Interim Review Report on the Progress of Implementation of the National Strategic Action Programme for YSLME 2009-2020 of the People's Republic of China

By the
National Marine Environmental Monitoring Center, MEE
The First Institute of Oceanography, MNR
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Implementing the Strategic Action Programme for the Yellow Sea Large Marine Ecosystem: Restoring Ecosystem Goods and Services and Consolidation of a Long-term Regional Environmental Governance Framework (UNDP/GEF YSLME Phase II Project)

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This publication was made possible through the support provided by the National Marine Environmental Monitoring Center, the Ministry of Ecology and Environment; The First Institute of Oceanography, the Ministry of Natural Resources; Yellow Sea Fisheries Research Institute; Chinese Academy of Fishery Sciences, the Ministry of Agriculture and Rural Affairs of the People's Republic of China.

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Acronyms and Abbreviations

BGI	Blue Growth Initiative
CBD	Convention on Biological Diversity
COP	Conference of Parties
CPUE	Catch per Unit Effort
EBSAs	Ecologically or Biologically Significant Marine Areas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
CCRF	Code of Conduct for Responsible Fisheries
GDP	Gross Domestic Product
IMTA	Integrated multi-trophic aquaculture
IMCAM	Integrated Marine and Coastal Area Management
LMEs	Large Marine Ecosystems
MFOZ	Major Function Oriented Zoning
MSP	Marine Spatial Planning
NDRC	National Development and Reform Commission
CWIIWH	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
RAS	Recirculating Aquaculture Systems
RCP	Representative Concentration Pathways
RDI	Resource Density Index
SOA	State Oceanic Administration of PR China
SSF	Small-scale Fisheries
SST	Sea surface temperature
TACs	Total allowable catches
UNCLOS	United Nations Convention on Law of the Sea
UNFCCC	United Nations Framework Convention on Climate Change
YS	Yellow Sea
YSLME	Yellow Sea Large Marine Ecosystem
YSCCs	Yellow Sea Coastal Currents
YSCWM	Yellow Sea Cold Water Mass
YSCWMC	Yellow Sea Cold Water Mass Current
YSWC	Yellow Sea Warm Current
SAP	Strategic Action Programme

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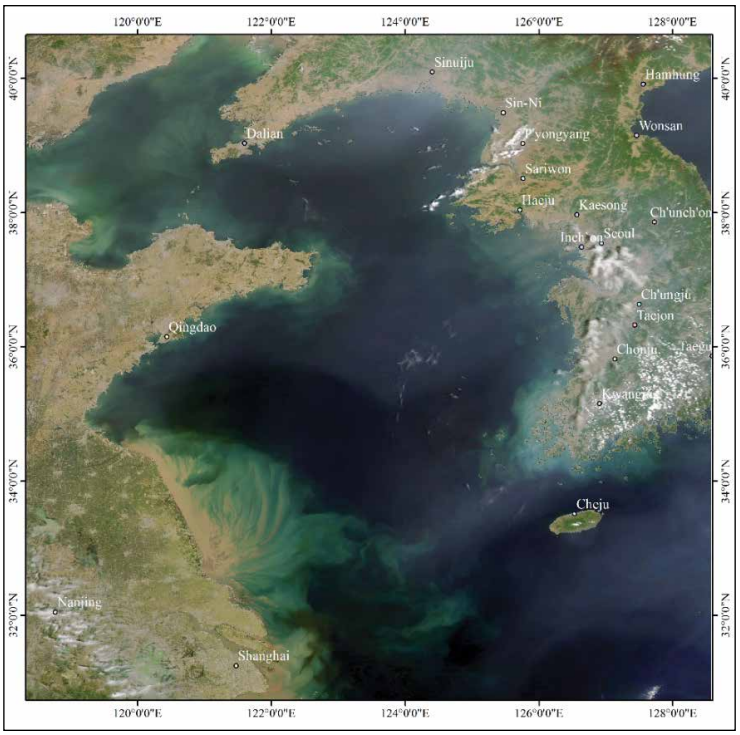
1 Contexts of Yellow Sea

1.1 Geographical conditions

The Yellow Sea (YS) is located in the warm temperate zone of the earth's northern hemisphere. Seasonal climate patterns in the YS region are mainly controlled by the East Asia Monsoon System. The climate in this region is warm and wet during summer, but cold and dry during winter. Annual precipitation is about 500 mm in the north and increases to 1,000 mm in the south, with half of precipitation occurring in the rainy season during June to August. Foggy weather frequently occurs in the coastal areas during winter, spring and early summer. Coastal shoreline is mostly rocky or sandy along the Liaoning and Shandong Peninsulas, becoming mudflats in the east coast of Jiangsu Province. The seafloor slopes gently from coasts to the middle part of the Yellow Sea Trough. Sediments at the seafloor are mainly clay-sandy silt, being coarser near the coast and finer in the middle.

Figure 1.1. Diagram of the Yellow Sea Large Marine Ecosystem.



The Yellow Sea Large Marine Ecosystem (YSLME) is located between the Chinese continent and the Korean Peninsula (31°40'–39°50'N and 119°10'–126°50'E). Its western boundary faces the Shandong Peninsula and the North Jiangsu Plain, its eastern boundary is the Korean Peninsula, and at its northern end is the Liaodong Peninsula. Three nations — the People's Republic of China (PRC), the Republic of Korea (ROK) and the Democratic People's Republic of Korea (DPRK) — are located along the coasts of the Yellow Sea. The area of the YS is 380,000 km^2, with a mean depth of 44 m. YS, as a shallow, semi-enclosed sea, possesses typical characteristics of a large marine ecosystem (LME): large area, distinct bathymetry, hydrography, productivity and trophically linked populations.

The Yellow Sea Cold Water Mass (YSCWM) is a significant seasonal water mass characterized by high salinity. It occupies approximately one-third of the deep layer of the YS in the summer, and is a unique and important YSLME hydrological characteristic. The YSCWM has unique seasonal variabilities. It forms in spring, matures in summer, recedes in autumn, and completely disappears in winter. The YSCWM has more conservative temperature–salinity characteristics than the other water masses in the YS. It also has a substantial impact on the biomass and acquisition of fishery resources in the YS.

The YSLME supports rich marine living resources, and is recognized as an important regional fishery ground. A total of 113 families and 321 fish species have been recorded in the Yellow Sea. Among these fish species, 139 are warm temperate species, 107 are warm water species, 70 are cold temperate species and only 5 are cold water species. Main commercial fish species are: small yellow croaker (*Larimichthys polyactis*), largehead hairtail (*Trichiurus haumela*), Spanish mackerel (*Scomberomorus niphonius*), Pacific herring (*Clupea pallasii*), silver pomfret (*Pampus argenteus*) and Pacific cod (*Gadus microcephalus*). The YSLME also plays an important role in marine transportation with several important port cities along its coastline. Coastal cities of the YSLME include the Chinese cities of Lianyungang, Yancheng, Nantong, Rizhao, Qingdao, Yantai, Weihai, Dalian, and Dandong; DPRK cities of Sinuiju and Nampo; and ROK city of Incheon.

