

Demonstration Zone of Integrated Ecosystem-based Investigation
on Wetland of Jiaozhou Bay of Qingdao
(UNDP/GEF YSLME Phase II Project)

**Suggestions and Countermeasures for the Protection
of the Ecosystem of Jiaozhou Bay**

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Preface

This report is one of the outputs of the United Nations Development Program (UNDP) Yellow Sea Large Marine Ecosystem Phase II Project (YSLME II) Demonstration Zone of Integrated Ecosystem-based Investigation on Wetland of Jiaozhou Bay.

This project takes Jiaozhou Bay as a demonstration zone to conduct a series of integrated investigations on the wetland ecosystem, and to master the status of wetland ecosystem, so as to provide the municipal government with scientific information and decision making support. Therefore, Qingdao Municipal Marine Development Bureau, taking charge of the management of Jiaozhou Bay, provided strong supports for the application and implementation of this project.

This report, on the basis of the project research, described the status of Jiaozhou Bay, analyzed the ecological problems and submitted the countermeasures and suggestions on Jiaozhou Bay, so as to contribute to the ecological protection and sustainable development and utilization of Jiaozhou Bay.

1 Introduction

The Jiaozhou Bay bordering on the West of the South Yellow Sea ($120^{\circ}05'36''\sim 120^{\circ}19'01''\text{E}$, $36^{\circ}07'07''\sim 36^{\circ}15'17''\text{N}$), is a semi-enclosed natural bay with total area of 370.6km^2 and an average water depth of 7m. There are diverse ecosystems in the Jiaozhou Bay Region, such as shallow sea, wetland, and etc.



Fig. 1.1-1 Remote sensing image of Jiaozhou Bay

Jiaozhou Bay is the area with high productivity, especially the muddy-sandy bank in the north of Jiaozhou Bay, which is an excellent area for mariculture of shellfish and algae. Jiaozhou Bay is the important spawning ground, feeding ground and nursery ground for a variety of economic species, including fishes, shrimps, crabs and cephalopods. And Jiaozhou Bay also has the value of fishery resources and biodiversity conservation.

Jiaozhou Bay wetland, with a total area of about 260 square kilometers, is the largest

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wetland ecosystem in the southern part of Shandong Peninsula. There are multiple rivers flowing into the Bay, such as Moshui River, Baisha River, Dagu River, Yanghe River, and etc. The Jiaozhou Bay wetland is amongst the most important stopover areas for migratory birds on East Asian Australasian Flyway (EAAF) and is used by the birds for feeding and resting during the migration.

Meanwhile, Jiaozhou Bay also has various cultural tourism resources with unique characteristics and values, such as folk culture, historical culture, festival culture, military culture, fishery culture, port culture, and etc.

2 Status of Jiaozhou Bay Ecosystem

2.1 Status of Marine Environments of Jiaozhou Bay

In 2019, the environmental quality of the waters in Jiaozhou Bay was generally good, with 74.8 percent of the waters meeting the quality standards for category I and II seawater, an increase of 1.1 percent over 2018. 8.3% of the sea areas were in the fourth and worst category, an increase of 0.3% over 2018. The polluted sea areas are mainly distributed in the northeast of Jiaozhou Bay and the top of Beibu bay. The main pollutants are inorganic nitrogen, followed by active phosphate and petroleum. On the whole, in the past five years, the environmental quality of the sea water in Jiaozhou Bay has been on a continuous upward trend. The proportion of the sea areas with the water quality standards of category I and category II has increased, while the proportion of the sea areas with the water quality standards of category III and category IV has decreased.

The sediment quality of Jiaozhou Bay is generally good. Only one petroleum station exceeds the Marine Sediment Quality Standard of category I, while all other monitoring stations meet the Marine Sediment Quality Standard of category I.

The Marine community in Jiaozhou Bay is relatively stable with little change. The species number, density, biomass and dominant species composition of Marine phytoplankton, zooplankton and benthos have not changed significantly over the years. But 2019 species of fish larvae number was lower than that in 2015, and in recent years, according to the survey, the are the main dominant of fish larvae of low-value fish, small yellow croaker, hairtail, white Chinese croaker economic fish larvae have appeared, but few in number or only in few months, showed that the shallow waters as traditional economic types of spawning, the brood place function declined.

