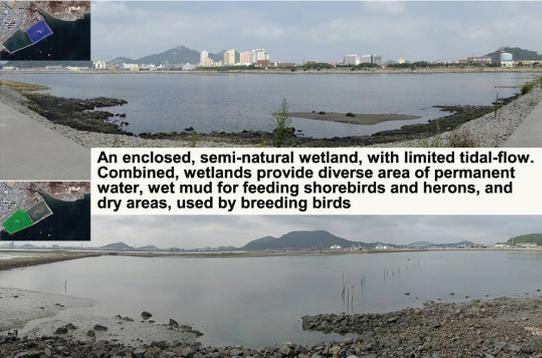
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### Design options for hides and screens



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### P2 & P3 - Tidal Lagoons: Present Values



An enclosed, semi-natural wetland, with limited tidal-flow. Combined, wetlands provide diverse area of permanent water, wet mud for feeding shorebirds and herons, and dry areas, used by breeding birds

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### P2 & P3 - Tidal Lagoons: Conservation Issues

- P2 and P3 both targeted for infilling by local Ministry of Land, Transport and Maritime Affairs
- Disturbance is excessive
- Water quality needs research
- Research needed on benthos
- Vegetation community is rather simple



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### P2 - Tidal Lagoon: Possible Solutions



Clay Marshes  
Ducks and other birds that swim

- With ecological landscaping small islands, permanent water surface and areas of wet mud could be improved and enlarged
- Boards can improve educational and recreational use

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### P3 - Tidal Lagoon: Possible Solutions

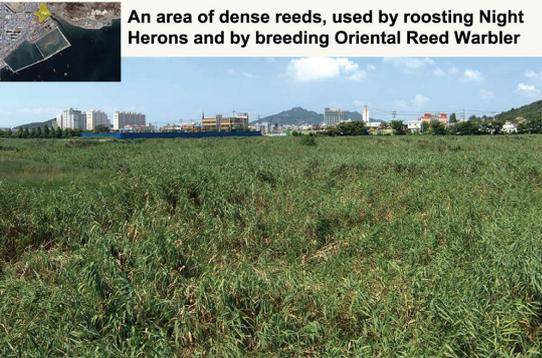
- General access could be restricted to reduce disturbance
- Infilling plans could be altered to create more diverse wetlands - realise new benefits and values from the site (creating a very positive image for the Ministry and the City)



London Wetland Centre, UK

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### P4 - Reedbed: Present Values



An area of dense reeds, used by roosting Night Herons and by breeding Oriental Reed Warbler

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### P4 - Reedbed: Conservation Issues

- Site is undervalued with garbage, roads and much background noise
- Reed vegetation will succeed over time, as reeds become old and die
- Species are hard to see
- Water quality and water quantity



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### P4 - Reedbed: Possible Solutions

- Water quality can be monitored and improved
- Creation of one or two small, open areas would increase diversity
- Path/short boardwalk could transect small part of edge of reedbed



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### P4 - Reedbed: Possible Solutions

- Reedbed would improve through selective and careful management
- Educational signs and activities increase understanding of reedbeds, and increase sense of value



Rieselfelder Münster (Germany)

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### Mokpo Namhang Urban Wetland: Process to Date

**Research:**

- Waterbird counts, near-daily: 2006 to present
- Vegetation survey, Sep & Oct 2008

**Public Awareness**

- Meetings with Mokpo City councillors
- Open symposia, Mokpo,
- Presentation on wetlands to expert meetings in Mokpo, Seoul and Changwon: Aug-Nov 2008
- Shorebird display at Mokpo Natural History Museum
- Posting on Birds Korea' websites
- Media coverage

**Monitoring**

- Expert guidance provided on refining waterbird count methodology (Aug-Sep 2008)

**Planning**

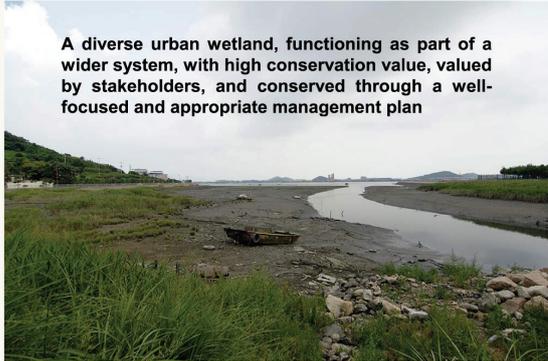
- Expert advice from the RSPB (Sep 2008)
- Expert input from Institute of Islands and Culture, Mokpo University (Aug-Oct 2008)
- Site visit by expert from national restoration committee

This process needs to continue, with increased involvement of local stakeholders

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### Our vision for Mokpo Namhang Urban Wetland

A diverse urban wetland, functioning as part of a wider system, with high conservation value, valued by stakeholders, and conserved through a well-focused and appropriate management plan



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### Summary

- Management of wetlands in populated areas is essential to conserve their ecosystem services
- The Mokpo Namhang Urban Wetland is a small and rather degraded wetland of still high conservation value, for biodiversity and for future use for environmental education and eco-tourism
- Present use and future proposals for the site threaten to lead to its further degradation
- Future management of the site, in line with the guidance and Resolutions of Ramsar, should include enhancement and restoration of the wetland
- Restoration is a long process, involving multiple steps
- Early steps have included increasing awareness of the site's values and of the involvement of local stakeholders
- Future conservation and Wise Use of Mokpo Namhang Urban Wetland will benefit people as well as birds and other wildlife

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### Acknowledgements and Links to Further Information

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<http://www.birdskorea.org>  
<http://www.birdskorea.or.kr>  
<http://www.ramsar.org>  
<http://www.rspb.org.uk>  
<http://www.yslme.org/>

## Annex II: Results of ecological pre-warning assessments

### 1. Results of seawater and pre-warning assessment

Only the data of mercury and arsenic was measured with good results by AF-610A atomic fluorescence spectrometer. The measurement of Cd, Cr, Cu, Pb, Zn, Ni was finished by SOLARRM6 atomic absorption instrument. However, the contents of those heavy metals were lower than the limit of detection equipment.

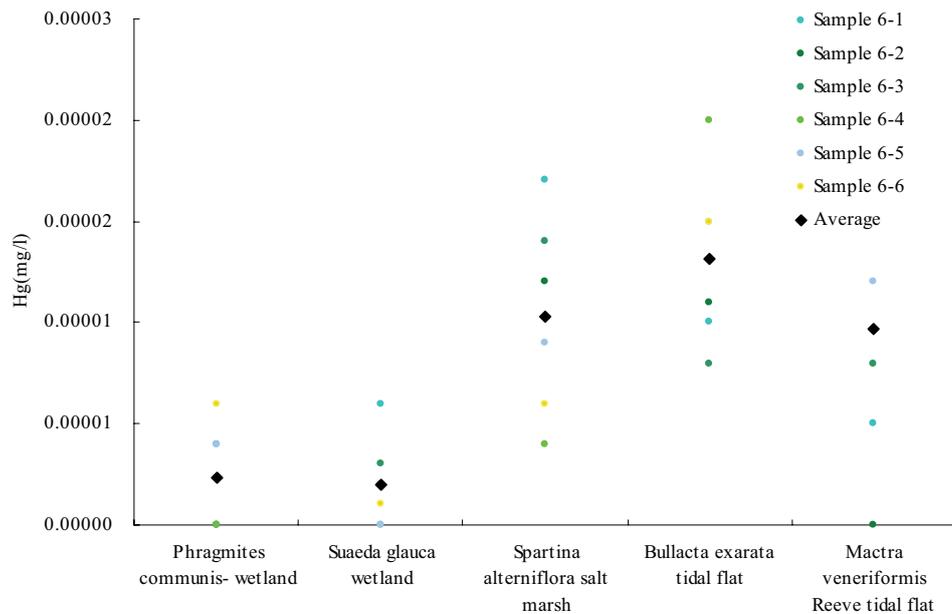


Figure 6: Contents of mercury in surface water in different wetlands from the land to the sea

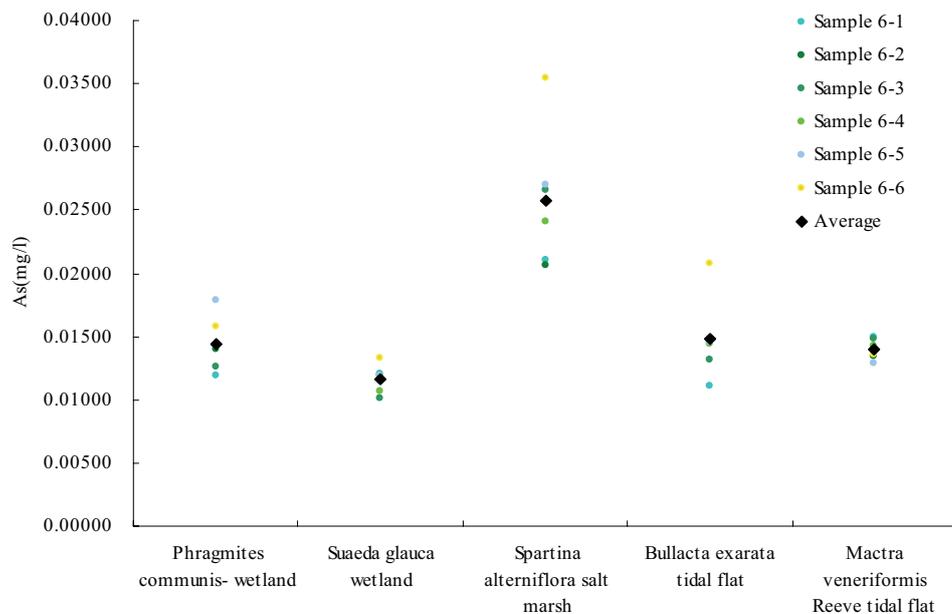


Figure 7: Contents of arsenic in surface water in different wetlands from the land to the sea

Figure 6 showed the contents of mercury in *Phragmites communis* wetland, *Suaeda glauca* wetland, *Spartina alterniflora* salt marsh, *Bullacta exarata* tidal flat, *Macraa veneriformis* Reeve tidal flat (from left to right, corresponding from the land to the sea). From which we can see, there is a high value in *Bullacta exarata* tidal flat. The contents of Hg in *Phragmites communis* wetland and *Suaeda glauca* wetland is the lowest among those five sites. Figure 7 showed that arsenic in *Spartina alterniflora* wetland was the highest in all 5 wetlands.

Table 2 showed the average contents of Hg, As in 5 different wetlands. The average content of Hg was is lower than the Nation Quality of the 1st class waste water according to GB 3097-1997 Sea Water Quality Standard. It is also lower than the background value in this area. The contents of As is near to the 1st class water according to GB 3097-1997 Sea Water Quality Standard except the surface water in *Spartina alterniflora* wetland. However, it is much higher than the background value measure in 1978-1979, which showed the influence of anthropogenic activities since 1980 with much arsenic accretion in seawater.

Table 2: Average contents of Hg, As in surface seawater (mg/L)

	<i>Phragmites communis</i> wetland	<i>Suaeda glauca</i> wetland	<i>Spartina alterniflora</i> wetland	<i>Macraa veneriformis</i> Reeve tidal flat	<i>Bullacta exarata</i> tidal flat	GB3097-1997			Background value
						1 <sup>st</sup> class	2 <sup>nd</sup> class	3 <sup>rd</sup> class	
Hg	0	0	0.00001	0.00001	0.00001	0.0005	0.0002	0.0005	0.0016
Standard deviation	0	0	0	0	0	--	--	--	--
As	0.014	0.012	0.026	0.015	0.014	0.02	0.03	0.05	0.003
Standard deviation	0.002	0.001	0.005	0.003	0.001	--	--	--	--

## 2. Results of sedimentary and pre-warning assessment

Figure 8 - 15 showed the contents of the 8 heavy metals in surface sedimentary in five wetlands. The core area in Jiangsu Yancheng National Nature Reserve belongs to one of the last original salt marshes, with perfect succession of *Phragmites australis* wetland, *Suaeda glauca* wetland, *Spartina alterniflora* wetland, *Bullacta exarata* wetland and *Macraa veneriformis* Reeve wetland from the land to the sea. The contents of mercury, arsenic, cadmium, chromium, copper, lead, zinc, nickel were measured in the core area. The average contents of these metals showed that the contents of all the metals have exceeded that background values in the coastal zone of Jiangsu Province except mercury. The contents of mercury, arsenic, chromium, lead, copper belongs to the first class of sediments, while the contents of cadmium belongs to the second class comparing to the Sediments of National Standards. The absorption capacity of heavy metals in vegetated wetlands with reed, *Suaeda glauca* and was *Spartina alterniflora* was higher than that in non-vegetated wetlands with high density of macrobenthos, especially *Bullacta exarata* and *Macraa veneriformis* Reeve. *Spartina alterniflora* wetland has the strong absorption capacity of heavy metals than other vegetated wetlands in the core area. Results showed that anthropogenic activities had been threatening the ecosystem health in the core area with food chain transferring from water, sediments to plants, animals and microorganism. Thus, there is an urgent need of sewerage treatment before discharging to the Yellow Sea in those surrounding areas of the Reserve.

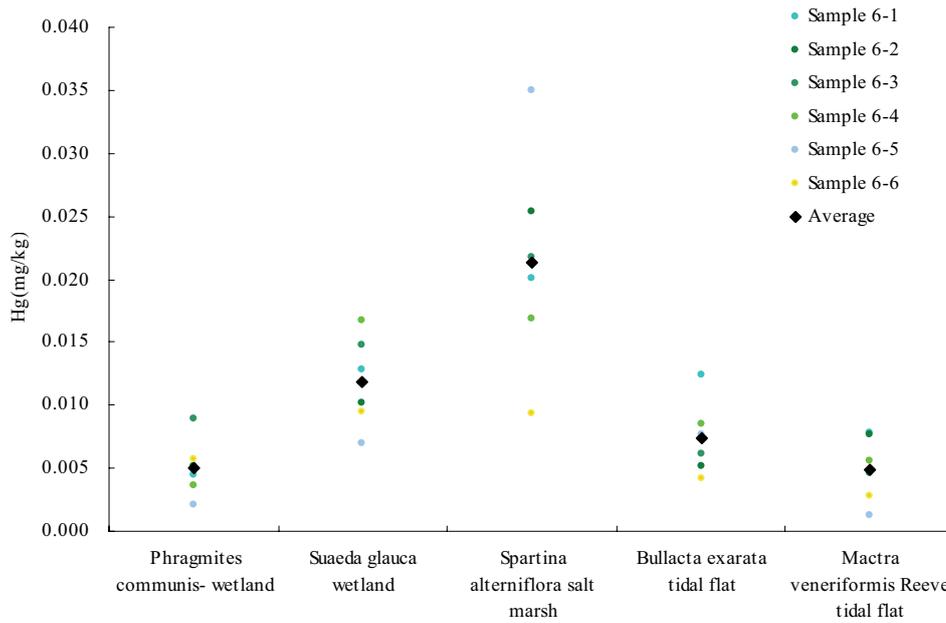


Figure 8: Contents of mercury in surface sedimentary in different wetlands from the land to the sea

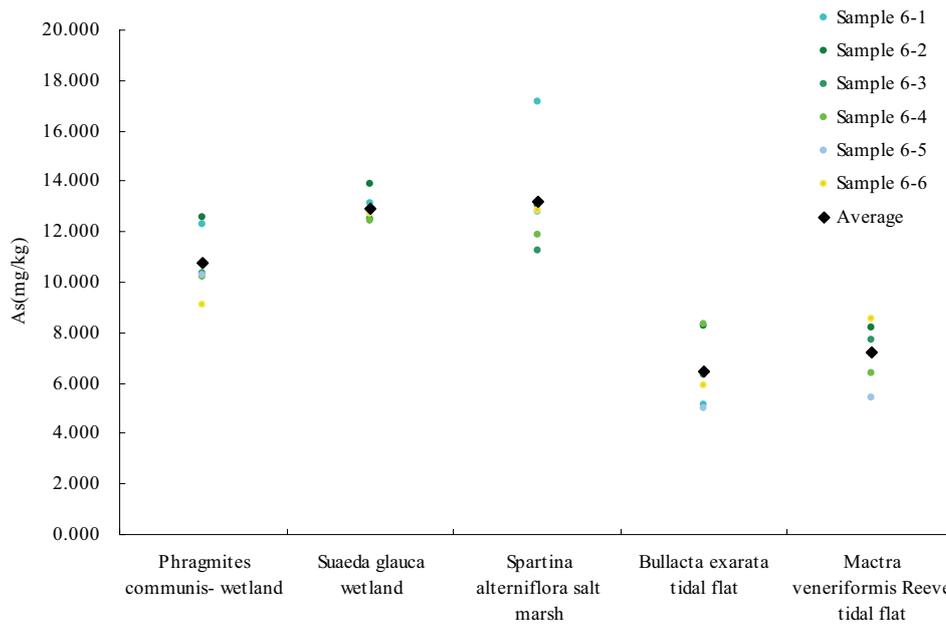


Figure 9: Contents of arsenic in surface sedimentary in different wetlands from the land to the sea