Circulations in the Yellow Sea are mainly composed of Yellow Sea Coastal Currents (YSCCs), Yellow Sea Warm Current (YSWC) in winter and Yellow Sea Cold Water Mass Current (YSCWMC) in summer. YSCCs, which are featured by low salinity, low temperature (during winter) and high turbidity, flow southward along the east coast of China and west coast of the Korean Peninsula. YSWC, which is characterized by high temperature and high salinity, flows northward during winter along the 50–60 m isobath at the west Yellow Sea Trough with a speed of 5–10 cm/s. YSCWMC is a circulation around the YSCWM with a speed of about 5 cm/s. Tide is regular semi-diurnal in the whole Yellow Sea except in areas east of Chenshanjiao and in the Haizhou Bay. Generally, stormy waves are strong in the north and during autumn and winter, whereas ground swells are strong in the south and during summer and autumn.

Biota in the YS belongs to the East Asian sub-region of the North Pacific Region. The biological community is dominated by temperate species, while some tropic species appear in the southeast part of the Yellow Sea. Plankton abundance shows obvious seasonal patterns with two peaks in spring and autumn. The main planktonic species of economic importance are acetes (*Acetes chinensis*), euphausia (*Pacific euphausiid*), and jellyfish (*Rhopilema esculenta*), etc. Benthic animals are dominated by eurythermal and low salinity species. The main groups of economic importance are mollusca and crustaceans. Commercial seaweeds include *Laminaria japonica*, *Porphyra spp.* and *Gelidium amansii*, etc. As mentioned, there are about 300 fish species, such as Spanish mackerel, small yellow croaker, largehead hairtail, Pacific cod, anchovy (*Engrauli japanicus*), *Trachurus japonicus*, chub mackerel (*Pneumatophorus japonicus*), silver pomfret,

Setipinna taty, *Ammodytes personatus*, *Pterois anennata*, *Lophius litulon*, *Enchelyopus elongates*, etc. There are some cephalopods, such as *Todarodes pacificus*, *Loligo japonica* and *Loligo beka*. In addition, some mammals are found in YS, e.g., *Phoca largha*.

The YSLME and its three bordering countries located along its coast are experiencing joint impacts of anthropogenic activities and global environmental change. The environmental threats and resource pressures of YSLME are increasing from the anthropogenic activities of the bordering coastal nations. For mitigating those transboundary challenges, the ecosystem-based governance approach is believed as the optimal way to sustain the goods and services of YSLME, which needs strong collaboration by all the three YSLME nations.

1.2 Socioeconomic conditions

Along the coast of YS, there are three provinces — Liaoning in the north, Shandong and Jiangsu provinces in the south. The total land area is 410,000 km^2, accounting for 4.2% of the total land area of China. In 2016, the total population of this region was about 218 million, accounting for 15.8% of the total population of China. The population density was much higher than the average in China. The major coastal cities of the Yellow Sea from north to south are Dandong, Dalian, Yantai, Weihai, Qingdao, Rizhao, Lianyungang, Yancheng and Nantong, etc. There are about 50 million people who live in the coastal cities and counties of the Yellow Sea, of which 25 million people are fishers.

The coastal regions of the YS have developed quickly in recent decades. In 2016, the GDP of the three coastal provinces was 16.5 trillion RMB, which was 22% of the GDP of China. By GDP, Jiangsu is the second, Shandong is the third and Liaoning is the fourteenth among all the provinces of China. In 2016, the marine GDP of the coastal regions of the Yellow Sea was 2.54 trillion RMB, which was 3.4% of China's GDP and 36% of China's marine GDP. The marine industries include marine fishery, coastal tourism, marine salt industry, marine chemical industry, marine biological pharmacy, marine shipbuilding industry, marine power industry, comprehensive utilization of seawater, marine engineering projects and marine transportation.

The coastal regions of the Yellow Sea are well developed in industry and agriculture, of which the industrial and agricultural products play an important role in China. The traffic infrastructure is well developed with many highways, airports and harbors. The more than 100 harbors play an important role in China, of which Dalian Harbor is the most important harbor in northeast China; Qingdao Harbor is the second biggest harbor in terms of load, and ranks 3rd in container transportation in China and 15th in the world.

2

Status of YS ecosystem services and progress with implementation of NSAP since 2009

2.1 Fish stocks and mariculture

2.1.1 Current status

The 13th Five-Year Plan period is crucial for China to accelerate eco-civilization construction and to complete the construction of a moderately prosperous society. Fisheries can support food security, increase the income of fishers, and regulate climate change effects. Marine fisheries are an important part during the construction of eco-civilization and moderately prosperous society. In China, the Fisheries Law was revised in 2013, since then, more fisheries conservation items have been developed. The Ministry of Agriculture and Rural Affairs launched the regular monitoring survey on fisheries in coastal waters and inland waters since 2014, as well as monitoring of the main spawning ground. These results will provide an important basis for adaptive management. Since 2017, the total allowable catches (TAC) and quota management have been introduced in China fishery management, and the closed season extended to 4–4.5 months. Control of fishing vessels was conducted in 2003, and were reduced to 30,000 fishing vessels in 2010, and will be reduced to 20,000 fishing vessels in 2020. Fuel subsidies have been greatly reduced since 2015, and will reach 40% of 2014 figures. The guidelines in stock enhancement and marine ranching were issued by the Ministry of Agriculture and Rural Affairs in recent years, which serve as guides to scientific development. In particular, the China-Korea joint stock enhancement in 2018 was a good beginning to the conservation of fishery resources in the Yellow Sea. In the future, China will continue to cooperate with the other countries to develop responsible fisheries.

To recover YSLME fishery resources, the Chinese government has invested a lot of effort since 1995, such as a "double-control" system of fishing vessel effort and closed season/areas, a licensing system, and establishment of limits of catchable sizes of fish and the proportion of juveniles in the catch (Tang, et al., 2016). In 2017, the Ministry of Agriculture and Rural Affairs of China issued "The 13th Five-Year Plan for the National Fisheries Development", proposing that the domestic marine fisheries yields should be controlled within 10 million tons by 2020; the number and power of the marine motorized fishing vessels in the whole country would be reduced by 20,000 vessels and 1.5 million kW, respectively (MOA, 2017). On this basis, it is also proposed to implement the total allowable catch management and the moratorium system, called "the strictest in history", and the fishing moratorium

in all sea areas has been extended to 4-4.5 months. Facing the situation of YSLME, it is necessary to carry out new and strict management measures.

Though the recovery of ecosystem resources is a hard job, the adaptive fisheries management can relieve the decline of fishery resources to some extent. The resource conservation-based capture fisheries and environment-friendly aquaculture should be encouraged, some of them have been proven to have both ecological benefits and socioeconomic requirements (Tang, et al., 2012, 2016).