2.2 Status of Jiaozhou Bay Wetland

2.2.1 Shoreline and Wetland

In 2019, the shoreline of Jiaozhou Bay wetland is divided into artificial shoreline, sand (gravel) shoreline, silt and silt shoreline, bedrock shoreline, estuary shoreline and

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ecological shoreline. The total length of shoreline is 213.93 km, of which the total length of artificial shoreline is 164.44 km and the total length of natural shoreline is 49.49 km, and the retention rate of natural shoreline is 23.14%.

In 2019, the wetland types of Jiaozhou Bay wetland include shallow waters, sandy beaches, muddy beaches, *Phragmites communis*, *Spartina alterniflora*, intertidal brine marshes, reservoirs, aquaculture farms and 10 other types, covering a total area of 27,729.85 hectares. Among them, the area of shallow waters is 21,191.98 hectares, the area of sandy beaches is 8.84 hectares, the area of muddy beaches is 1405.86 hectares, the area of estuary waters is 727.89 hectares, the area of *Phragmites communis* is 18.37 hectares, the area of *Spartina alterniflora* is 290.01 hectares, the area of intertidal brine marshes is 10.87 hectares, the area of reservoir ponds is 355.43 hectares, the area of aquaculture farms is 3,161.43 hectares, and the area of other types is 559.16 hectares.

2.1.2 Birds

Jiaozhou Bay wetland is on the EAAF, which is one of the 8 migratory routes all over the world. It is also the important stopover for the waterfowl migration. From January to November 2019, 114 species of birds of 12 orders, 35 families, including 12 national protected birds and 21 threatened birds on the IUCN red list were recorded in Jiaozhou Bay wetland. 10 species under state protection (category II, including Vervet spoonbills, White spoonbill, Whooper swans, Green-winged teal and Black wings, the ordinary Kuang, Jaw, White-tailed eagle, Kestrels. Two species of extremely dangerous birds, the Common duck and the Chinese crested tern. Four species of endangered birds, including the Black-faced spoonbill, the Great curlew, the Great curlew and the Little greenshank. Three species of vulnerable birds, including the Red-headed duck, the Gull and the Black-headed gull. 11 species of birds at risk.

From January to November 2019, the total number of birds in the Jiaozhou Bay wetland was 201,531, with the charadriiformes accounting for 85% of the total. The dominant species of birds were the Charadriiformes, the Grey plover, the White-tailed curlew, the Bar-tailed godcock and the Wild-tailed curley-duck. The largest number of birds overwintered in winter, followed by spring, summer and autumn. Coastal tidal flats,

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offshore and coastal river wetland, artificial ponds, farmed shrimp ponds, abandoned shrimp ponds and puddles of sand are the main habitats for wetland birds breeding and feeding.

According to standard 5 of the convention, if a wetland regularly supports 20,000 or more waterfowl, it should be considered of international importance. According to standard 6, a wetland should be considered of international significance if it regularly hosts 1% of a waterfowl species or subspecies. The total number of overwintering waterbirds in Jiaozhou Bay wetland exceeded 20,000, which reached the standard of wetlands of international importance. Three species accounted for more than 1% of the total population on the migration route, namely the curley-nosed duck, the white-tailed curley-nosed curley-nosed and the rib duck, and two species accounted for more than 10% of the total population on the migration route, namely the oystercatcher and the black-headed gull. This indicates that Jiaozhou Bay wetland plays an extremely important role in the migration route of birds from east Asia to Australia and should be included in the international wetland of importance.

2.1.3 Vegetation

According to the survey in 2019, there are 272 species plants belonging to 190 genera of 59 families in Jiaozhou Bay wetland, including 28 shrubs, 202 herbs, 33 trees and 9 vine. A national secondary protected plant, Wild soybean, sparsely distributed in the vicinity of the Yanghe estuary bridge, the number is less than 1000 plants, there is a green belt nearby, subject to a moderate degree of human interference. There were 53 species of invasive plants, including 44 species of invasive plants of grade 1 to 4. The main invasive species were *Spartina alterniflora* and *Spartina anglica*.