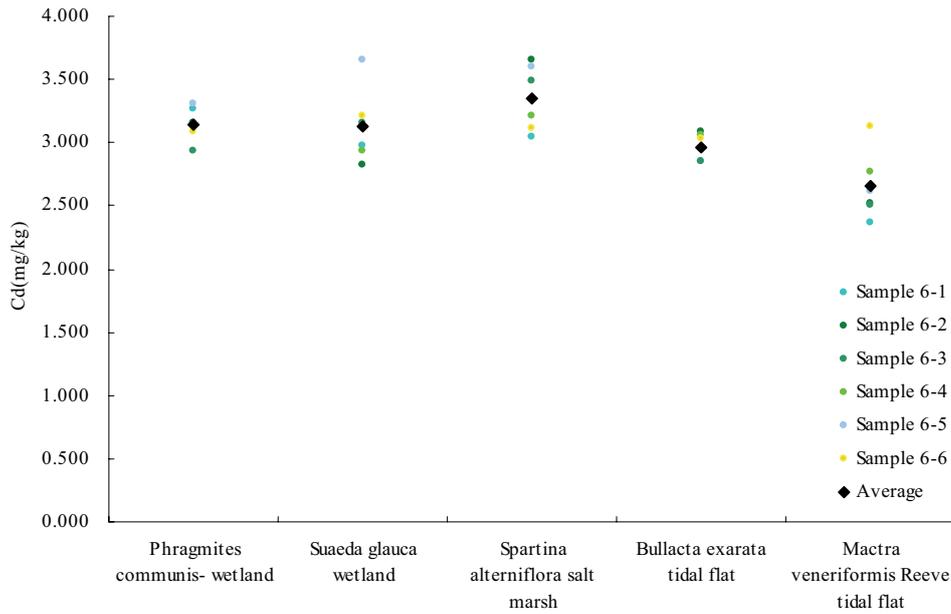


Figure 10: Contents of cadmium in surface sedimentary in different wetlands from the land to the sea

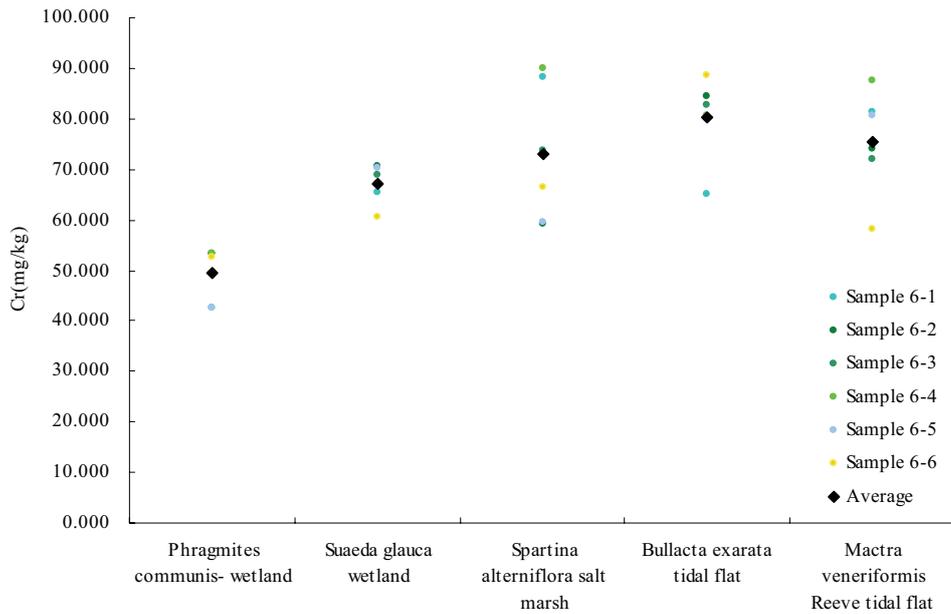


Figure 11: Contents of chromium in surface sedimentary in different wetlands from the land to the sea

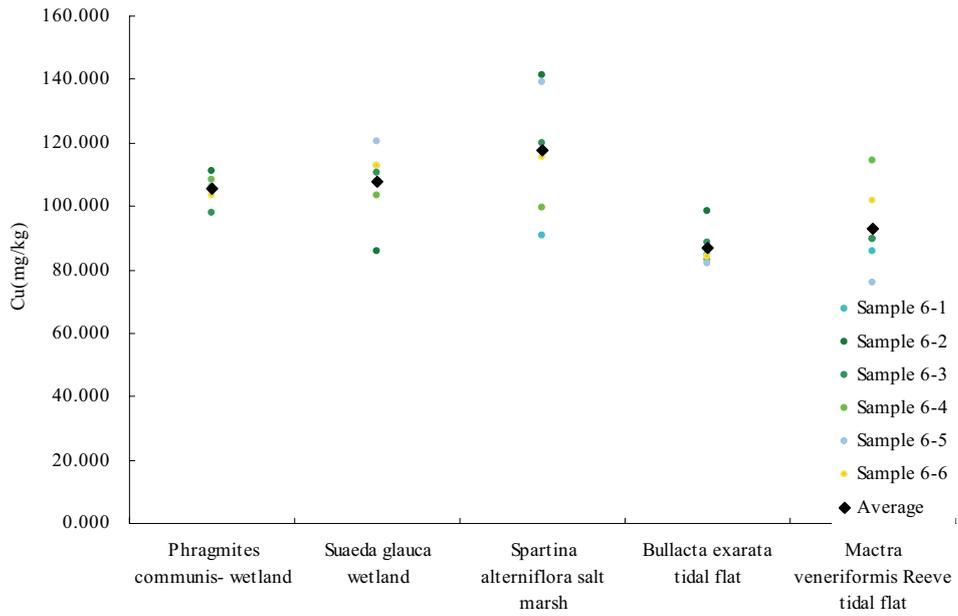


Figure 12: Contents of copper in surface sedimentary in different wetlands from the land to the sea

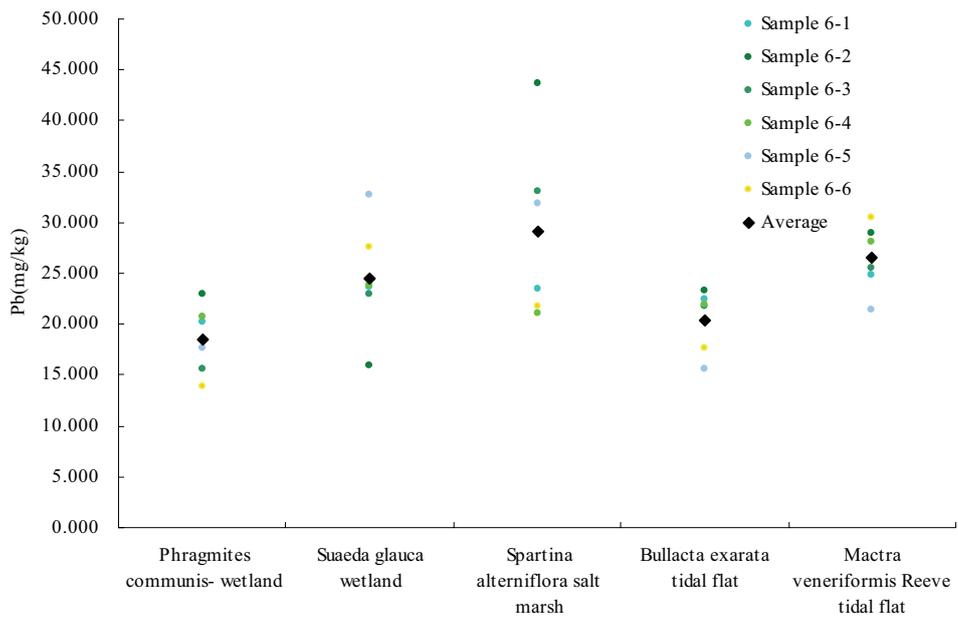


Figure 13: Contents of lead in surface sedimentary in different wetlands from the land to the sea

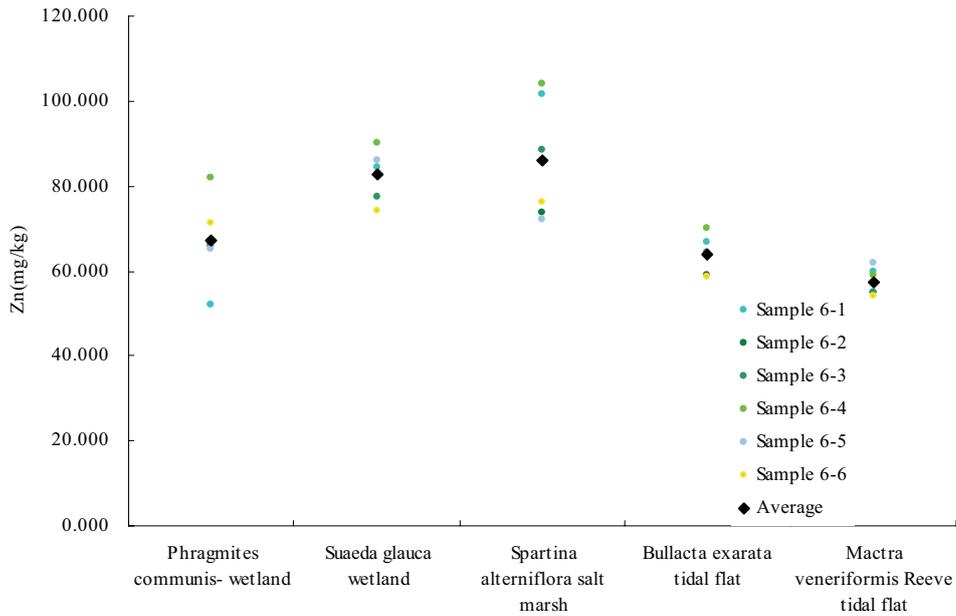


Figure 14: Contents of zinc in surface sedimentary in different wetlands from the land to the sea

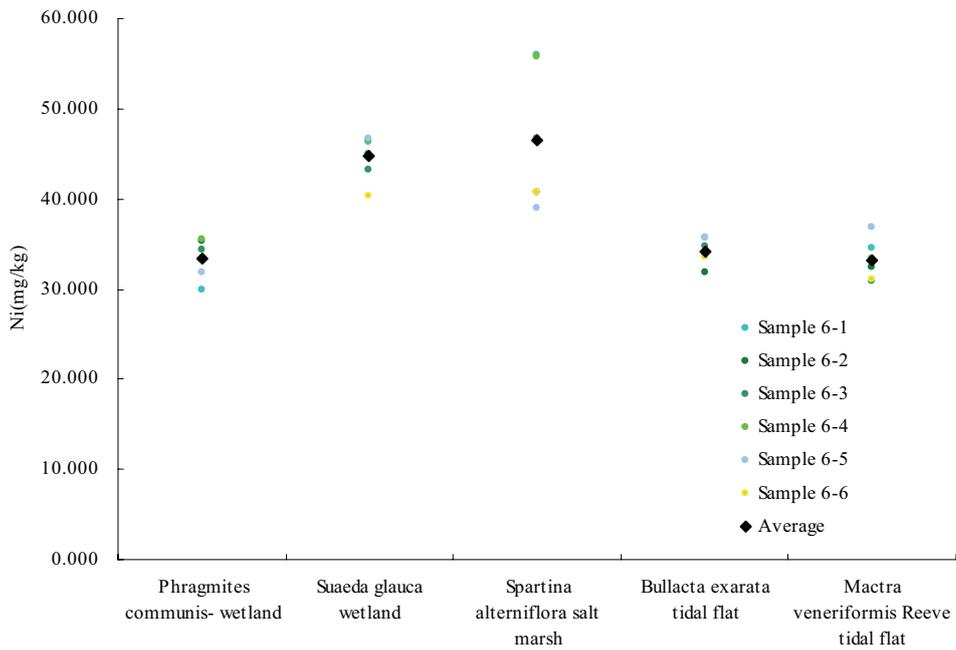


Figure 15: Contents of nickel in surface sedimentary in different wetlands from the land to the sea

Table 3 showed the average contents of the 8 heavy metals in surface sedimentary. The contents of all heavy metals in *Spartina alterniflora* wetland were much higher than that in any other wetlands. The contents of all heavy metals are higher than GB 18668-2002 Marine Sediment Quality except Mercury.

Table 3: Average contents of Hg, As, Cd, Cr, Cu, Pb, Zn, Ni in surface sedimentary (mg/kg)

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni	
<i>Phragmites communis</i> wetland	0.005	11	3	50	106	18	67	33	
Standard deviation	0.002	1.349	0.133	5.398	4.471	3.394	9.689	2.170	
<i>Suaeda glauca</i> wetland	0.012	13	3	67	108	24	83	45	
Standard deviation	0.004	0.527	0.296	3.785	12.085	5.505	5.866	2.523	
<i>Spartina alterniflora</i> wetland	0.021	13	3	73	118	29	86	46	
Standard deviation	0.009	2.079	0.261	13.654	20.389	8.806	14.255	7.689	
<i>Mactra veneriformis</i> Reeve tidal flat	0.007	6	3	80	87	20	64	34	
Standard deviation	0.003	1.489	0.103	8.042	6.156	3.047	4.367	1.451	
<i>Bullacta exarata</i> tidal flat	0.005	7	3	76	93	27	57	33	
Standard deviation	0.003	1.179	0.271	10.252	13.416	3.317	3.099	2.291	
GB18668-2002	1 <sup>st</sup> class	0	20	1	80	35	60	150	---
	2 <sup>nd</sup> class	1	65	2	150	100	130	350	---
	3 <sup>rd</sup> class	1	93	5	270	200	250	600	---
Background value	0.019	8.59 <sup>[9]</sup>	0.72	28.50	15.99	17.63	78.10	---	

### 3. Results of plants and pre-warning assessment

Figure 16 – 23 showed the contents of all 8 heavy metals in the underground part and aboveground part of *Phragmites communis*, *Suaeda glauca*, and *Spartina alterniflora*. From which we can deduce that nearly all the contents in the underground part are higher than that in the aboveground part. The contents of mercury, arsenic, chromium, zinc, nickel were highest than that in other parts in *Phragmites communis*, *Suaeda glauca*, and even the aboveground part of *Spartina alterniflora*. The contents of cadmium, lead in the aboveground part of *Suaeda glauca* are the highest than that in other parts of the plants. The contents of chromium in the underground part of *Phragmites communis* is the highest. It can be deduced that different parts of plants have different absorption capability of different heavy metals.

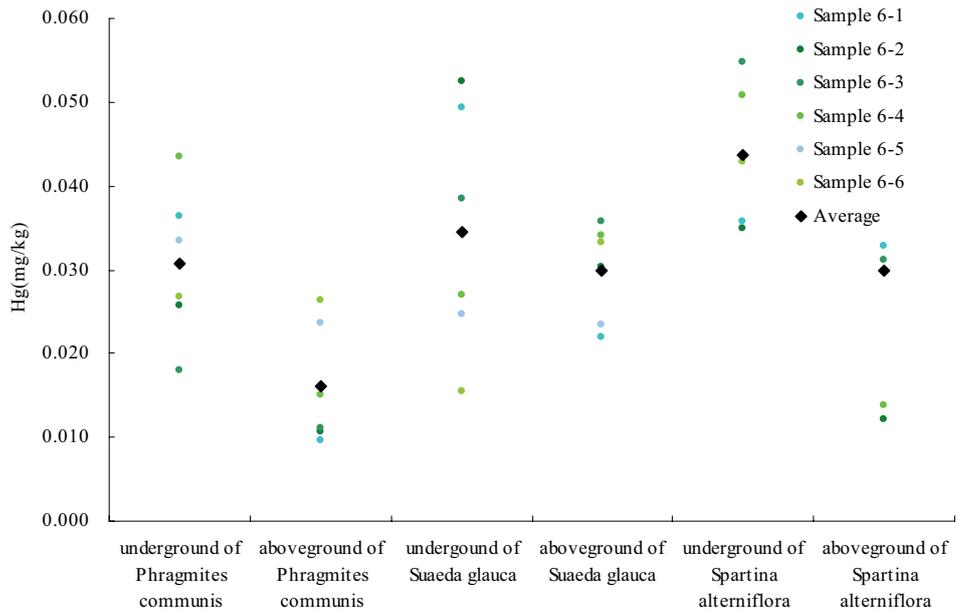


Figure 16: Contents of nickel in plants in different wetlands from the land to the sea

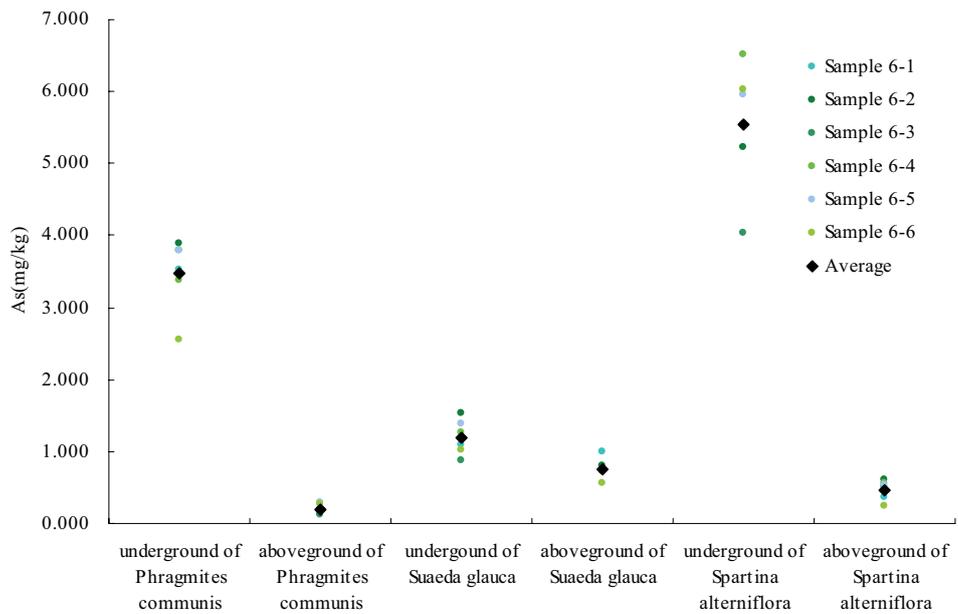


Figure 17: Contents of arsenic in plants in different plants from the land to the sea