On the other hand, China is accelerating mitigating efforts to cope with environmental stress including optimal spatial planning for mariculture to reduce environmental risks. With such objectives, application of the Integrated Multi-Trophic Aquaculture (IMTA) in suspending aquaculture regions has been proved to be an efficient measure to better utilize the available productivity of coastal and estuarine waters. The application of an IMTA approach has been developed over the past decades and especially for the commercial integrated aquaculture of shellfish and seaweeds at Sanggou Bay of Shandong Peninsula, China. With a series of different IMTA models, greater value of production has been achieved than the monoculture system. Meanwhile, IMTA practice has also achieved the goals of reduction of the ecological footprint and increase of the social acceptability of culture systems.

Land-based aquaculture developed very fast along the coast of YS. Most of the wastewater from farms was discharged into the sea directly. To help reduce the environmental effects in the past years, the recycle system was applied. But wastes such as animal feces, waste feed, and metabolic elements (N and P) released still need solutions as there are no effective methods to process such substances.

For land-based aquaculture, Recirculating Aquaculture Systems (RAS) developed very fast during the past years. Compared to traditional farming methods, RAS can save up to 90%-99% of water (reducing 160–2,600 times) and 99% of the land (reducing 50–100 times) per unit aquatic products. RAS adopts certain engineering facilities and water treatment facilities to recycle the aquaculture discharge water, and through the establishment of standardized aquaculture management technology, it manually regulates the main environmental factors and feed, etc., of the aquaculture process, and provides cultured organisms with a suitable growth environment in the way of high quality, high yield, and high efficiency. The breeding cycle can be shortened by 2-6 times in the RAS farming system. The yield per unit area is 20-80 times higher than that of traditional pond culture. The product quality is highly controllable and can be traced. Though it is an efficient production system, the waste feed and feces is still an environmental problem.

IMTA is thought to be a probable solution to ease pollution from aquaculture. In the IMTA system, different trophic organisms are integrated. Organic or inorganic substances such as feed, feces and nutrients produced by feeding units (such as fish and shrimp) become the feed of other types of cultured units (e.g., filter feeders) in the system. The food or nutrient source of the species, macro-algae, and saprophytic organisms converts the excess nutrients in the system into aquaculture organisms to achieve efficient recycling of nutrients within the system, which reduce pressure on the environment and increase mariculture productivity. The diversity and economic benefits of the cultured species will promote the sustainable development of the aquaculture industry. It was demonstrated in a part of the Yellow Sea. In the shellfish-seaweed IMTA model, 1 kg of kelp (wet weight) could produce an average 211.7 mg h^{-1} oxygen during the day and consumes 22.9 mg h^{-1} oxygen at night, this means the net production of oxygen of 1 kg of kelp is 2,266 mg day^{-1}. It could remove carbon, nitrogen and phosphorus (4.05 t, 339 kg and 50.7 kg respectively), when harvesting 1 hm^2 kelp with the production of kelp in wet weight. Similarly, it could remove carbon, nitrogen and phosphorus (2.02 t, 239.4 kg and 23.1 kg respectively), when harvesting 1 hm^2 *Gracilarialemoneiformis*. Shellfish will produce 150 kg of nitrogen at the same time. So all of the nitrogen excretion of shellfish is absorbed by the integrated seaweed. When fish farming is integrated with shellfish, the shellfish could consume 35% of the waste particles from the fish cage. The data above shows that the IMTA system improved the efficiency of resources, which reduces the environmental stress of aquaculture.

2.1.2 Efforts made since 2009

2.1.2.1 Reduction of fishing efforts

Action 1-1: Control fishing boat numbers

The fishing vessel buy-back programme is widely used in the world with the decline of fishery stocks. In 2003, "the control system of marine fishing vessels during 2003-2010" was issued by the Ministry of Agriculture, China (called Ministry of Agriculture and Rural Affairs since March 2018). It was an effective measure to relieve the decline of fishery resources, and there will be a reduction of 30,000 fishing vessels in China, while strengthening alternative job markets, training, and financial support for retiring fishers. In the 13th Year Plan of China, the fishing vessel buy-back programme will be continued, with a reduction of 20,000 fishing vessels before 2020, as well as strengthen fishery management. Based on fishing vessels in 2015, marine motor fishing vessels will be reduced to 1,500,000 kW, the reduced fishing vessels in each province per year will not be lower than 10% of total reduced fishing vessels. The large- and mid-sized marine fishing vessels will be reduced to 8,303 vessels with 1,350,829 kW, the small-sized fishing vessels will be reduced to 11,697 vessels with 149,171 kW. The fishing vessel reduction targets in the four provinces of PR China by 2020 is found in **Table 2.1**. The goal of controlling fishing vessels in provinces along the YS coast is to realize the coordinated development between fishing intensity and catchability of fishery resources.

Table 2.1. Control large and middle size fishing vessels in 2020 in provinces along the YS.*

Provinces	2015		2020	
	Fishing vessels (number)	Fishing vessels (kW)	Fishing vessels (number)	Fishing vessels (kW)
Liaoning	7,084	703,520	6,177	614,660
Shandong	10,355	1,292,888	8,976	1,129,267
Jiangsu	4,274	550,932	3,644	480,192
Zhejiang	13,799	3,270,423	12,082	2,852,613

* does not include distant water fishing vessels.

Action 1-2: Stop fishing in certain areas/seasons

Summer fishing bans are important measures to protect fishery resources. The individual size of catch and production both greatly increased because of the implementation of closed seasons in recent years. Evidence shows that the fishing bans are effective in protecting fishery resources. Since 2017, summer fishing bans were extended from 4 to 4.5 months: 4 months in the north of latitude 35°N, and 4.5 months in the south of latitude 35°N. During closed season, strengthening of fishing vessels management, and monitoring by automatic identification system (AIS)and radar, basically guarantees "fishing vessels to port, gears to bank, fishermen to shore, collection of license". The closed season relieves the decline of fishery resources by reducing fish spawning stock and recruitment stock, effectively protects fishery resources and maintains the long-term interest of fishers. This measure brings good ecological, economic and social benefits. As a result, it is strongly encouraged to strengthen supervision, and the reduction of fishing intensity to more effectively protect fishery resources.

Fisheries resources dynamics in the YS obviously occurred, especially during the extended closed season in 2017. For example, the average biomass indicator of fishery species in 2017 greatly increased compared to 2015, the CPUE of pelagic species, such as Japanese anchovy, chub mackerel, silver pomfret, half-fin anchovy, increased more than 94.3%; the CPUE of the demersal fishery species, such as small yellow croaker, Pacific cod and angler fish, increased from 46.6% to 127.4% during 2015-2017. Commercial invertebrates like swimming crab and edible mantis shrimp showed great increase in CPUE. Based on survey data, the average body length of commercial species (small yellow croaker and largehead hairtail) increased (**Figures 2.1** and **2.2**), the large-size individuals proportion increased in the catch, the other commercial species (such as silver pomfret, point head flounder, Pacific cod and swimming crab (*Portunus trituberculatus)*, etc), their recruitment stock biomass increased, and the population structure was from simplicity to complexity. In addition, the fish egg and larvae composition also changed, the egg and larvae of some species have never been found in recent surveys, such as silver pomfret, black sea bream and largehead hairtail, their larvae and juveniles were found in a 2017 survey. The abundance of the dominant species of fish larvae and juveniles also increased, and widely distributed in the survey area. The quality of

fish larvae and juveniles in 2017 were better past years, correspondingly, the biomass of recruitment stock was higher than in the past years.