In autumn 2019, the vegetation distribution area of Jiaozhou Bay wetland was 649.31ha, the total dry biomass was 1.48×10^4 t, and the vegetation biomass per unit area was 2.27 kg/m². Wetland vegetation and tidal flats are mainly distributed at the river estuaries, including Licun estuaries, Hongdao, Baisha River and Moshui River tidal flats, Dagu River Estuary, Yanghe River Estuary, and etc., in which Yanghe River Esturay and the tidal flat distributed the vegetation with largest area, and then east tidal flat of Hongdao, Nvgukou,

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Moshui River Esturay and Baisha River Estuary.

Spartina alterniflora, *Suaeda salsa*, *Phragmites communis* and *Spartina anglica* is the main vegetation type in . *Spartina alterniflora* had the largest area, 576.9ha, and the total biomass was 1.36×10^4 t, mainly distributed in the Yanghe River Estuary, Dagu River Estuary, Hongdao dongtan, Nugu estuary, Moshui River Estuary and Baisha estuary. *Suaeda salsa* and *Phragmites communis* came next, with an area of 45.93ha and 42.26ha, and a total biomass of 75.8t and 960.1t, respectively. *Suaeda salsa* was mainly distributed in the mouth of Yanghe River and Moshui River Estuaries, while *Phragmites communis* was mainly distributed in the mouth of Dagu river and Moshui River Estuary. *Spartina anglica*, with an area of 11.9ha and a total biomass of 104.2t, is mainly distributed in Dagu River Estuary, Lianwan River Estuary and east tidal flat of Hongdao.

3 Countermeasures and Suggestions

3.1 Jiaozhou Bay protection management effectiveness

In the past few decades, with the rapid development of the city, Jiaozhou Bay had been influenced by human activities. The natural shoreline had been invaded, and the tidal influx had reduced. The area of wetland had been reduced and the function had been degraded. Land source sewage caused the serious problem of pollution in the northern part of Jiaozhou Bay. The fishery resources had declined.

In recent years, the Qingdao Municipality has been paying high attention to the ecosystem protection and restoration of Jiaozhou Bay. A series of policies and measures has been issued to strengthen the protection of Jiaozhou Bay. In 2012, the protection control line of the Bay was demarcated, which prohibited reclamation, and protected natural coastline and wetland. In 2014, *Regulation for Jiaozhou Bay Protection of Qingdao* was issued and Jiaozhou Bay Conservation Committee was set up. In 2016, Jiaozhou Bay National Ocean Park was approved. In 2017, *Jiaozhou Bay Conservation and Utilization Plan* was further improved to fully integrate other plans for city development, marine functional zoning, land use, environmental protection, and exploration and utilization. And the Qingdao Municipality pioneered to promote the Bay Chief System, in order to protect the marine resource, prevent marine pollution, improve the marine environment and promote the integrated value of the bays.

Many measures have been taken to optimize resource management, strengthen the ecological remediation, and intensify the pollution control of Jiaozhou Bay and have achieved remarkable results. The ecosystem of Jiaozhou Bay wetland region has been improved. However, there are still some ecological problems, such as invasion of alien species, jellyfish bloom, decline of fishery resource and the pollution in the certain area.

3.2 Countermeasures and Suggestions

In order to achieve the overall goal of “clean water, green shoreline, tidy beach,

Countermeasures and Suggestions

beautiful bay, and abundant resources”, more delicacy management should be taken into practice in Jiaozhou Bay, basing on the Regulation for Jiaozhou Bay Protection of Qingdao and focusing on two mainlines of strengthening marine pollution prevention and implementing ecological restoration. And marine ecological red line and the Jiaozhou Bay protection control line should be strictly abided by as the "bottom lines".

3.2.1 Strengthen leadership of the Committee and implement ecosystem-based management

As a relative independent bay, ecosystem-based management would be more appropriate and effective for Jiaozhou Bay. Furthermore, it has great advantages for Jiaozhou Bay to implement the ecosystem-based management, which include that there is a Committee to take charge of the management of Jiaozhou Bay, and a series of policies has been issued.