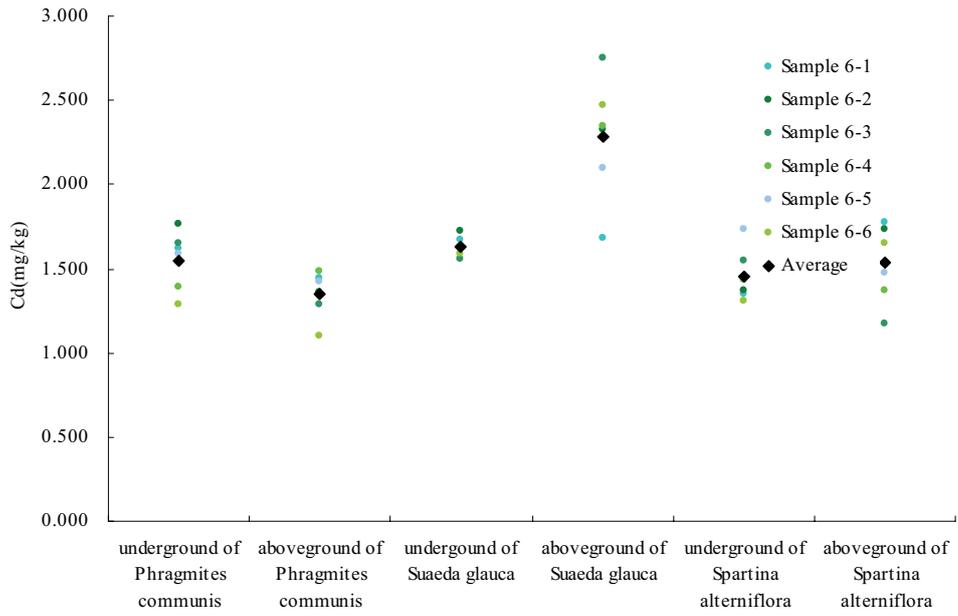


Figure 18: Contents of cadmium in plants in different plants from the land to the sea

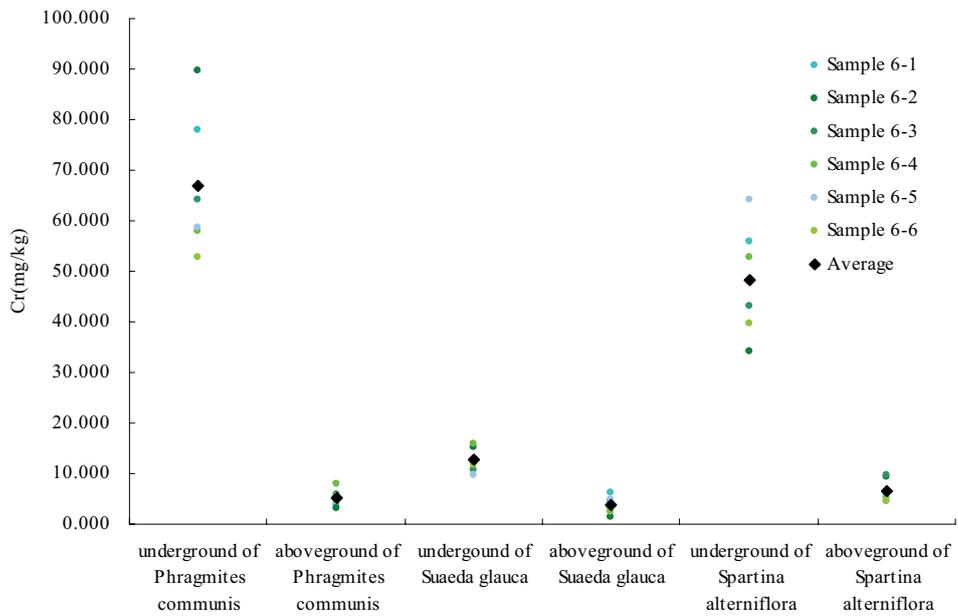


Figure 19: Contents of chromium in plants in different plants from the land to the sea

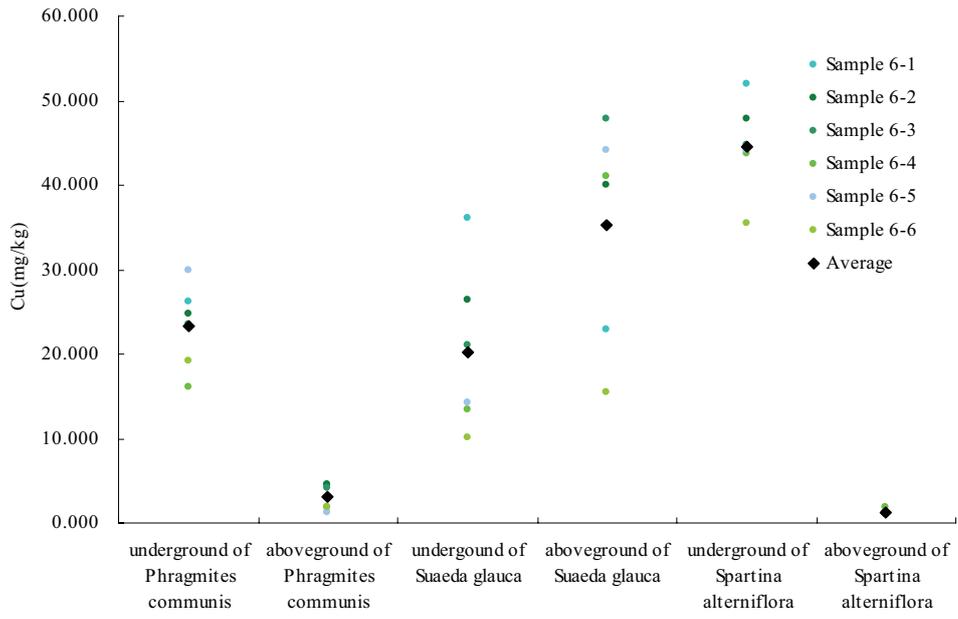


Figure 20: Contents of copper in plants in different plants from the land to the sea

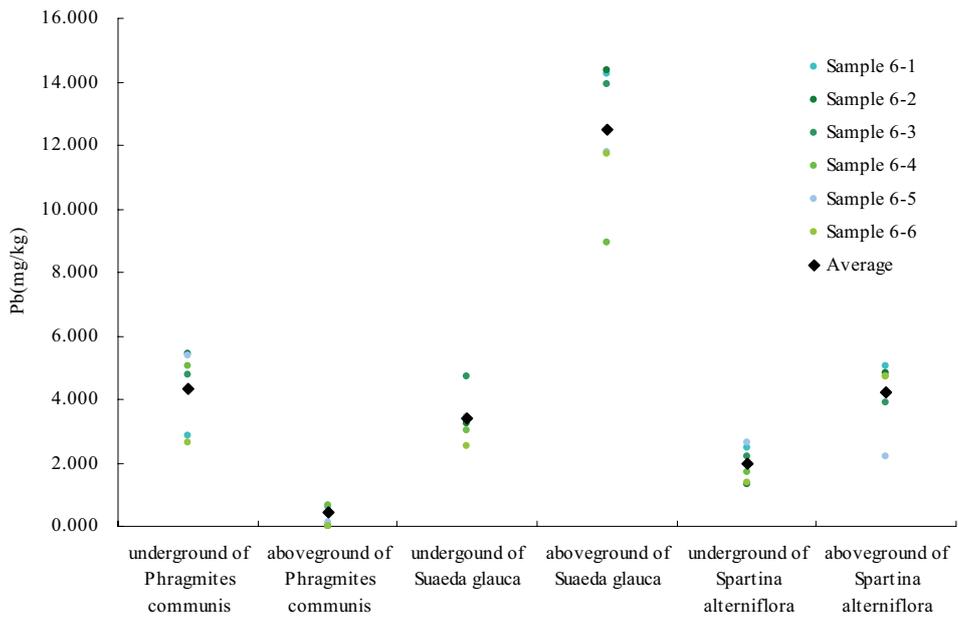


Figure 21: Contents of lead in plants in different plants from the land to the sea

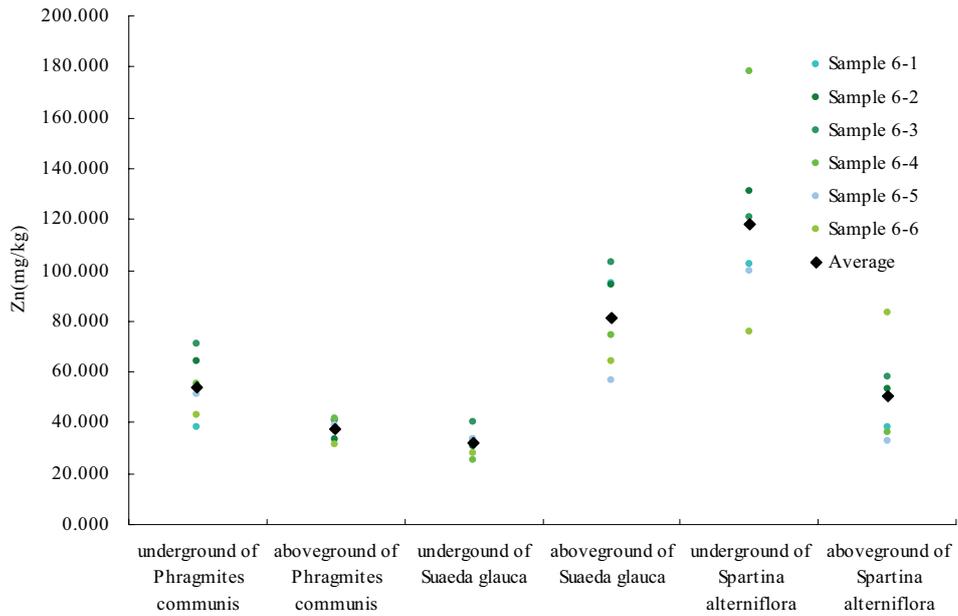


Figure 22: Contents of zinc in plants in different plants from the land to the sea

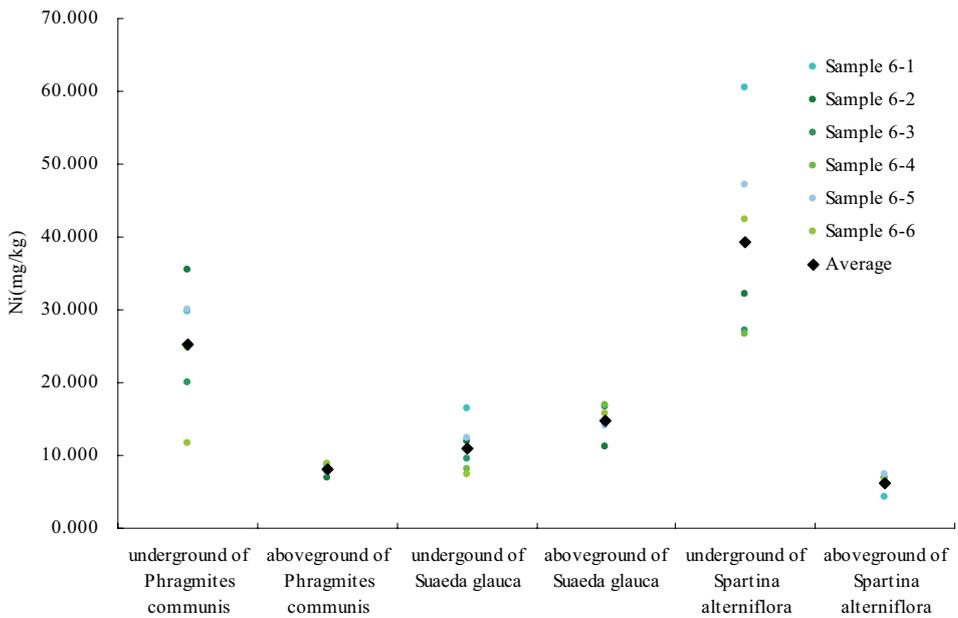


Figure 23: Contents of nickel in plants in different plants from the land to the sea

Table 4 showed the average contents of all 8 heavy metals in plants growing in the core area. It is obvious that nearly all contents of heavy metals in the underground parts are much higher than that in the aboveground parts.

There is a tendency that the contents of heavy metals might be increasing with much waste water discharge to estuaries in surrounding areas.

Table 4: Average contents of Hg, As, Cd, Cr, Cu, Pb, Zn, Ni in plants (mg/kg)

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni
underground part of <i>Phragmites communis</i>	0.031	3.488	0.177	14.164	4.989	1.265	12.448	8.465
Standard deviation	0.009	0.495	0.177	14.164	4.989	1.265	12.448	8.465
aboveground part of <i>Phragmites communis</i>	0.016	0.201	0.138	1.679	1.545	0.310	4.404	0.746
Standard deviation	0.007	0.066	0.138	1.679	1.545	0.310	4.404	0.746
underground part of <i>Suaeda glauca</i>	0.035	1.190	0.059	2.533	9.776	0.736	5.242	3.362
Standard deviation	0.015	0.241	0.059	2.533	9.776	0.736	5.242	3.362
aboveground part of <i>Suaeda glauca</i>	0.030	0.757	0.362	1.732	12.979	2.114	18.764	2.135
Standard deviation	0.006	0.139	0.362	1.732	12.979	2.114	18.764	2.135
underground part of <i>Spartina alterniflora</i>	0.044	5.552	0.160	11.287	5.462	0.550	35.262	13.228
Standard deviation	0.008	0.866	0.160	11.287	5.462	0.550	35.262	13.228
aboveground part of <i>Spartina alterniflora</i>	0.030	0.470	0.235	2.331	0.330	1.068	19.096	1.084
Standard deviation	0.015	0.136	0.235	2.331	0.330	1.068	19.096	1.084

#### 4. Results of macrobenthos and pre-warning assessment

All macrobenthos were removed the offal and cleaned by denionized water. For *Mactra veneriformis* and *Bullacta exarata*, the shell of them was also removed. The measurement of mercury and arsenic was used with fresh samples, which other samples were dried by ALPHA14 freeze dryers.

Figure 24 – 31 showed that the contents of mercury, arsenic, chromium, copper, lead, nickel in *Bullacta exarata* living in tidal flat were the highest, which indicated higher pollution by environment. However, it is a delicious food for local stakeholders. The contents of cadmium in *Mactra veneriformis* Reeve was the highest that that in other

animals. It is also a delicious food for local stakeholders. Both of them are economic animals as a major income for local stakeholders by picking up them during low tides.

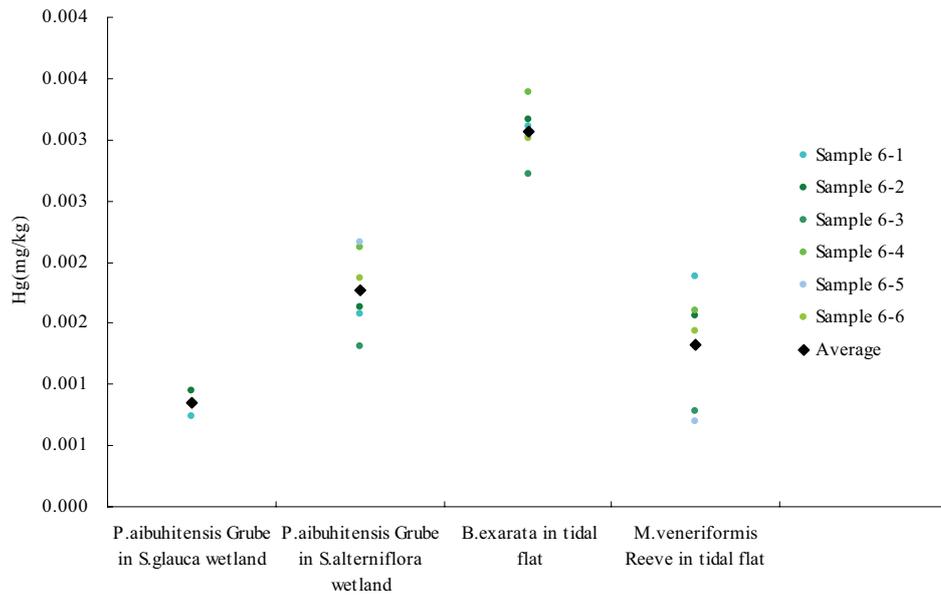


Figure 24: Contents of mercury in macrobenthos in different animals from the land to the sea

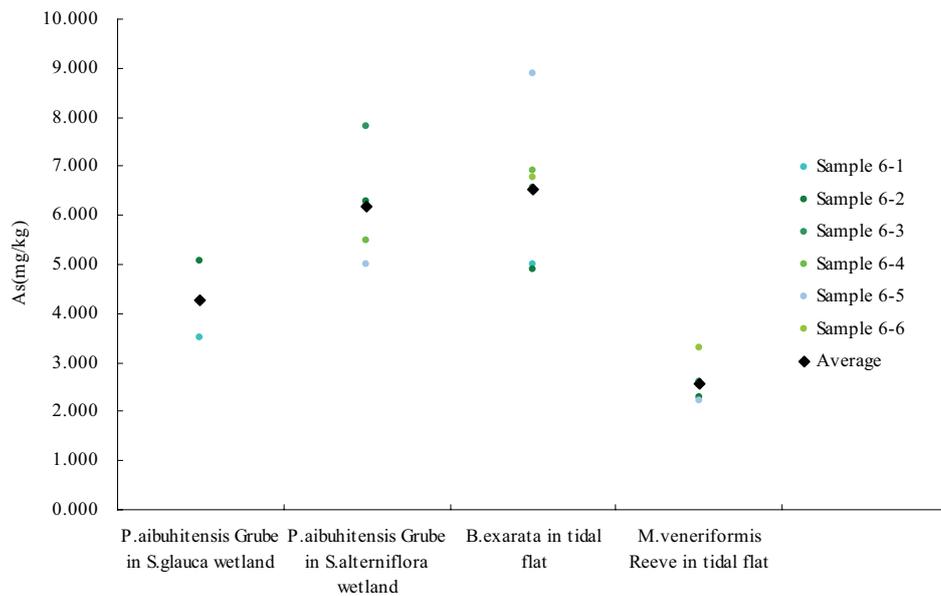


Figure 25: Contents of arsenic in macrobenthos in different animals from the land to the sea