The fishing production in the YS was better than in previous years, the production of Yanwei fishing grounds in the northern YS was higher than in Dandong waters, as well as the production increase from bottom trawl and set net in the southern YS, however, the production from gill net decreased.

Figure 2.1. Body length distribution of small yellow croaker in the YS.

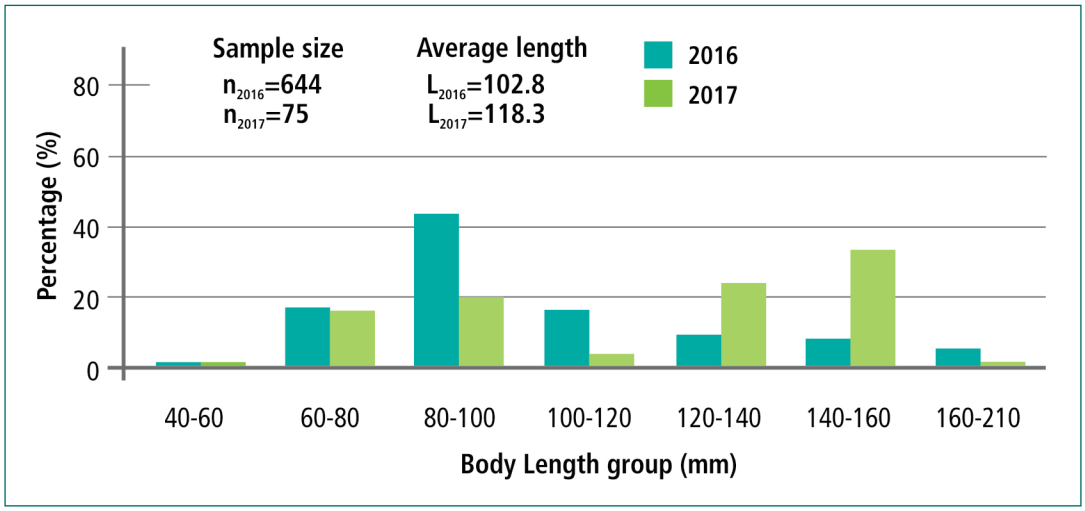
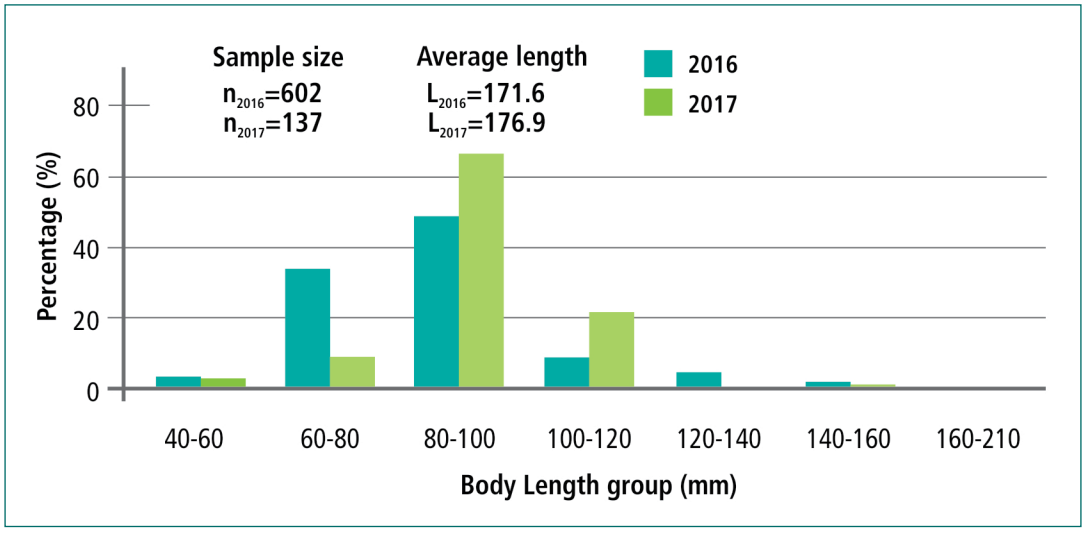


Figure 2.2. Body length distribution of largehead hairtail in the YS.



The closed season/area played an important role in the conservation of fishery stock, especially extended 4 to 4.5 months since 2017. The results based on survey data and production data showed increased fish stock biomass and production. However, the effects of the evaluation system of the closed season needs to be improved, the evaluation system

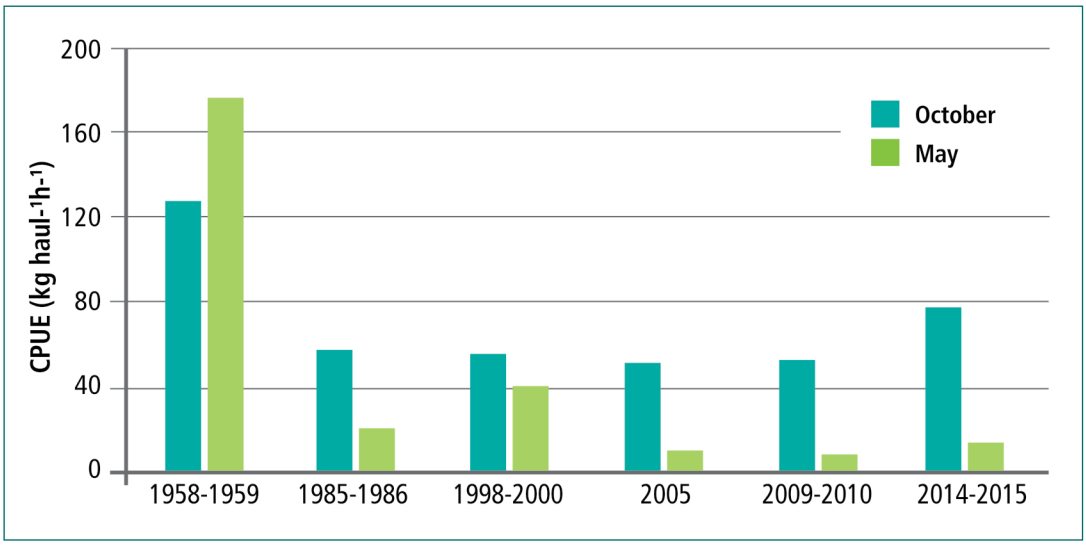
of closed season/area is not just ecological indicators, the economic and social indicators should be considered. According to the comprehensive evaluation analysis, the closed season can be regulated, and the related laws and regulations should be improved, which are the basis of fishery management during closed season.