As the lead agency, the Jiaozhou Bay Conservation Committee should play more and more important role in the management of Jiaozhou Bay to realize the overall goal, especially after the government institutions reform in 2018. It is necessary to coordinate the relationships among deferent government departments, to coordinate the relationship between government departments and industries, and to coordinate the relationship among different industries. It will greatly help to minimize the conflicts, so as to realize the effective cooperation among all stakeholders involved in Jiaozhou Bay.

Meanwhile, to protect Jiaozhou bay and implement the ecosystem-based integrated manangement, it is essential to analyze the evolution process and overall functions of Jiaozhou Bay systematically on the basis of the integrity and characteristic of Jiaozhou Bay. According to the analysis, the plan on protection and restoration of Jiaozhou Bay could be worked out and the extent and scope of marine development could be established, for the sake of the rational and effective utilization of marine resources, and correct positioning for the protection and management of Jiaozhou Bay in the future.

3.2.2 Strengthen ecological conservation

As a typical ecosystem, ecological protection takes the priority of the management of Jiaozhou Bay. Therefore, to implement the national control requirements for coastal wetland management and reclamation management, marine ecological red line and natural shoreline management and control requirements should be put into practice strictly. The restoration projects should be carried out continuously. The standardized construction of Jiaozhou Bay National Marine Park should be promoted. And the investigation should be carried out on natural resources, environments and ecosystem, utilization activities and socio-economic activities.

The ecological restoration of Jiaozhou Bay and the wetland should be put forward. For example, in the key areas such as Yanghe River Estuary and Moshui River Estuary, the further efforts should be put on remediation of *Spartina alterniflora* and ecological restoration of beaches. The protection of the habitats is essential for the conservation of wetland birds and the biodiversity of Jiaozhou Bay and the wetland. Otherwise, the capacity of early warning and prevention of ecological disasters such as jellyfish bloom, should be improved.

In order to guide the protection and restoration of Jiaozhou Bay scientifically, the long term continuously integrated monitoring should be carried out to grasp the status and the trends of Jiaozhou Bay ecosystem. The investigation and research would be focused on: (1) water exchange capacity and tidal influx, (2) habitats and resources of marine and wetland lives, including plants, birds, fishery resources and etc; (3) The position and function of Jiaozhou bay wetland in global bird migration route; (4) threats and impacts of environmental pollution and human activities on habitats and organisms; (5) wetland ecological restoration technology.

It would be great helpful to establish an real-time information management platform for the integrated management of Jiaozhou Bay. The information from different departments, industries and agencies could be collected in this platform, which could reflect the status and changes immediately and provide the support for decision-making. This plat could improve the efficiency of the management of

Jiaozhou Bay.

3.2.3 Strengthening comprehensive improvement and supervision

In order to effectively implement the Regulation for Jiaozhou Bay Protection of Qingdao, comprehensive improvement and supervision should be intensified. The routine supervision system should be improved. The joint law enforcement should be carried out to conduct the strict crack-down. It is also effective to conduct some special actions, which could focus on a certain problem

It is available to open information collection channels and public supervision channels to the society, and encourage the local citizens to take an active part in the supervision of Jiaozhou bay. By this mean, more information and clues could be obtained to help the supervision and management.

3.2.4 Strengthen publicity and cultural developmen

It is import to improve the public awareness on the protection of Jiaozhou Bay. Therefore, the ecological protection and sustainable utilization of Jiaozhou bay should be publicized and popularized in various forms, and in a wide range.

Record the protection measures of Jiaozhou bay through the new media, retain the protection work mark of Jiaozhou Bay, publicize the remarkable results of the protection of jiaozhou bay, attract wide attention of the public, and enhance the protection awareness of the whole society.

Special publicity activities could be organized on some special days to increase publicity efforts and enhance the participation of the publics, such as "2.2 World Wetland Day", "May 12 National Day for disaster prevention and mitigation", "5.22 International Day for Biological Diversity" and "6.18 World Oceans Day".

Otherwise, the role marine culture could not be absent, because it has the significant effect on the development of marine economy.