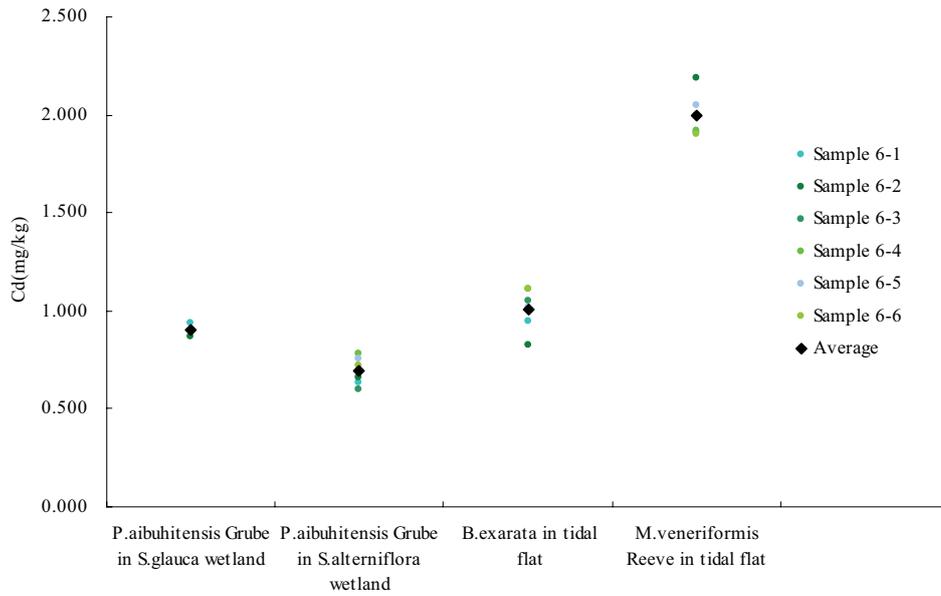


Figure 26: Contents of cadmium in macrobenthos in different animals from the land to the sea

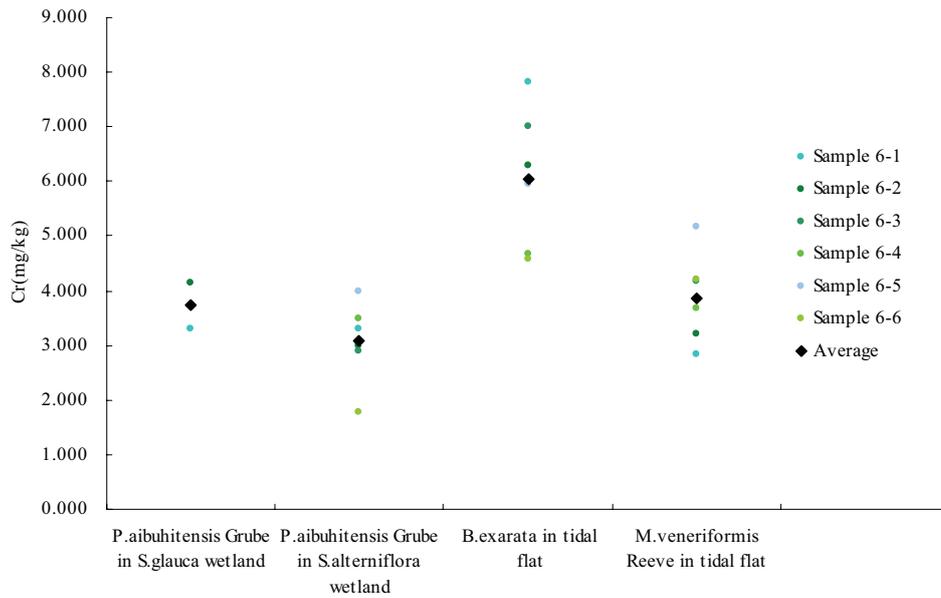


Figure 27: Contents of chromium in macrobenthos in different animals from the land to the sea

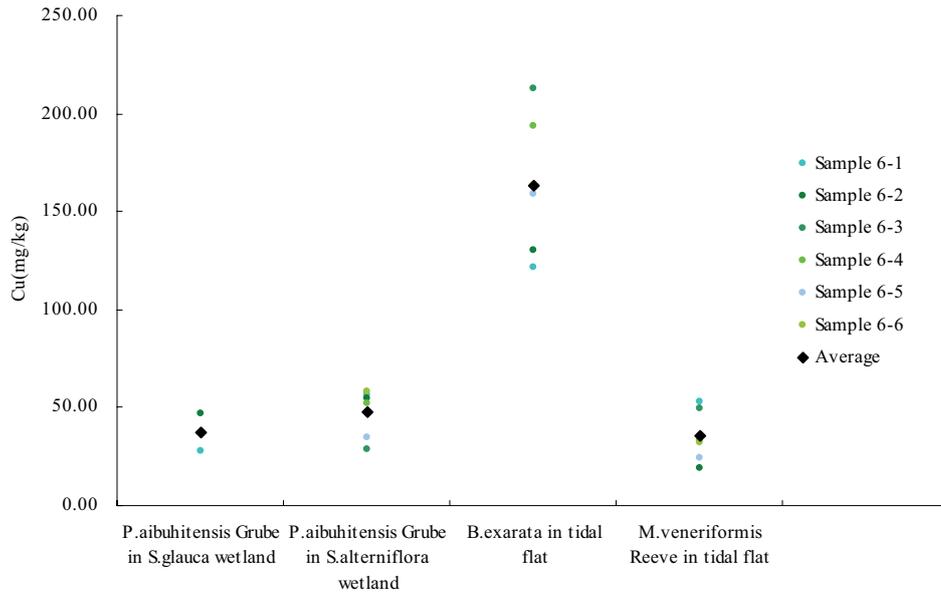


Figure 28: Contents of copper in macrobenthos in different animals from the land to the sea

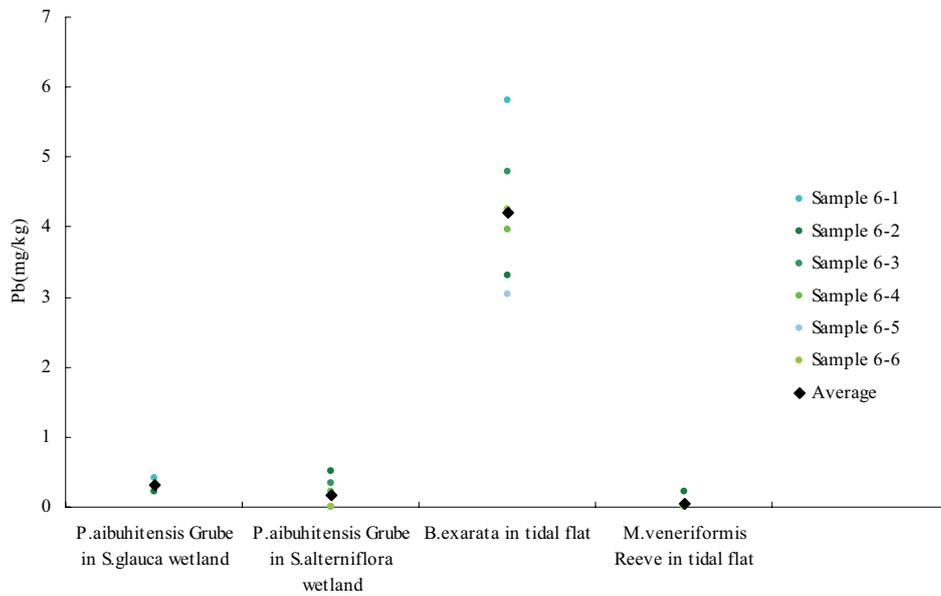


Figure 29: Contents of lead in macrobenthos in different animals from the land to the sea

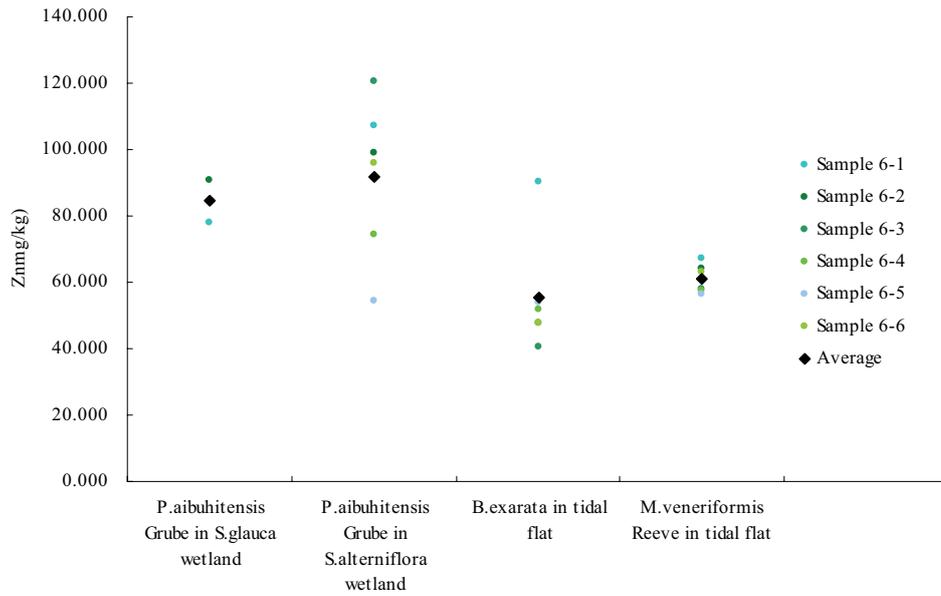


Figure 30: Contents of zinc in macrobenthos in different animals from the land to the sea

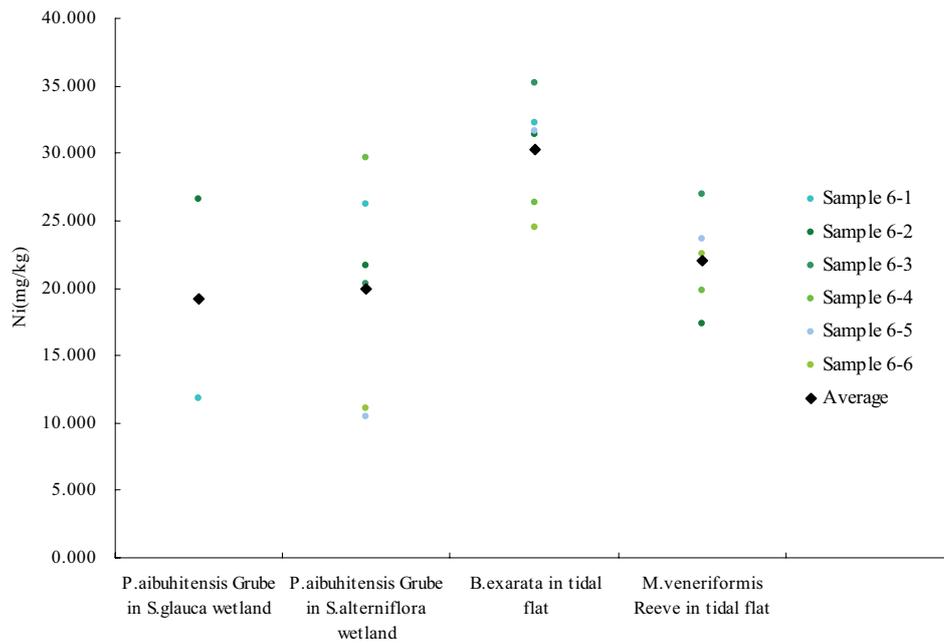


Figure 31: Contents of nickel in macrobenthos in different animals from the land to the sea

Table 5: Average contents of Hg, As, Cd, Cr, Cu, Pb, Zn, Ni in macrobenthos (mg/kg)

	Hg	As	Cd	Cr	Cu	Pb	Zn	Ni
<i>Perinereis aibuhitensis</i> Living in <i>Suaeda glauca</i> wetland	0.001	4.286	0.901	3.727	37.126	0.326	84.383	19.193
Standard deviation	0.000	1.090	0.051	0.605	13.302	0.136	9.269	10.390
<i>Perinereis aibuhitensis</i> Living in <i>Spartina alterniflora</i> wetland	0.002	6.163	0.691	3.071	47.371	0.177	91.895	19.897
Standard deviation	0.000	0.955	0.071	0.741	12.620	0.215	23.805	7.827
<i>Bullacta exarata</i> Reeve living in tidal flat	0.003	6.511	1.011	6.045	163.353	4.196	55.334	30.227
Standard deviation	0.000	1.473	0.110	1.281	35.273	1.010	17.571	4.007
<i>Mactra veneriformis</i> living in tidal flat	0.001	2.585	1.993	3.871	35.161	0.037	61.019	22.015
Standard deviation	0.000	0.385	0.112	0.828	13.212	0.091	4.395	3.288
NY5073-2006 Pollution-free Food at Seafood Toxic Substances Harm Limited	0.5	1 <sup>1</sup>	1	2	50	1	--	--
Background value <sup>2</sup>	0.04	0.57	0.365	2.33	15.99	0.356	--	--

Table 5 showed that nearly all the contents of heavy metals in the three macrobenthos were far higher the background value. And some of them also have exceeded the limit for pollution-free food. Thus, food safety is very important for those seafood consuming people, especially local stakeholders.

<sup>1</sup> Inorganic arsenic

<sup>2</sup> These data was measured by shellfish samples, not the same macrobenthos as what we measured in this program.



## Annex III: Results of Participatory Rural Appraisal

### 1. Investigation Result Analysis

#### 1.1. Basic Information of the Sample Villages

We have chosen 3 sample villages for the investigation based on the criteria for choosing sample villages (Table 6).

Shui Gou Village: Under the administration of Cheng Kou township and located at the western side of the buffer zone, it has a total household of 270 with a total population of 1215. In the past, the villagers lived on fish capturing. Due to the decrease of fishing resources, currently the major source of income of the villagers are cultivation and salt production, with a tidal flat area of 7000 Mu.

Meng Village: Under the administration of Cheng Kou township and located at the southwestern side of the buffer zone, it has a total household of 264 with a total population of 836. The villagers major source of income is fish capturing and cultivation. The village has 1101 Mu farming land, 2000 Mu tidal flat, and 2 fish capturing boats.

No. 2 Cha Jia Village: Under the administration of Ma Shan Zi township and located at the south of the buffer zone, it has a total household of 144 with a total population of 558. The village has 3000 Mu of tidal flats.

Table 6: Basic Information of the Sample Villages

Name of the Village	Location in the Reserve	Number of Household	Total Population	Major Source of Income	Areas of Farmland (Sea Are, Tidal Flats)
Shui Gou Village	Buffer Zone	270	1215	Cultivation, Salt Production	7000 Mu of Tidal Flats
Meng Village	Buffer Zone	264	836	Cultivation, Agriculture	1101Mu Farmland 2000Mu Tidal Flats
No. 2 Jia Cha Village	Buffer Zone	144	558	Cultivation	3000Mu Tidal Flats

#### 1.1.1. Sexuality and Education Background of the Sample Villages

A total of 120 questionnaires are distributed with 110 effective feedbacks whose education background are illustrated in Figure 32 as: 13% illiterate, 38% primary school graduates, 31% secondary school graduates, 9% graduated from high school or higher education institutions. Total of 29 (26.36% ) of the interviewees are female, including 9 illiterates, 11 primary school graduates, 6 secondary school graduates 3 high school graduates. 81 of the interviewees are male, counting for 73.63% of the total, including 6 illiterates, 31

graduates from primary school, 33 graduates from secondary school and 4 high school graduates 7 received education higher than high school.

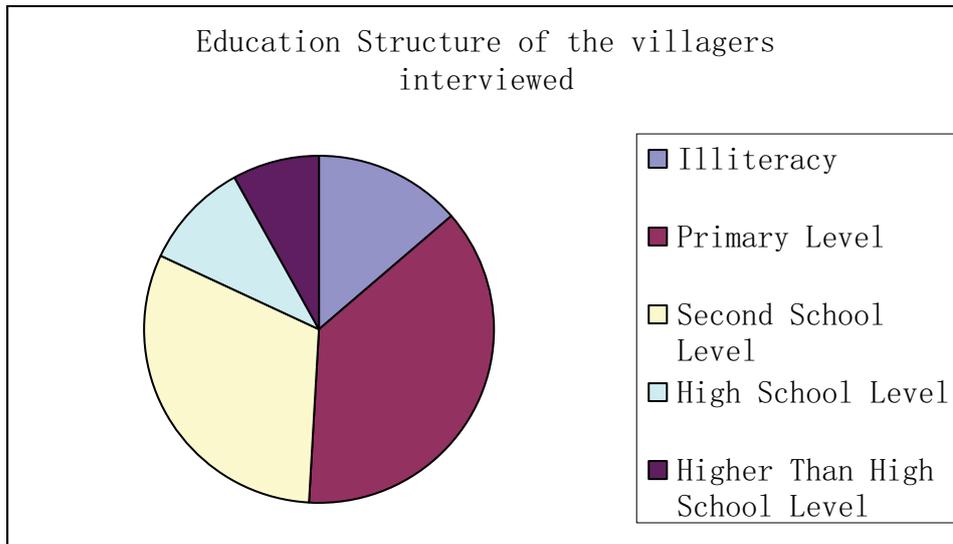


Figure 32: Education background of the interviewees

### 1.1.2. Income Structure of the Farmers

Among all the 110 households under investigation, 68% of the villagers' annual household income is below RMB 10000; only 32% are over RMB 10000 (Figure 33). If we assume 4 people per household, per capita annual income is only RMB 2500, which shows a low income level of the farmers from the surrounding areas of the reserve. Although there are possibilities of the farmers on purposely reported their come lower than the actual figure, the data in general show that Wudi county is a less developed county in Shandong province with simple industrial structure and limited source of income, low level of realization of people's income.