Action 1-3: Monitor and assess stock fluctuations

1. Changes in biomass yields

The long-term CPUE changes of fishery resources in the YS were found in **Figure 2.3**. CPUE in the spring and autumn during 1958 to 1959 was higher than in other years, but since then CPUE greatly decreased due to overfishing (Tang 1989, 1993). From 1985 to 2015, CPUE changed little, and varied from 50.33 kg haul^{-1}h^{-1} to 76.64 kg haul^{-1}h^{-1} in autumn and between 8.20 kg haul^{-1}h^{-1} to 40.50 kg haul^{-1} h^{-1} in spring. Thus, the biomass of fishery resources in YSLME were relatively stable in the past 30 years.

Figure 2.3. Long-term CPUE changes of fishery resources in the YS.



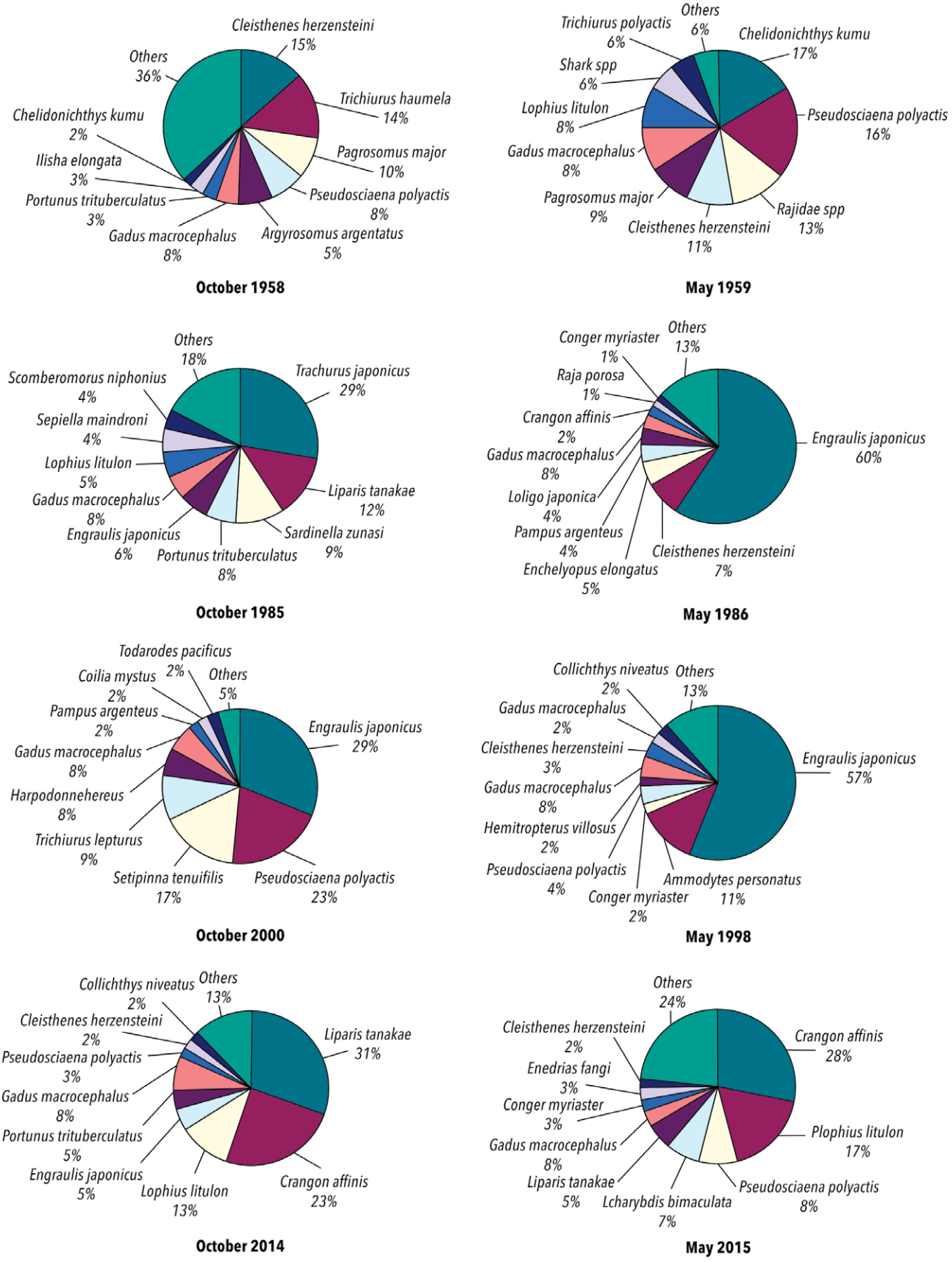
Source: Tang 1989, 1993.

The CPUE data was collected by Yellow Sea Fisheries Research Institute, Chinese Academy of Fishery Science, based on scientific surveys. The data in the 1950s were collected by fishing vessels, and in other years, the data was based on research vessels.

2. Changes in species composition and trophic level

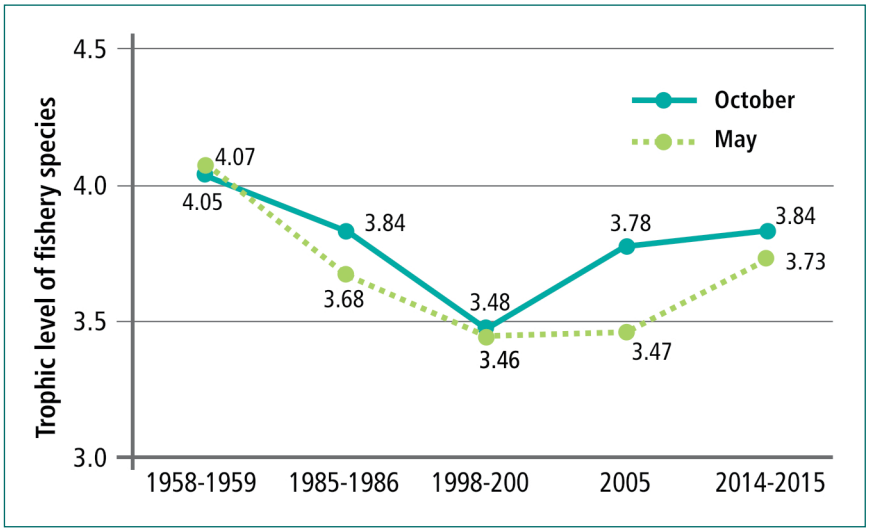
Over the past half century, the dominant fishery species in YSLME had changed significantly, but its trophic level was relatively stable, excluding the higher trophic level in 1958 and 1959 (**Figures 2.4** and **2.5**). There were no significant changes in trophic level from 1985 to 2015, which implied that the trophic level of fishery resources in the Yellow Sea was relatively stable in the past 30 years, which might be attributed to the feeding characteristics of fishery species.

Figure 2.4. Long-term changes of fishery species composition in the YS.



Source: Qiang Wu, Yiping Ying, Qisheng Tang, 2018. Changing states of the food resources in the Yellow Sea large marine ecosystem under multiple stressors. Deep-Sea Research Part II, https://doi.org/10.1016/j.dsr2.2018.08.004

Figure 2.5. Long-term changes of trophic levels of fishery species in the YS.



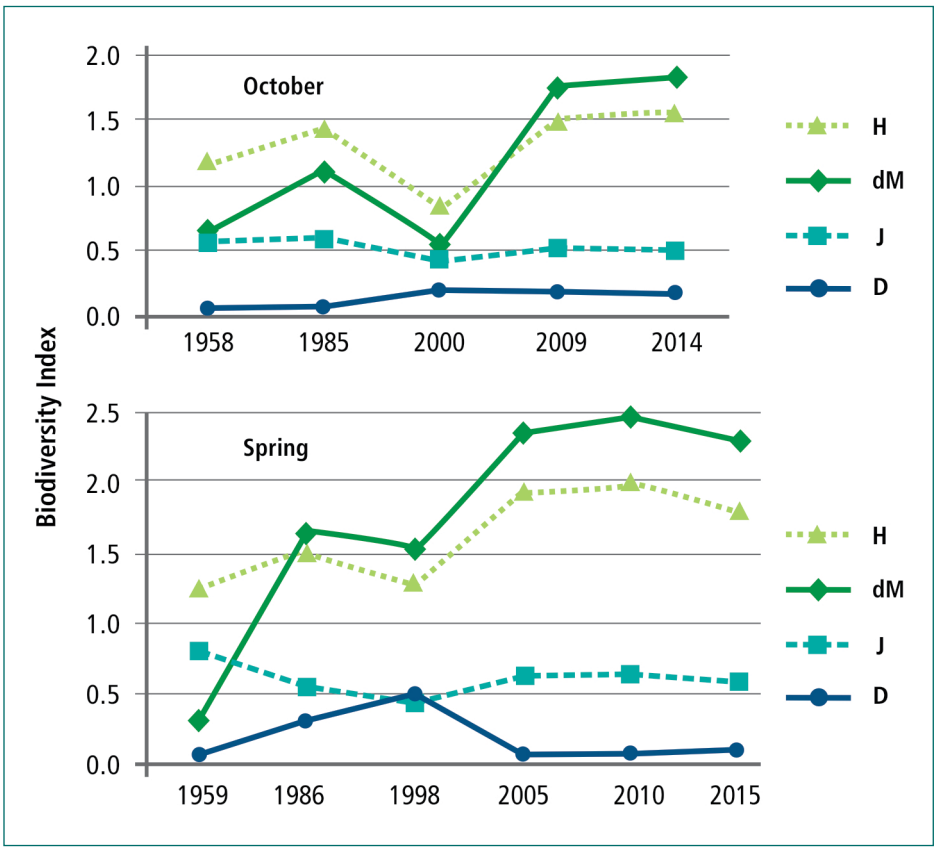
Source: The trophic levels cited from Zhang & Tang 2004. (Tang 1989, 1993).

In 1958-1959, the dominant species were demersal, benthophagic, ichthyophagic, highly commercial valued species, including pointhead flounder (*Cleisthenes herzensteini*), Bluefin searobin (*Chelidonichthys kumu*), small yellow croaker, largehead hairtail, red seabream (*Pagrosomus major*), and the trophic level (TL) was 4.05-4.07; In 1985-1986, the dominant species were pelagic, demersal, planktophagic, ichthyophagic, lower value species, including anchovy (*Engraulisjaponicus*), horse chub mackerel, snailfish (*Liparis tanakae*), scaled sardine (*Sardin llazunasi*), and TL was 3.68-3.84; In 1998-2000, the dominant species were pelagic, demersal, planktophagic, ichthyophagic, lower commercial value species, including anchovy, small yellow croaker, hairfin anchovy, sand lance (*Ammodytes personatus*), and TL was 3.46-3.48; In 2014-2015, the dominant species were demersal, benthophagic, ichthyophagic, low valued species, including crangonid shrimp (*Crangon affinis*), snailfish, yellow goosefish, small yellow croaker, and TL was 3.73–3.84. Clearly, there were two different types of species shift in YSLME under multiple stresses. One is from demersal, high valued species to pelagic, low valued species during 1958-1959 to 1998-2000, and the other is from pelagic, low valued species to demersal, low valued species during 1998-2000 to 2014-2015.

3. Changes in biodiversity

In 1958-1959, the biodiversity of fishery resources in the YS was relatively low, which might be related to the difference of the survey vessels and nets between 1958-1959 and other years. Biodiversity fluctuated from 1985 to 2015, but was relatively stable in the past 30 years. The variations of Shannon Weiner index (H) and species richness index (dM) showed positive trends, and the evenness index (J) and Simpson dominance index (D) showed the opposite changing trend (**Figure 2.6**).

Figure 2.6. Long-term changes of biodiversity index of fishery species in the YS.



(H: Shannon-Weiner Index, dM: Species richness Index, J: Pielou's evenness Index, D: Simpson dominance Index.
Source: Tang 1989, 1993.

Although there was no significant decline in biomass, trophic level and biodiversity of fishery resources in the YS since the 1980s, the dominant species changed from demersal, higher value species to pelagic, lower value species during 1958-1959 to 1998-2000, and then from pelagic, lower value species to demersal, lower value species during 1998-2000 to 2014-2015. These changes were the response of ecosystem resources in YSLME to multiple stressors. There may be two mechanisms in ecosystem shift: systematic replacement occurs when one dominant species declines in abundance or is depleted by overexploitation, and another competitive species uses the surplus food and vacant space to increase its abundance; ecological replacement occurs when minor changes in the natural environment affect stock abundance, especially for pelagic species. In the long-term, the effects of the two types of ecosystem shift and its resources may be intermingled (Tang, 1993, 2014). These changes further confirmed that the recovery of ecosystem resources would be a slow and complex process under multiple stresses, so the development of conservation-based capture fisheries will be a long-term and arduous task.

In summary, according to the analysis in the previous context, the assessment of target 1 is listed below (**Table 2.2**).

Table 2.2. Assessment of progress on Target 1.

Target 1	Indicator	Progress
25%-30% reduction in fishing effort	Control fishing boat numbers	• The 30,000 total fishing vessels was reduced during 2003-2010; • The remaining 20,000 fishing vessels will be further reduced during the 13th five-year plan; • The fuel subsidies have been greatly reduced since 2015 and will be just 40% of 2014 numbers in 2019, which indirectly reduce fishing vessels; • Strengthening alternative job markets, training, and financial support for retiring fishers;
	Stop fishing in certain areas/ seasons	• The summer fishing ban was extended to 4-4.5 months since 2017; • 4 months to the north of latitude 35°N, and 4.5 months to the south of latitude 35°N; • Strengthening of fishing vessels management, and monitoring by AIS and radar;
	Monitor and assess stock fluctuations	• Kickoff the annual survey of fishery resources in China coastal waters during 2014-2019, as well as the survey of spawning ground distribution; • Make the plan on annual survey of fish stock

2.1.2.2 Rebuilding of overexploited marine living resources

Target 2 is about "Rebuilding of overexploited marine living resource". Increase mesh size, enhance stocks, and improve fisheries management were covered in this target. The related data is updated to the present.