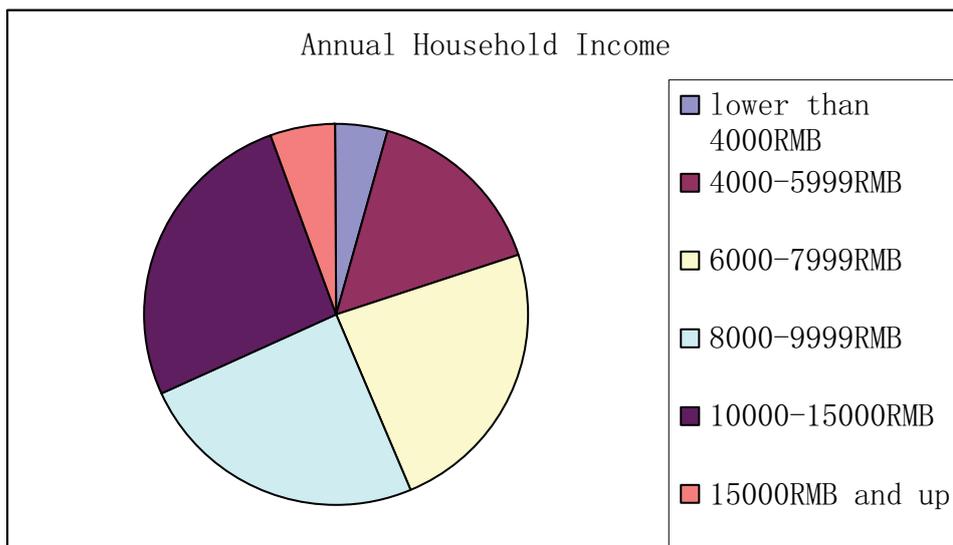


Figure 33: Interviewee's Annual Household Income

## **1.2. Analysis of the Relationship between the Communities' Development and the Management of the Reserve's Resource Management**

### **1.2.1. Stipulations on the Reserve's Resource Management**

According to the "Stipulations on the Natural Reserves of the People's Republic of China", the reserve is divided into core area, buffer zone and experimental zone.

The core area prohibits any activities which might cause danger to or have negative effects on the reserve except scientific research and investigation activities approved by the relevant marine management government organizations at municipal, provincial and autonomous regions levels. The core area of the Shell Dyke Island Reserve is at the northern part, including Shell Dyke Island and surrounding natural wetland covering an area of 28527hm<sup>2</sup>. There is only one village in the core area with 40 seasonal populations.

The buffer zone allows fishing production, tourism, scientific research and education field trips within a defined range and time period under the conditions that those activities will not damage or pollute the protection objectives and they are approved by the reserve's management organizations. This reserve's buffer zone is divided into southern and northern parts, located in the middle and northern part of the reserve respectively covering an area of 26780hm<sup>2</sup>. The southern buffer zone is a vast piece of wetland mostly kept as its original status, except a small area used for aquaculture. Located at the northern part of the core area, the northern buffer zone is the reproduction area for the shells which is the major protective objective of the reserve.

The experimental zone allows reasonable development activities under the unified plan and guidance of the reserve's management organizations. Located at the southern part of the reserve, the experimental zone is mainly made up of upland wetlands which are used for salt production and aquaculture, with a small amount used as farmland. The total experimental area is 25173hm<sup>2</sup>.

When China established the reserve, many villages have had residential history of many years and many salt works already exist, therefore those already exist before the reserve are recognized as facts: 16 villages and 11 enterprises altogether in the reserve.

### **1.2.2. Analysis on the conflicts between villagers production and living activities and resource protection.**

#### *Villagers' production activities' effect on the resources*

Total of 12009 people from the three sample villages mainly work in the field of agriculture, salt production, fishing, cultivation and other industrial and engineering works. Over the years, due to lack of farmland, many villagers take advantage of the vast piece of wetland between the tides to dig many salt production evaporation ponds. Recent years, with the decreasing of fishing resources, many fishermen use the tidal flats to dig ponds for shell and shrimp cultivation in order to receive economic benefit.

However, those orderless developing activities by the villagers have threatened the reserve's geological and biological resources. Take Meng village in the southwestern part of the reserve for example, land developing, aquaculture activities and the construction of roads have caused damage to the shell sand layers. Based on the data collected by an aerial survey in 1992 on the No. 1 shell dyke with shell layer depth of 3-5 meters and history of 5000 years, due to serve development, there is a decrease of the shell layer, the areas between the tides have become wider and there is also signs of coastal line corrosion

which are causing negative effects on the further research on the change of the Yellow River, changes of coastlines, the form and environmental evolution of shell dyke islands as well as the types of wetlands.

Table 7: Major Production activities of the sample villages

Name of the village	Shui Gou Village	Meng Village	No. 2 Jian Cha Village
Location	Buffer Zone	Buffer Zone	Experimental Zone
<b>Fishing Capture:</b>			
Production (tons)	5000	202	950
Output (RMB10000)	206. 1	85. 2	210
<b>Aquaculture:</b>			
Production (tons)	335	34	135
Output (RMB10000)	67	66.3	110
<b>Salt production through evaporation:</b>			
Production (tons)	3500	1570	
Output (RMB10000)	460.3	188.4	
<b>Agriculture:</b>			
Production (tons)		102	
Output (RMB10000)		98.3	
Others			

### 1.2.3. Enterprises' production activities' effect on the reserve

Of all the 11 enterprises in the reserve, majority are saltworks, salt chemical factories and aqua-product processing factories. Most salt chemical factories, saltworks evaporation ponds were there before the establishment of the reserve with a relative large production scale and active production. The total output of the enterprises in 2007 is RMB 594 million and employees in these enterprises are 4138, including 3223 mobile and 915 permanent. The buildings and roads have damaged a large amount of natural wetland, the disposal of the pollute from the factories have effected the ecological system. For instance, there is one chemical company in the experimental zone, its major product is bromine with disposal of polluting brine and sulphide which is easy to deposit. They mainly pollute the deposits in the wetland and effect the growth of the shell resources as well as the active balance of mud and sand along the coast. Production activities have damaged the topography of the reserve, some important plantations are diminishing, the kinds of migrant birds are decreasing, and the wetland is degrading. Currently, due to storm and other development activities, Zhao Sha Zi Shell Dyke Island located at the eastern side of the core area is gradually disappearing by corrosion.

Table 8: Analysis on the effect of enterprises production activities on the reserve

Potential Problems	Cause Analysis
Usage of the tidal flat resources	Conflicts between protection and usage. Lack of other economic resource has increased the reliance on the resources
Damage of wetland plant and effect on the organism between the tides	Construction of factories an roads directly cause the disappearance of the wetland
Disposal of the waste water from the salt chemical factories into the sea	Lack of necessary pollute processing equipment
Deposits from the chemical factories directly damage the topography of the uptide wetland	Lack of reasonable planning
Takes over the nesting place of plants and animals	

#### 1.2.4. The effect of surrounding enterprises' production activities on the reserve

Under the administration of Hebei Province, Huang Hua port is located only 400 meters from the reserve at the northwest side. After its construction, clearing of the sand and mud is needed every month to prevent the blocking of the waterways. Therefore the construction of Huang Hua Port and waterway clearing have increased the corrosion of sand beach surrounding the reserve. In the northeast side of the reserve, there are Cha Jian Fishing Port and Dock, Chao He Dock. The constructions of the dock's tide protection bank and the roads have also damaged part of the natural wetland.

#### 1.2.5. The effect of other production activities on the reserve

Since the discovery of oil field in 1992 in the southeastern part of the reserve, accumulatively there are 409 oil wells which produce 255000 tons of crude oil every year. The large scale production of oil field has promoted the construction of the utilities in the Northeastern part of Wudi's communication, hydropower, electricity, telecommunication, etc. However, oil exploitation, channel digging and paving of oil pipes will cause threats to the overall ecological system of the reserve.

## 2. Cause Analysis on the Conflicts between Resource Development Usage and The Reserve's Management.

### 2.1. Less-development of the surrounding communities' economy

Wudi County is a less-developed county in Shandong province as well as in China with 2007 total county gross production of RMB 12177 million and annual per capita of the farmers of RMB 4630. Compared with the counties in Qingdao, Weihai and Yantai along the coastal line of Shandong province, Wudi county's gross product is only 3% of the average of the above three. Its per capita is only 61% of the average of the above three. Especially, Cheng Kou township in the reserve, with agriculture population of 19300 (82% of the total population), its per capita income is only RMB 3899. Fishermen have been living on fishing for generations. But now fishing income is not enough for living due to decrease of fishing resources. Besides, farmers are lack of relevant knowledge, technology, capital, experience and are in a disadvantageous position in job competitions.

In order to survive, the farmers are motivated to develop more resources currently available. Apart from making salt from evaporation, many farmers choose to dig shell sand and sell them to nearby shell ceramic factories which produces porcelains by using the shell sand.

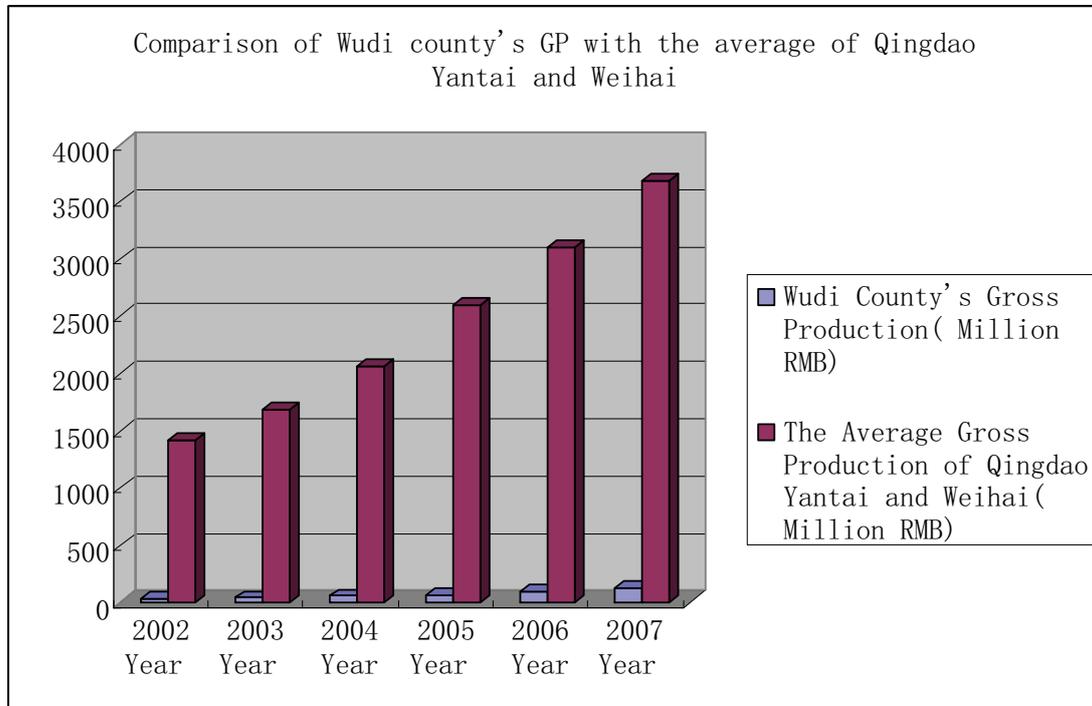


Figure 34: Comparison of Wudi County's gross production with the average of Qingdao, Yantai and Weihai

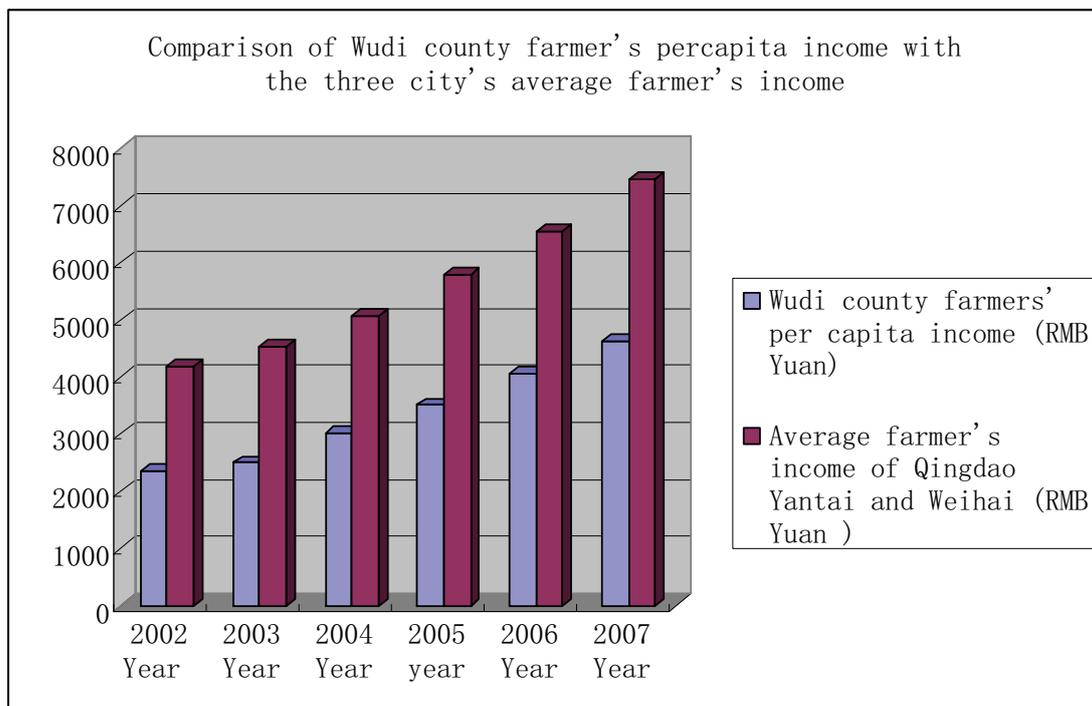


Figure 35: Comparison of Wudi county farmers per capita income with the Three City's average farmer income.

## **2.2. Unclearness of the Usage Right of the Reserve's Tidal Flat Resources.**

According to our investigation, the reserve's between-the-tide wetland and downtide wetland are in the sea area under the administration of Wudi county. Part of its core area and buffer zone has received "Sea Area Usage Right Certificate" for public purposes after application according to "The Stipulations on the Usage and Management Measures of the Sea Areas of the People's Republic of China". Based on these stipulations, if the villages or committees of the villages have already collectively operated or managed some areas of the sea, their usage rights can be certified and further contracted to their members for cultivation purposes, upon approval from the county government assuming their usage meets the function division of the sea area. Therefore, before the establishment of the reserve, the usage of tidal flats has been contracted to each household, who already received the right of usage, operation and benefit from the tidal flat from legislative perspective. Along with the establishment of the reserve and stipulation of its core area and buffer zone, farmers' usage right and management of the reserve conflicted.

Another situation is that before the establishment of the reserve, the usage right of some of its tidal flat areas is not clear. The reserve's management applied for "Sea Area Usage Right Certificate" and confirmed its usage right belongs to the state, which causes disagreement from the local community and local government, who continue to allow development of enterprises in the reserve. According to the investigation, among all the 11 enterprises currently operating in the reserve, 2-3 were established after the establishment of the reserve.

The third reason is that the establishment of the reserve has objectively deprived the communities of its recessive rights to part of the resources in the reserve, since they have been living in the area generation after generation. After the tidal flats are preserved as resources of the reserve, it affects the communities' in a way that the communities are no longer able to obtain living sources from the area and their sacrifices are not compensated, as a common phenomena in the reserve. This conflict is hard to solve simply through legislation education and putting up borders and road barricades.

### **2.2.1. Incompleteness of the reserve's management**

Incompleteness in the reserve's management has also caused the conflict. Firstly, China's reserves conduct cooperative management system which combines comprehensive management and department management. The state's environmental protection department controls the comprehensive management of the nation's natural reserves, whereas the departments of Agriculture, Forestry, Geology and Minerals, Hydropower and Marine are in charge of relevant natural reserves within their responsibilities. The establishment and definition of the responsibilities of the reserve's management organizations are in the hands of county, provincial, autonomous regions governments based on actual situations. This type of administration with many heads and scattered decision-making in different aspect are not beneficial to the reserve. In the case of Binzhou Shell Dyke Island and Wetland Natural Reserve, Wudi County is in charge of the establishment of the reserve organization, but the reserve is under the administration of county level marine and fishing bureau, provincial and state level Marine Department. It is the state Environmental Protection Department that is responsible for its comprehensive management. Most administration decisions are made based on each department or bureau's tasks and needs, which created many conflicts between the protection and development, environmental protection, local economic development, construction and ecological system protection. Some of the conflict are hard to coordinate.

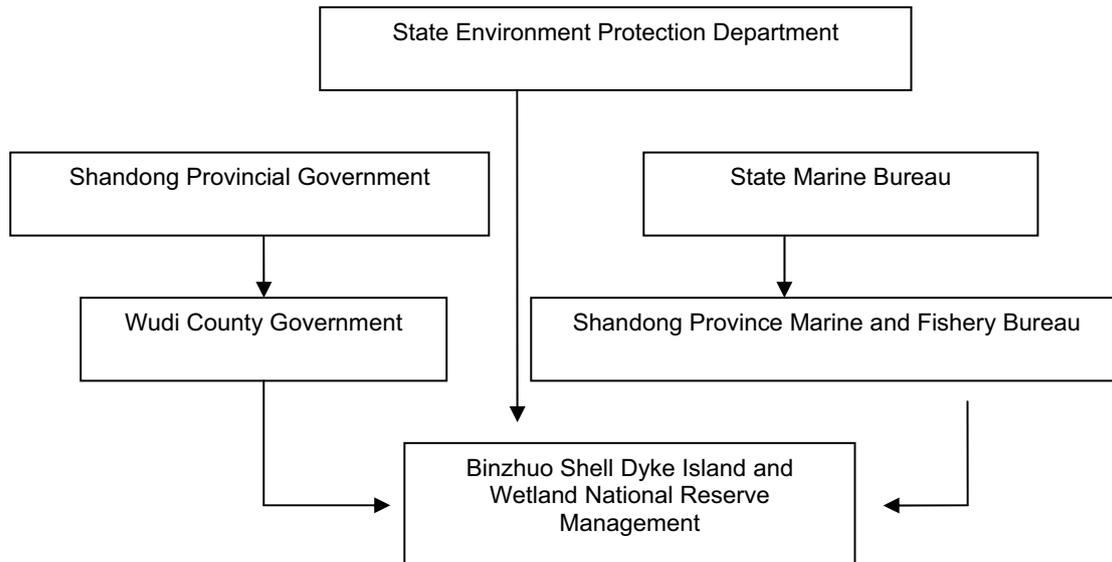


Figure 36: The management framework of the Binzhou Shell Dyke Island and Wetland Natural Reserve

The second problem is management of the inputs. The establishment and management of a reserve is generally a difficult and expensive task. The average input of China's natural reserve is RMB 415 Per  $\text{hm}^2$ , far below the international average of RMB 1125 Per  $\text{hm}^2$ . Reserve funding is not listed in the state budget, rather expensed from administration expenditures, which makes it an unstable input. The county government is responsible for the payroll of the reserve's staff. Quoting from a staff of the reserve: "We are raising other's child", which typically reflects the problem of management under many heads and insufficient input of the reserve.

The third reason is that the demand for higher management level for the reserve, including many technical measures and supervision methods for planning and function definition, scientific research, usage of variable organism, tourism development, relationship coordination with the surrounding communities, etc. Lack of measures in these aspects have prevented the functioning of the reserve. The key factor in management is human resources, which is now in desperate need at the moment for the reserve's management, particularly the one who is an expert in management and operation.

### 2.2.2. Lack of Sense of Protection of the Surrounding Communities

The surrounding communities' support to the reserve is greatly determined by their level of awareness of environmental protection, which doesn't look very optimistic to us. During our interviews at the three sample villages, most villagers know the existing of the reserve. When they are asked the pros and cons of the reserve, 32% of answer is that more cons than pros. 50% answered that they are not clear, which might show two problems: one, under the pressure of public education from the village leader, they dare not speak out their real thoughts, rather say that they are not clear. Two, the reserve has no clear effects on them, which makes it hard for them to make judgments. However, in general, only 18% believe that pros are more than cons, which shows that the villagers in general have negative attitude toward the reserve. Many farmers say, "We simply dig some shells from it, no big deal."

In addition, the answers to the pros and cons have a positive correlation with the age and negative correlation with the education background. The elder, the higher awareness of the importance of resource protection, since they have learned it from their own experiences. According to our interview, about 7-8 years ago, a large amount of waste water below the disposal standard from the upstream was disposed into the Bohao sea from Zhang Wei new river, causing a large quantity death of the fish, shrimp, crabs and young fish in the close sea area of Wudi county, 50% of the fishing boats out of operation, which affected over 10000 fishermen's life.

Villagers with higher education background can see the short-term and long-term benefit of the reserve from different aspects, therefore, they are actively supporting the management of the reserve. However, our investigation shows that not only most of the villagers are lack of sense of protection, but also some village leader are lack of awareness of the reserve's multi-functions and benefits. From the feedbacks we receive from the questionnaires distributed to the government organizations and enterprises, 80% believe that the resources in the reserve are effectively protected. The results from our interview indicate that many enterprise managers and governmental officials think that the wetland is "a useless vast piece of waste land", "It is not meaningful to set up too large areas of reserve", "Protection shouldn't sacrifice the economic development", etc. When there is a need for expansion of a construction, the wetland is first on the list, which causes more and more usage of the wetland by constructions.

### **3. Community Sustainable Development Plan**

The purposes of establishing the Binzhou Shell Dyke Island and Wetland National Natural Reserve are to protect and promote the growth and development of the shell dyke islands, to prevent the degeneration of coastal wetland's ecological environment, to resume and promote the ecological function and the rare birds' proliferation on coastal wetlands. However, there is a possibility that the reserve will become inefficient and end up in failure if it can not resolve the conflicts among the stakeholders and obtain public's support to the establishment of the marine reserve during its daily management. The basic problem in the conflicts is the economic development. The reserve will end up a "Castle in the Air" if the sustainability problem of the surrounding villagers' production can not be solved. The fundamental route to realize the reserve's management is to draw up community sustainable development plan, set up sustainable substitute industry, and have the community people received actual economic benefit from the reserve protection and wetland resumption. The drawing up of community sustainability development plan should follow the following principles:

#### *First, principle of economic development*

Natural reserves are mostly build up at remote areas, areas lack of transportation or mountain areas. Located in Wudi County, a poor county in Shandong Province, Binzhou Shell Dyke Island and Wetland National Natural Reserve is no exception. The local resident relies heavily on the local natural resources. The establishment of the reserve causes potential threat to the living of the local poor residents, who have contributed to the protection of the ecological environment. Farmers' difficulty in living and decrease in income will lead the reserve to an unstable situation. The drawing up of community sustainable development plan shall base on the principle of promoting local economic development. Only with the development of local economy, the villagers changing to substitute lifestyle, improvement of economic conditions, and stability of occupation and income structure, the reserve can have a solid economic and social foundation.

### *Second, principle of sustainable usage of resources*

The development of the economy should be based on the sustainable usage of the reserve's resources. The purpose of establishing the reserve is to maintain the biodiversity of marine ecosystem, guarantee the fair and sustainable usage of marine resources, resume and further enhance the damaged marine ecosystem function. Reserve is an effective tool to realize the inter-era fairness of marine usage and sustainable development. Therefore, the drawing up of community sustainable development plan should help the villagers to get out of their current condition of living on local natural resources, in order to realize the aim of non-expendable usage of marine resources.

### *Third, principle of reserve management efficiency*

The reserve's current management mode totally focuses on natural protection, which ignores at a large degree the effective developing of the reserve's economic function. The unsatisfactory result of the current management will eventually lead to the lose of both natural protection and economic development. If the drawing up and implementation of the community's sustainable development plan can base on the community's economic growth and resource sustainable usage, there will be a great decrease of conflicts in resource usage and a great increase of resource users' obedience to management's administrative plan. In addition, the local and county community's capability of organization of participation in the reserve will also be greatly improved. Therefore, the principle of reserve management efficiency should be followed when drawing up the community's sustainable development plan.

Based on the above principles, this report believes that the following should guide the community development plan of Binzhou Shell Dyke Island and Wetland National Natural Reserve:

#### **3.1. Reasonable plan of the reserve's coverage area**

Apart from biological factors, the coverage area of the reserve should also be affected by the social economic factors such as internal and external management and/or risk of the reserve. If the management of the surrounding environment is poor, there will be a greater effect of human being's activities on the marine reserve. Even though the coverage area of the reserve might be designed very large, there won't be enough protection. Past experiences show that the design and planning of a successful reserve should integrate the local conditions, including natural environment, economic pressure, social management, etc. Over-activity of the human beings in the reserve will increase the cost of the reserve and expose the reserve's resources at high risk.

Under current plan's coverage area of Binzhou Shell Dyke Island and Wetland National Natural Reserve, there are 16 villages with rural population of 12009, 11 enterprises with total employment of 4138. These stakeholders take part in production activities such as mariculture, fishing, salt-production and marine product processing, etc. Along with the increase of population and expansion of production scale, the production areas are increasing.

We suggest a redesign of many minimized reserve areas within the reserve, based on the principle of protection and sustainable development as well as on scientific research and reasonable planning, according to the reserve's biological, social and economic aims. Within each minimized reserve, protections will focus on the locations which have the most ecological influences and need the protection badly, in order to get people's support. After many years, the locations can be expanded to meet the management target. Furthermore, the core and buffer areas should also be redesigned. That is, to establish a smaller core

area with less coverage area but more strict management measurements; also to establish a larger buffer area with more coverage but looser management measurements. We believe this change will greatly increase the protection efficiency, reduce the protection cost, as well as provide development space to the villagers and enterprises.

### **3.2. Development of eco-tourism**

Every year from May to October, the reserve enjoys marvelous scenery due to its rich plantation and bird resources. We suggest that the local government should plan a tourist area for activities such as bird-watching, vacation, and boating in the wetland, etc. At the same time, in order to avoid the tourist activities' damages to the protection target, we suggest that function areas should also be designed within the ecological areas: separation of core protection area, tourism and entertainment buffer zones and concentrated tourism and entertainment zones. Different ticket prices should apply to different zones. Local villagers should be able to be hired as management staff in the tourist area; they should also be allowed to conduct tourism-related activities such as leasing of tourist tools, selling of tourism crafts, setting up restaurants, etc. Necessary vocational training should be provided in order to improve the participants' qualification and service quality, therefore to provide a better soft environment for the local tourism. Service standards and fees should also be regulated to improve the overall level of local tourism.

### **3.3. Ecological compensations to the villagers who have made scarification to the reserve.**

According to our investigation, the reserve's villagers' main income come from fishing (43%) and tidal flat cultivation, salt-production, and the combination of other economic activities, with an annual average income of RMB 8000 per household (Chengkou County residents' average income is only RMB 3899). From survey conducted in the reserve, there is a general decrease of villagers' average income after the establishment of the reserve, mainly due to the fact that the villagers are not allowed to conduct cultivation and salt-production on the tidal flats located in the core and buffer zones of the reserve. The decrease of income level made the villagers resistant to the preserve. This report believes that compensation should be made to the reserve's villagers, who were harmed by the decrease of income through giving out their right of life and production, and sacrificed for the establishment of the reserve. Country and society, who benefit from the reserve, should make the compensation. The standard of compensation should be the villagers' opportunity cost of giving out and transferring production right.

Compensation standard = production quantity × unit production income

Here, the unit production income is decided by the investigation results based on 3 sample villages, provided in Table 9 as follows:

Therefore, money compensation should be made to every receiving household once a year, with average amount of RMB 3516.78 per ton for fishing products, RMB 15884.71 per ton for mariculture products, RMB 1257.57 per ton for salt production, RMB 9637.25 per ton for agriculture products. The actual compensation for a particular household will depend on what category industry it gave-up production belongs to. The relevant households should be compensated until all the labors in the household confirm their employment. Generally speaking, the money compensation should last for no more than 3 years, in the form of fiscal subsidy, tax reduction and favorable-interest loans.

Table 9: Sample Villages' Unit Production Income (Unit: RMB10,000/ton)

Sample Villages	Fishing Unit Production Income	Mariculture Unit Production Income	Salt-Production Unit Production Income	Agriculture Unit Production Income
Shui Gou Village	0.4122	2.000597	0.131514	
Meng Village	0.421782	1.95	0.12	0.963725
Cha Jian No. 2 Village	0.221053	0.814815		
Average	0.351678	1.588471	0.125757	0.963725

#### **3.4. Provide capital, technology, information support to the farmers in transition period.**

We learn from our investigation that some farmers have already had plans for transferring into different kind of production or industry. For instance, some farmers who are planning to plant date trees or open pig farms find it hard to receive financial support, some farmers transition plans are limited by relevant technology. Therefore, we suggest that the government should provide the farmers with low or non-interest loans, at the same time provide them with information and technology consultation. The purpose of doing these are, firstly, to help the villagers adjust their plantation and cultivation structure based on market demand, since market orientation can reduce the blindness and risk of local residents' investments; secondly, to increase the technology contents in their agricultural production. In addition, the government should also provide the local residents with high-quality seeds, technology, feed, as well as further processing of preliminary products.

#### **3.5. Recruit qualified villagers as management staff for the reserve**

During the process of our investigation, several villagers suggest that the reserve should recruit experienced villagers to participate in the management. The project team reckons this suggestion reasonable and necessary. The local residents live in this area for generations and accumulated many experiences and lessons in utilizing current resources and seeking economic development opportunities. They understand the local resource's conditions and potential problems, experience the limitation factors faced by development, and care very much how to solve these problems and explore the potentials of current resources. The government may employ some of them to participate in the management of the reserve and drawing up of establishing plans. They can be paid by undertaking daily management of the reserve, such as daily watch, patrol and supervision, etc. Through this measure, they will be changed from resource users to resource protectors, therefore to realize the double aims of "effective protection of the reserve's resource environment" and "improve living standard" at the same time.

#### **3.6. Encourage the enterprises located within the reserve to undertake social responsibilities of nature protection**

The reserve and government should encourage the enterprises located in the surrounding areas of the reserve to provide funds for the reserve, to provide employment opportunities for the local residents, to conduct public education jointly with international organizations and non-governmental organizations, to create conditions for the local villagers to conduct small-scaled business and trade activities. The reserve should publicize those enterprises

who actively undertake environmental responsibilities and meet the relevant environment protection standards.

### **3.7. Set up community joint-management committee**

Joint-management committee may be composed of representatives from the reserve's management authority, local villagers, enterprises located within and surrounding the reserve, local government organizations, local social groups and non-governmental organizations, local academic and research institutions. The committee's acting organization should mainly be composed of representatives from stakeholders. The committee should establish a system to facilitate the stakeholders' supervision and information exchange; solve resource usage conflicts through joint negotiations, and help the community to draw up economic development plans; further demonstrate and promote the joint-management experiences in a broader range. Under the assumption that the joint-management committee receives support from the local government, it should expand its decision-making power, make adjustments to its supervision and encouragement system, mobilize its members, enhance its members' responsibility and cohesive power, as well as draw up long-term community resource management plans and hold regular meetings based on resource's current usage condition and development trends.

### **3.8. Public education for a long period of time**

From the investigation, we found that the surrounding area's residents have little knowledge on the reserve and low awareness of resource and environmental protection. These are the main reasons for the residents to conduct resource developing activities ignoring relevant regulations for the reserves. Therefore, it is very important to implement public education in order to coordinate the relationship between community economic development and resource environment protection. Governmental and reserve management organizations should start from students by regularly conducting theme educations in schools (such as lectures, reports, writing and drawing competitions, etc.)

Detailed practices include: in-class education, some core areas of the reserve can be opened to primary and secondary schools regularly; setting up some relevant education groups in schools. For instance, under the teachers supervision, posters group can demonstrate their collections of knowledge on natural reserves from environment newspapers and the reserves' legislations and regulations; blackboard group can draw educational blackboard on environment at local villagers' groups; education groups can divide themselves into smaller groups targeting at different geographical areas and regularly visit the enterprises and villagers during their holiday times, and educate them with relevant knowledge on environmental protection and natural reserves, in order to help and guide them to avoid damage to the reserve's resources and realize resource protection and sustainable usage. In addition, relevant departments can also conduct non-profit activities in public regularly for education purposes, such as distributing brochures and souvenirs on environmental protection and the reserve.