Action 2-1: Increase mesh size

To conserve fishery resources and improve the sustainable fisheries in China, the China government improved the "China Fisheries Law", and issued "The Action Outline of Aquatic Living Resources Conservation in China" in 2006. In 2018, The Ministry of Agriculture of China (now called the Ministry of Agriculture and Rural Affairs) announced the limit of catchable size of 15 commercial fishery species and the limit of their juveniles and young fish proportion in the total catch (**Table 2.3**). If the body length of these 15-fishery species would not reach the catchable size, they belong to juveniles and young fish. The proportion of these species in the catch should not be beyond 50%, 30% and 20% in 2018, 2019 and 2020, respectively. After 2020, the proportion of young fish in the catch should not be beyond 20% (according to the standard of 2020). If this rule is violated, penalty will be according to No. 38 items of Fisheries Law. The announcement pointed out that

there should be stricter fishery management rules according to the base rules from the Ministry of Agriculture, and the relative assorted rules should be conducted during the transportation, process and utilization of young fish in each province.

Table 2.3. The catchable mesh size (mm) of 15 commercial fishery species in China coastal waters.

Species	Bohai Sea, Yellow Sea, East China Sea	South China Sea
Largehead hairtail	Anal length≥210	Anal length≥230
Small yellow croaker	Body length≥150	/
Silver pomfret	Fork length≥150	Fork length≥150
Chub mackerel	Fork length≥220	Fork length≥220
Japanese butterfish	Fork length≥130	Fork length≥130
Spanish mackerel	Fork length≥380	/
Decapterus maruadsi	Fork length≥150	Fork length≥150
Silver butter-fish	Fork length≥180	Fork length≥180
White croaker	Body length≥150	Body length≥150
Parargryrops edita	Body length≥100	Body length≥100
Thamnaconus septentrionalis	Body length≥160	Body length≥160
Thamnaconus hypargyreus	Body length≥100	Body length≥100
Priacanthus macracanthus	Body length≥160	Body length≥160
Taius tumifrons	Body length≥130	Body length≥130
Trachurus japonicus	Fork length≥150	Fork length≥150
The method of measurement is according to the standard of 14.3.4.1.1 in GB/T12763.602007		

Source: Ministry of Agriculture and Rural Affairs, China, 2018.

Action 2-2: Enhance stocks

Stock enhancement has been paid more and more attention since "The Action Outline of Aquatic Living Resources Conservation in China" issued in 2006. More than 100 species (including freshwater species, endangered species, etc.) have been released every year in China, the investment from government and private organizations gradually increased, as well as the releasing scale. For example, the stock enhancement in Shandong province, including 19 marine species and 6 freshwater species, has a releasing time of April to end of November. Conservation measures, such as artificial reef and marine ranching, have been developed, with a total of 62 national level marine ranching built by 2017, and will reach 120 national level marine ranching in 2025. The studies on effects of stock enhancement have greatly been considered, including the ecological and genetic risks. Many national projects on fishery resources conservation have been conducted, a series

of innovative results were used to guide the conservation of fishery resources. In addition, the China-Korea joint stock enhancement was first conducted in the YS on July 24, 2018. In the coming years, more cooperation on conservation and management of fishery resources in the YS will be launched between China and Korea.

Action 2-3: Improve fisheries management

1. The main fishery management measures in China

The main fishery management can be found in **Table 2.4**, the input control and output control are the main part of China's fishery management system, such as closed season (4–4.5 months since 2017), fishing license, catchable size, zero growth policy, fishing vessel buy-back program, reducing fuel subsides, and TAC and quota management (started in 2017).

Table 2.4. The main fishery management measures in China.

Management measures	Year of issue
Closed season/areas 2 or 3 months closed fishing were issued from 1995 in Bohai Sea, YS and East China Sea; and from 1998 in South China Sea; 4-4.5 months since 2017	Since 1950s in limited areas; Trawling was banned from 1988 in whole Bohai Sea; Summer ban fishing,1995
Fishery genetic resource protection area	2007
The "zero-growth" policy	1999
The fishing license	1979
Limits of catchable size and the proportion of juveniles in the catch	2000
Environmental fee for stock protection and enhancement activities	2000
Control fishing capacity	1987
The fishing vessel buy-back program	At the beginning of 2003, 30000 fishing boats (~2010), 20000 fishing boats (~2020)
Reduce fuel subsidies	2015, reduce by 60% of 2014 during 2015-2019

2. TAC management

Combined with fishing vessel buy-back program, total allowable catch (TAC) management was conducted since 2017 (**Table 2.5**), and the total catch in China coastal waters will be no more than 10 million tons in 2020, the proportion of reducing catch in each province is not lower than 23.6% of that in 2015. After 2020, the goal of controlling total catch will be determined by the stock assessment and fisheries status in China, try to reach the goal of coordinated development, fishing production and catchability. At the same time, strengthening the renovation and improvement of fishery management, including the limit of fishing gears, mesh size, increasing the fine of IUU.

Table 2.5. Control fishing production in 2020 in provinces along YS waters* (tons).

Provinces	2015	2020
Liaoning	1,107,857	846,514
Shandong	2,282,340	1,743.937
Jiangsu	554,314	423,552
Zhejiang	3,36,6966	2,572,700

3. Quota management

In 2017, quota management was conducted in China, and swimming crab in Zhejiang Province and jellyfish in Shandong Province were the cases. The swimming crab showed exciting results, the biomass and the catch increased in 2017, as well as the individual size. The income of fishers for fishing crab in Zhejiang increased, the case of swimming crab showed better ecological, economic and social benefits. So, in 2018, five species will be involved in quota management (including freshwater species). However, jellyfish quota management in Shandong was not very successful. Jellyfish biomass is closely related to environment, especially temperature, so the quota and the catchable time of jellyfish should be determined by local condition.

In summary, according to the analysis in the previous context, the assessment of target 2 was listed below (**Table 2.6**).

Table 2.6. The assessment of Target 2.