## Annex IV: Status and use of Ganghwa ecosystem

### 1. Ecosystem of the Ganghwa Island

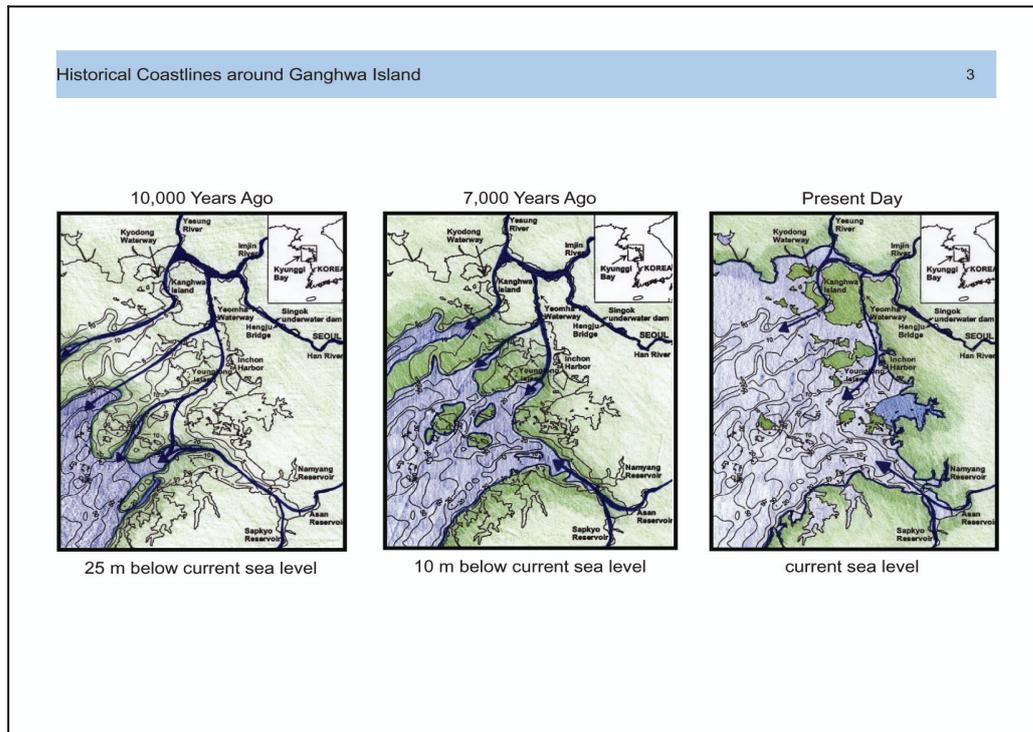


Figure 37: Ganghwa Island eco-system (a)

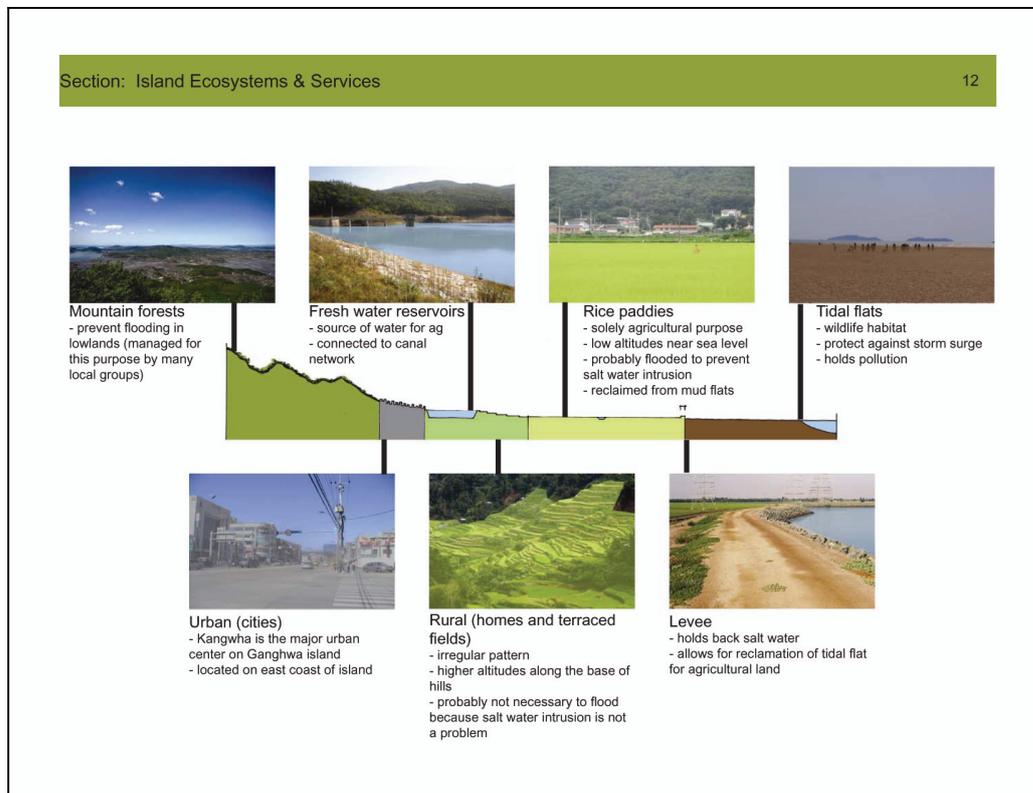


Figure 38: Ganghwa Island eco-system (b)

## 2. BFS habitat

# Study on Optimal Growth Conditions of Endangered Plant Species, *Ranunculus kadszensis* Makino

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### Abstract



*Ranunculus kadszensis* Makino

*Ranunculus kadszensis* is categorized as an endangered species by the Wildlife Protection Act in South Korea (Ministry of Environment of Korea 2005). However, there are only a few studies of taxonomy and ecological traits of *R. kadszensis*. Though there were no records of observation of *R. kadszensis* from 1970 to 1990, recently, many habitats were discovered in the rice paddy lands near the western coastal area of Korean peninsula. For the conservation of endangered species, studies on ecological traits in various aspects are needed first. *R. kadszensis* is an aquatic plant but can live in the out of the water as different ecotypes. Seedlings of *R. kadszensis* were collected at the *R. kadszensis* community in Ganghwa, Incheon and water depth and light intensity were set differently to see the effects on the growth. Biomass and various phenotypes of each samples were examined. For seed germination experiment, full ripened seeds were gathered at the site of Ganghwa and germination of the seed by the factors like seed sizes, light and water depth were examined.

### Introduction

- Categorized as an endangered species by Ministry of Environment of Korea in 2005
- Distributed in the rice paddy lands near the western coastal area of Korean peninsula
- Only a few studies on taxonomy and ecological traits

### Study Area

*R. kadszensis* conservation area (Choji-ri, Ganghwa, Incheon) by the National Trust of Korea

### Community Survey

- *R. kadszensis* conservation area (Ganghwa)
- Present species, biomass, height, pedicel number and water depth were examined.

### Glasshouse Experiment

- Shading was treated differently to see the dependence on the light.



### Growth Chamber Experiment

- Water depth were treated differently. (control, 5cm, 15cm)
- Germination experiment
- Effects on the germination rate of seed size, light and water depth

### Materials & Methods

#### Community Survey

- Quadrate method: May 2007 (Ganghwa, Incheon)



- Present Species: *R. kadszensis*, *Potamogeton berchtoldii*, *Alopecurus aequalis*, *Scirpus planiculmis*, *Callitriche verna*

#### Sampling

- Seedlings and soil were collected in April 2007 and full ripened seeds were gathered in May and June 2007 (Ganghwa).

#### Germination Experiment

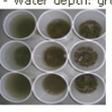
- Seed size, light and water depth were differently treated.

#### Treatments on the Seedlings

- Shading: glasshouse experiment

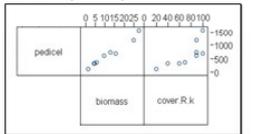


- Water depth: growth chamber experiment



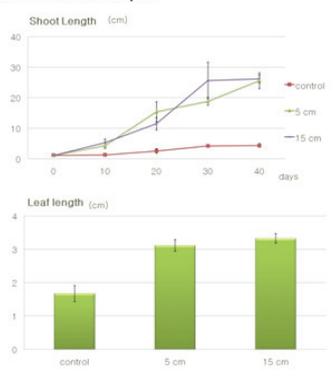
### Results

#### Community Survey

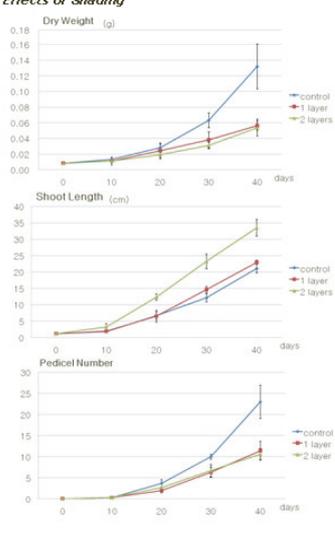


(cover R.k = coverage of *R. kadszensis*)

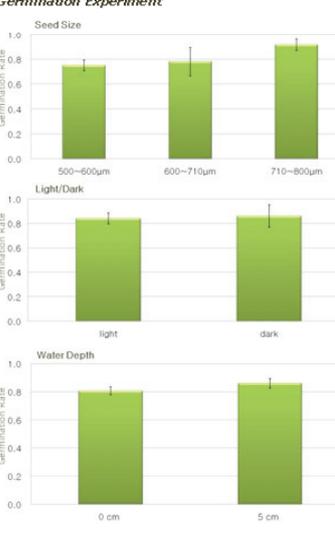
#### Effects of Water Depth



#### Effects of Shading



#### Germination Experiment



### Discussions & Conclusions

#### Community Survey

There were positive correlation between the pedicel number of *R. kadszensis* and each of biomass and coverage of it ( $p < 0.05$ ).

#### Effects of Water Depth

Water depth have affected shoot length and leaf length significantly. *R. kadszensis* living in the water has taller height and longer leaf than that on the ground.

#### Effects of Shading

Shading have affected dry weight, height and pedicel number.

#### Germination Experiment

Germination rate was affected by seed size but light and water depth didn't have significant effect to that.

#### Further Studies

- Tolerance to the herbicides
- Field experiment

### References

Ku, Y.B. (2007) Distribution and genetic uniformity of an endangered aquatic plant, *Ranunculus kadszensis*, in a South Korean rice paddy. *Weed Biology and Management* 7, 120-123.

Lacoul, P. (2006) Recent Observation of a Proliferation of *Ranunculus trichophyllus* Chaix. In High-altitude Lakes of the Mount Everest Region. Arctic, Antarctic, and Alpine Research, Vol. 38, No. 3, 394-398

Strand, J.A. (2001) Morphological plastic responses to water depth and wave exposure in an aquatic plant (*Myriophyllum spicatum*). *Journal of Ecology* 89, 166-175.

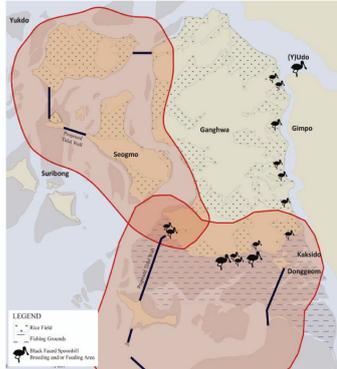
This research was supported by the National Trust of Korea.

Figure 39: Characters of rice paddy wetland in Choji-ri Ganghwa island BFS habitat



# THREATS ANALYSIS

## TIDAL POWER PLANTS



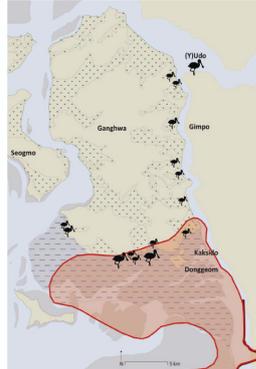
### Affects on BFS

1. National government estimates 52 species will be lost (further impacting species that feed on the ones lost)
2. Changes to water level diminish foraging and nesting opportunities for BFS
3. New road on tidal wall could increase development pressure and cause additional habitat loss

### Affects on Locals

1. Estimated 50% indirect disruption to fishing practices during construction and 30% direct disturbance during operation (based on tidal plant operating hours)
2. Effects on northern waterways still unknown
3. Loss of rice field in south-central island for species mitigation

## GRAND CANAL & INCHEON PORT



### Affects on BFS

1. Loss of foraging area from dredging
2. Increased disturbance from close and more frequent contact with ships
3. Pollution from ships degrades water quality which impacts foraging

### Affects on Locals

1. Disturbance to fishing areas from increased boat activity
2. Pollution increase and release from ships (ex: from ballast dumping) degrades water quality lowering fish yields
3. Loss of the 'quiet' quality of the area

## INCHEON FREE ECONOMIC ZONE



### Affects on BFS

1. Increased development pressure could lead to habitat loss
2. Increased water air and soil pollution from new industrial and commercial businesses

### Affects on Locals

1. Expected to increase population of Incheon by almost 20%
2. Loss of the 'quiet' quality of the area
3. Increased pollution

## HIGHWAYS



### Affects on BFS

1. Increased development may lead to habitat loss as rice fields and mudflats are developed
2. More pollution from cars lowers water quality impacting food supply
3. Direct disturbance from increased human and domestic animal contact

### Affects on Locals

1. More competition from outside businesses
2. More pollution from cars lowers water quality impacting fishing yields
3. More people moving through the island increasing traffic congestion

## POWER MAP FOR TIDAL POWER PLANTS: WHO ARE THE DECISION MAKERS AND WHO DO THEY TALK TO?

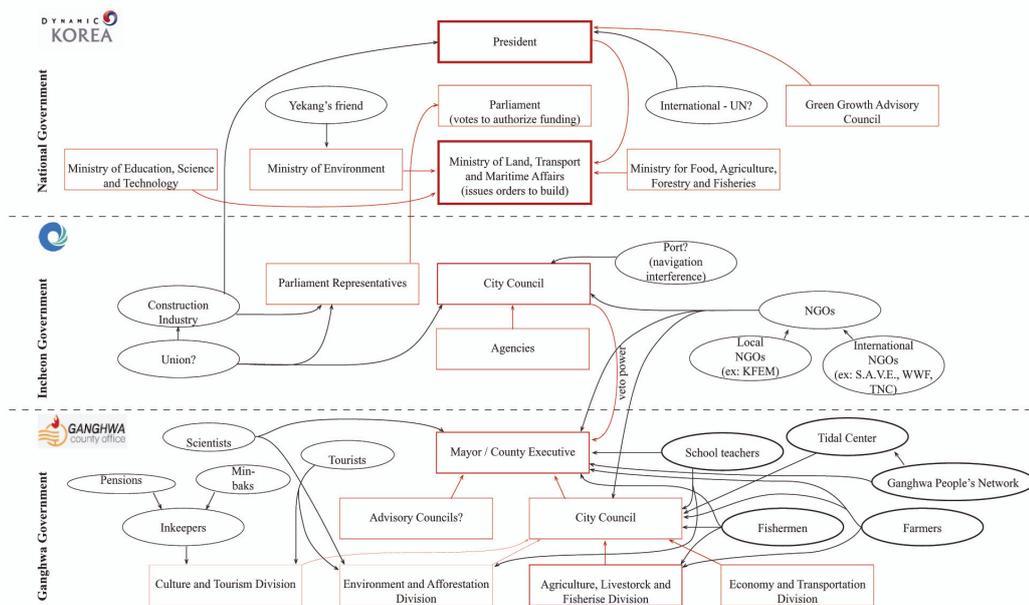


Figure 41: Ganghwa Island eco-design with BFS (b)



Figure 42: Ganghwa Island eco-design with BFS (c)

#### 4. Eco-tourism



Figure 43: Ganghwa Island eco-tourism with BFS and overseas example (a)

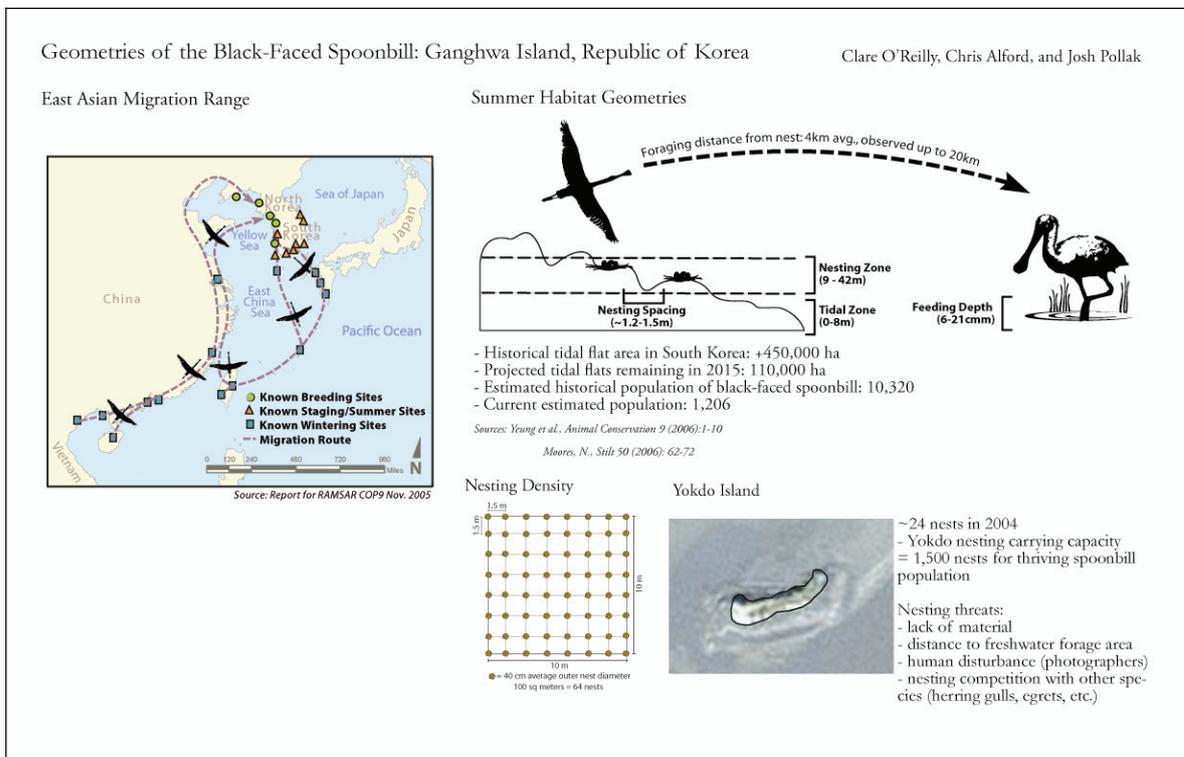


Figure 44: Ganghwa Island eco-tourism with BFS and overseas example (b)

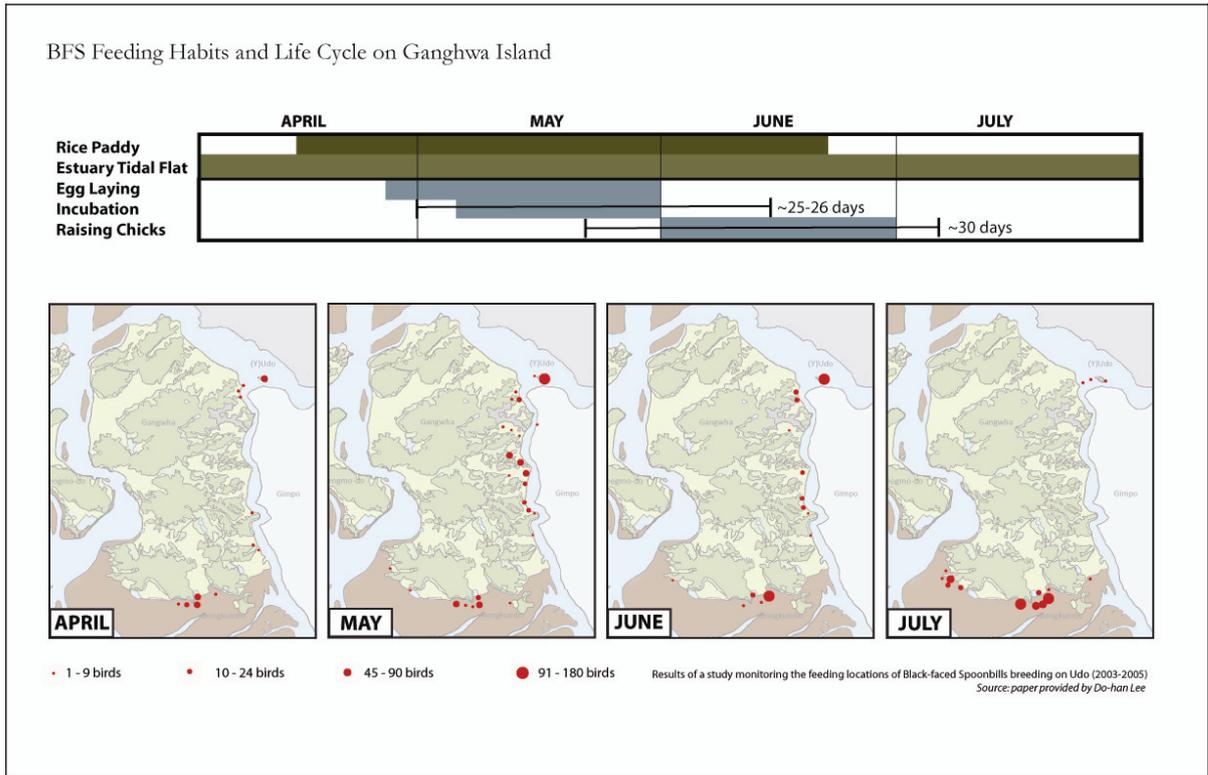


Figure 45: Ganghwa Island eco-tourism with BFS and overseas example (c)

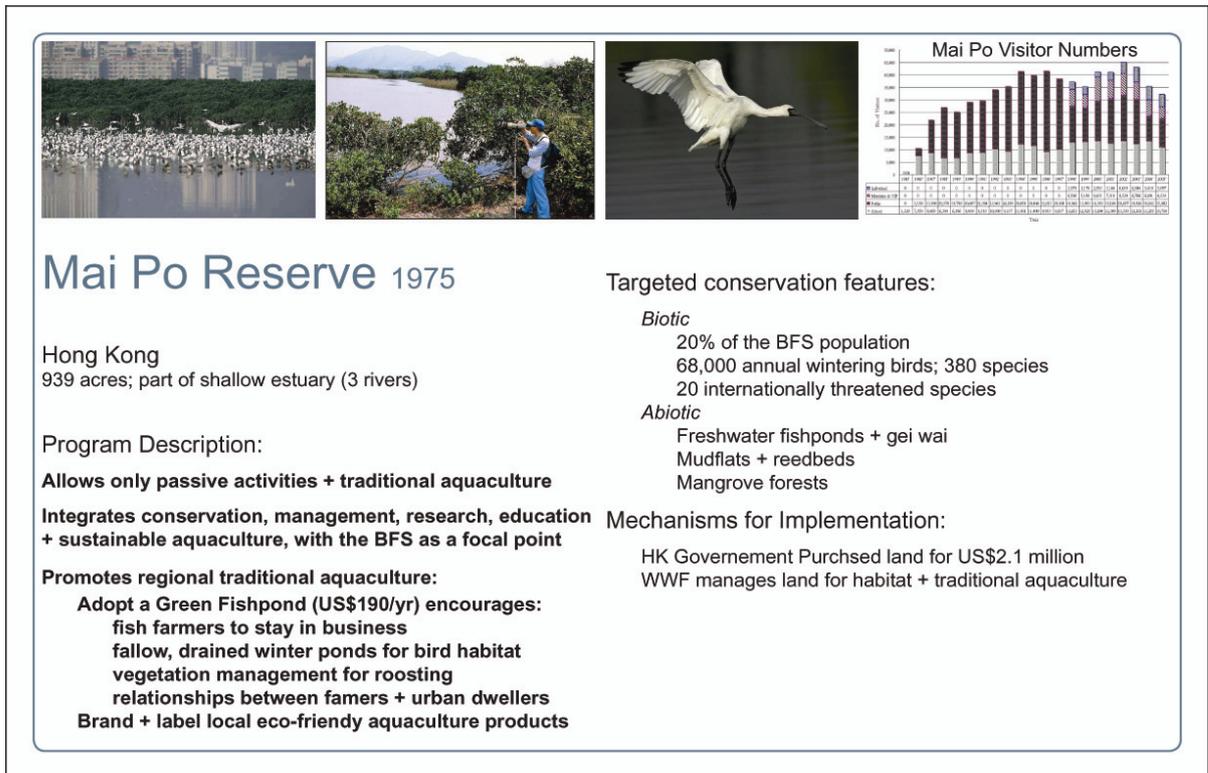


Figure 46: Ganghwa Island eco-tourism with BFS and overseas example (d)

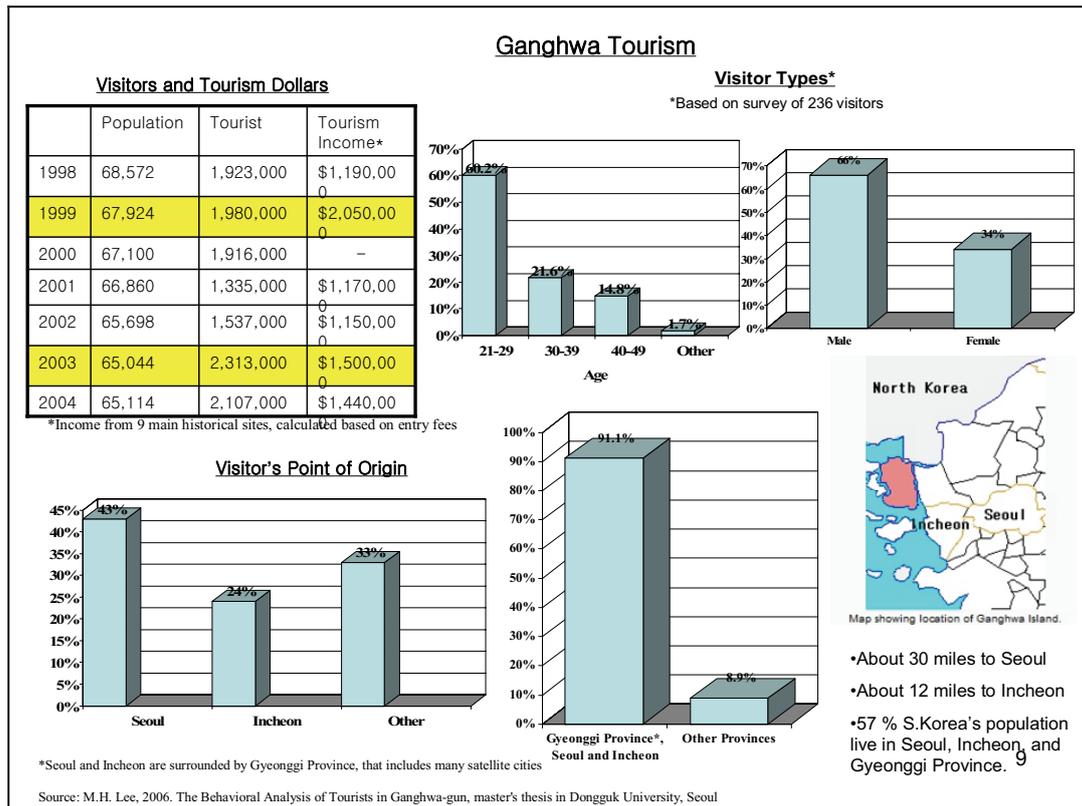


Figure 47: Tourism on Ganghwa Island (a)

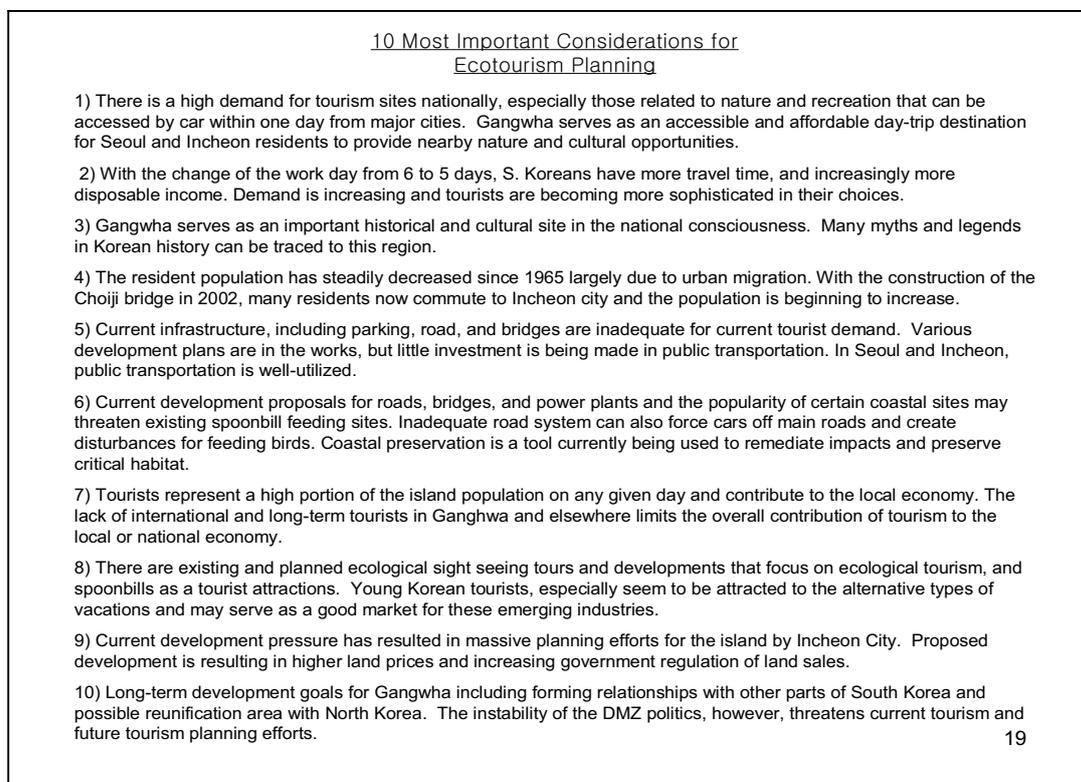


Figure 48: Tourism on Ganghwa Island (b)

## 5. Tourism on Ganghwa Island past in spires future

### *Research result announcements*

The idea of sustainability is derived from the ecology of the region that defines its unique character and identity. Sustainability for Ganghwa island can be discussed at three different levels of scale: (1) at the regional level, (2) at community and local neighborhood level, (3) at an individual level.

Role of agriculture had declined in Korea through Korea's "urban-centered" economy. Agriculture once defined Korea's landscape and our ancestors were stewards of the land. With the decline of agriculture, however much has been lost, the skills and the art of agricultural cultivation as well as stewardship of the land. Ganghwa's landscape once embodied the spirit of the living, but now we are at the forefront of an important time in Ganghwa's history as we face the risk of losing island's ecological integrity and cultural identity. Development plans geared towards holiday destinations throughout the world has made indigenous landscape desolate and intangible. Proposed development plans for Ganghwa island is similar illustration of parochial and short-sighted approach. So it begs the question: in the age of globalization, is there a sense of place that can only be experienced at Ganghwa island? Ganghwa is an island of national heritage for Koreans. Ganghwa can, and need to, maintain, preserve and inherit its history, culture and landscape to sustain its identity for the future generations.

Background studies of Ganghwa island and our experiences with eco-tourism suggest that Ganghwa island has extraordinary potential for eco-tourism. Green spaces in urban settings, providing recreation, are the attractors for urban development. Coupled with colorful history, and cultural remnants throughout the island, educational opportunities and vast array of biodiversity are critical building blocks of eco-tourism. From our research, Asia-Pacific is the fastest growing tourism region in the world, projected growth at 6.5% by 2020. We discovered two types of notable tourism trends: resort destinations, and authentic tourism/eco-tourism. Of the two, "authentic" tourism is category of tourist looking for unique cultural experience, experiencing history, livelihood, local food and landscape first-hand. Authentic tourism has an appeal to international tourists, planning for longer stays. However, gearing towards domestic travelers, which make up majority of the tourists to Ganghwa island, we project that eco-tourism and recreational tourism will generate repeated visitors to the island. As these consensus show, we believe that Ganghwa island can be an integral part of Korean national tourism growth, hence serving as an incentive, a motivation, for the locals of Ganghwa to invest in the landscape and become stewards of their land.

The main principles that fostered our thinking about goals, issues and potentials were trying to understand and reveal important ecological patterns in the landscapes that we wanted to see preserved. We felt that the landscape of Ganghwa Island had the potential to tell its own story and a development plan should preserve the capacity of the landscape to tell this story. We took these components of eco-tourism building blocks and organized them in following manner: the "land of the gods + visitors", the "land of the daily life + visitors", and finally the "land of the defense + habitat."

At the regional level, our approach is to identify elements of the ecosystem—for example, the forest, bodies of water, rivers and streams, agriculture, mud flats and tidal flats, fluctuating water levels, wildlife corridors, and key species. Historical and cultural sites, embodying the spirit of the ancestors further embellish unique characteristics of Ganghwa island. Safeguarding the ecosystem ensures sustainability of Ganghwa island and spiritual processes across the landscape. In "land of the gods+visitors," the past inspires

the future, as land design was once the king's art. These larger systems, then, define the urban growth pattern, the city forms and the infrastructure such as roads. In our alternative plan, we focused on expected development and population growth in the existing developed areas that ring the base of the island mountains. We also propose incentives to encourage higher density development in these areas through a transfer of development rights. Income generated from these bonuses would contribute to the preservation of both the mountain and farm areas. Our road and pedestrian network would be focused in the developed areas and follow the existing land contours. Our transportation network attempted to link existing tourism clusters and provide access via internal loops into sites within these clusters. At each cluster, we provided access to a mountain viewpoint where visitors could view the landscape – contributing to an understanding of its ecological and cultural patterns.

Urban growth is essentially a “horizontal” process. At community and local neighborhood level scale, we integrate horizontal processes of urban development with ecological protection. Regionally identified ecological infrastructure becomes urban green spaces, interconnected throughout the region, provides system of wildlife corridors, recreation for people, opportunities for people to establish connection with the landscape. This is the “land of the daily life + visitors.”

At the level of an individual farm, the ecological infrastructure guides site specific design. At Ganghwa island, specifically northern and southern parts of the island and along the edges of the island, we explored site specific design to accommodate black-faced spoonbills habitat. In United States, there are number of incentive programs for farmers to manage farms for wildlife habitat. Economic value of the land surrounding green spaces will increase, at the same time bringing nature to man, man and spirit together. Additionally, Ganghwa's history informed us that edges of the island were also forts and lookouts for her and her country's defense. This is the “land of the defense + habitat.”

## Annex V: Guidelines for eco-friendly fishing practice in the seagrass bed

**UNDP / GEF Yellow Sea Large Marine Ecosystem Project**

为了我们的未来更美好，让我们共同努力保护海草

1. 什么是海草？

我们通常说的大叶藻就是海草，它们是生长在大海中的“草”，有薄而长的叶片，有根扎在海底。海草每年春天发芽生长、开花、结籽，秋天叶片大部脱落，以基部和根越冬。

2. 哪里有海草？

我们所说的大叶藻一般在5米水深以浅、沙底或者泥沙底的海区。

3. 怎么保护海草？

- ◇ 不要在有海草的海区进行拖网作业
- ◇ 不要在有海草的海区进行海底采掘作业
- ◇ 不要在海草区使用地笼子、迷魂网等各种网具捕捉鱼苗
- ◇ 不要在有海草的海区进行打桩等破坏海底的作业
- ◇ 不要在有海草的海区抛锚
- ◇ 船只要避免在有海草的海区搁浅
- ◇ 不要向海中倾倒、排放各种固体废物、污水和其它有毒有害物质等
- ◇ 不要割取或拔出活着的海草，只捡拾脱落后冲到海滩上的海草
- ◇ 不要在有海草的海区进行筏式养殖
- ◇ 不要在有海草的海区进行网箱养殖
- ◇ 在有海草的海区可以适度、科学地进行底播养殖或者天然资源护养
- ◇ 在有海草的海区进行底播养殖和收获时不要破坏海底
- ◇ 在有海草的海区进行底播养殖和收获时要保持海水透明度
- ◇ 不要改变有海草的海区的水流和其它环境条件

Figure 49: Guidelines for eco-friendly fishing practice (Chinese version)



## Let's Protect The Seagrass For Our Better Future

### 1. What's seagrass?

Seagrass is known to us as “Da Ye Zao”. It is the grass living in the sea, with long thin leaves and root (rizhyme) inside the sea bed. The seagrasses grow by both seed germination and producing new shoots from the overwintering rizhymes. The seagrasses start grow in spring, bloom and seed, then overwinter by getting off most their leaves.

### 2. Where do the seagrasses live?

They generally live in seawaters shallower than five meters with sandy or sandy-silty seabed.

### 3. How to protect the seagrass?

- ❖ Don't make net trawling in seagrass beds
- ❖ Don't dig/drill in the seagrass beds
- ❖ Don't use various nets to capture fish larvae in the seagrass beds
- ❖ Don't set poles in the seagrass beds
- ❖ Don't anchor in the seagrass beds
- ❖ Avoid strand in the seagrass beds
- ❖ Don't discharge solid wastes, sewage or other hazards into the sea
- ❖ Don't cut or stub live seagrasses, only collect the seagrass debris on the beach
- ❖ Don't make raft culture over seagrass beds
- ❖ Don't make cage culture over seagrass beds
- ❖ You may appropriately make benthic releasing or bottom culture by taking care of natural resources according to expertise guidance
- ❖ Don't damage the seagrass bed during bottom culture and harvest
- ❖ Always keep the water transparency during bottom culture and harvest
- ❖ Don't change the water flows or other environmental conditions

Figure 50: Guidelines for eco-friendly fishing practice (English version)