Target 2	Indicator	Progress
Rebuilding of over-exploited marine living resource	Increase mesh size	• Conduct the catchable size of 15 fishery species in China coastal waters since August 2018; • Limit the juveniles and young fish proportion of 15 fishery species in the catch during 2018-2020;
	Enhance stocks	• Releasing aquatic species that is more than 100 species; • The releasing scale greatly increased, as well as the investment from government and personal; • The more focus on stock enhancement is the releasing effects evaluation, including the ecological and genetic risk; • The first joint-stock enhancement China-Korea will be conducted in Korea in July 2018;
	Improve fisheries management	• Reduce fuel subsides since 2015; • Reduce total catch since 2017; • Conduct quota management of swimming crab and jellyfish since 2017, and expanded to 5 provinces (Liaoning, Shandong, Zhejiang, Fujian and Guangdong provinces) in 2018; • Extend the summer fishing ban since 2017; • Strengthen fishery law enforcement during summer fishing ban, combined with China Coast Guard

2.1.2.3 Improvement of mariculture techniques to reduce environmental stress

Target 3 is about the "Improvement of mariculture techniques to reduce environmental stress". The indicators are developing environment-friendly and higher efficiently IMTA models and technology for the purpose of rising good provisions of mariculture ecosystem and reducing nutrient discharge to natural environment.

- **Action 3-1:** Develop environment-friendly mariculture methods and technology
- **Action 3-2:** Reduce nutrient discharge
- **Action 3-3:** Control diseases effectively

Graf & Rosenberg measured the horizontal transport characteristics of biological sediments, and the organic matter provided to benthic organisms was doubled due to the sedimentation of biological sediments produced by shellfish aquaculture activities. A model study showed that mussel farming reduced nitrogen in Gullmar Bay in Sweden by 20%. Therefore, increasing biomass of mussels in the bay is a very economical and effective way to reduce nutrient load in the bay compared to sewage treatment. Mussels increase the absorption of ammonia nitrogen and total inorganic nitrogen in seaweed by 3 and 4.5 times, respectively. The growth of adherent brown algae on dead mussels' ropes is poor, which means that the metabolites of farmed mussels and other attached organisms can promote the growth of macroalgae. The attached large algae can absorb the nutrients produced by the metabolism of shellfish and thus limit the feedback of nutrients to the phytoplankton in the water body to control phytoplankton bloom.

The developed IMTA models mainly include: shellfish-seaweeds, abalone-kelp-sea cucumber model, fish-shellfish-kelp model, abalone-sea cucumber-clam-seagrass integrated model, etc. Most of them have been successfully demonstrated in Sanggou Bay, China. In the abalone-kelp-sea cucumber IMTA model, 18% N was transferred into abalone and 0.5% N was used by sea cucumber (**Figure 2.7**). The same time, there are 2.83 kg dissolved inorganic carbon absorbed in the system when 100 kg seaweed is produced. In the fish-shellfish-kelp IMTA model, the released nitrogen from 1 hm^2 shellfish could support 1,500 kg dry kelp production. The oxygen produced by seaweed could support the fish growth of double weight of seaweed. The value of the IMTA model in adjusting to climate change is much higher than that of monoculture (**Table 2.7**).

Figure 2.7. The nitrogen budget in the abalone-kelp-sea cucumber model.

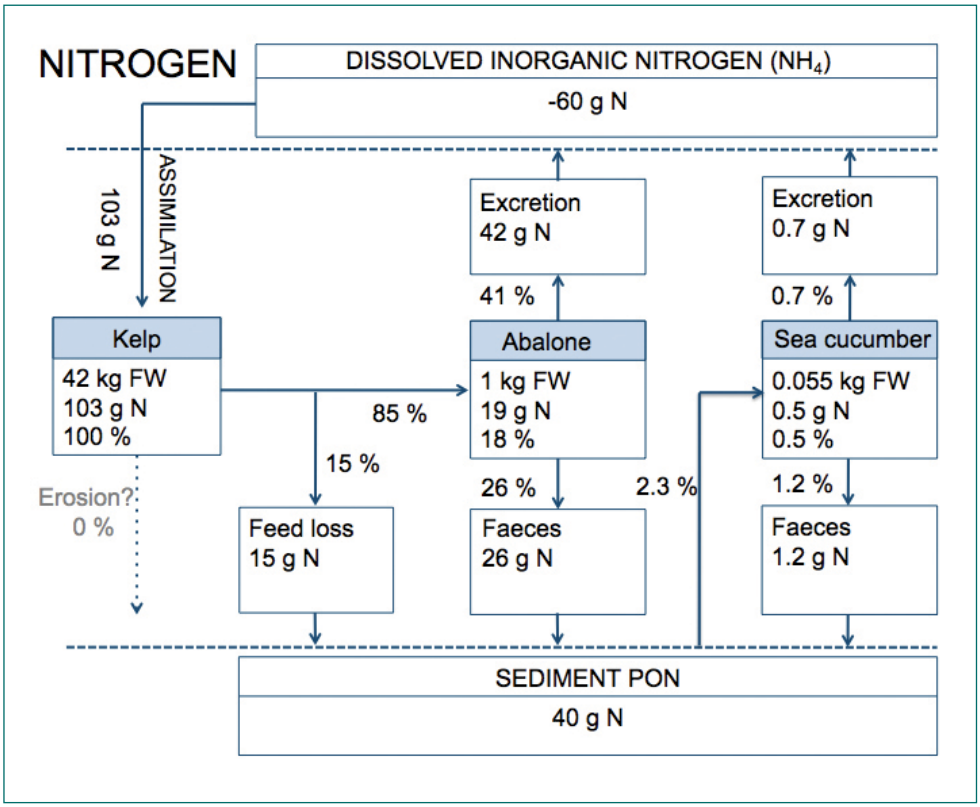


Table 2.7. Evaluation of effects of different aquaculture models on regulating climate change.

model	Carbon Sink (kg/ha/a)	Released CO_2 (kg/ha/a)	Value (Y/ha/a)				
			Benefit		Lost		Total value
			Reforested cost	Carbon tax	Reforested cost	Carbon tax	Average value
Kelp	8,424.00	0	2,197.82	9,232.70	0	0	5,715.26
Scallop	1,741.17	22.3460	454.27	1,908.32	5.83	24.49	1,166.14
Kelp + Abalone IMTA	23,638.85	32.0394	6,167.38	25,908.18	12.37	51.95	16,005.62
Kelp + Abalone +Sea cucumber IMTA	24,054.75	31.02	6,275.88	26,364.01	8.0934	34.00	16,298.54

IMTA in land-based aquaculture is more popular today. Different species benefit each other in the same aquaculture system. But most of the land-based aquaculture species are fish and shrimp. They all need feed input. In fish and shrimp farming, the utilization rate of nitrogen in cultured organisms is usually 20%-30%, rarely exceeding 40%. Fish and shrimp integrated with shellfish or seaweed is a good choice to reduce adverse effects to the environment. The study on land-based aquaculture pond shows that the treatment of aquaculture wastewater by biological purification can achieve better results, such as the use of phytoplankton or large seaweed to absorb nutrients in wastewater, and the use of filter-feeding shellfish such as mussels and oysters. It can reduce the content of particulate organic matter in culture wastewater. The shellfish + algae system can be used to treat the wastewater discharged from aquaculture pond. The integrated aquaculture of shellfish and algae can usually reduce more than 20% of the nitrogen in wastewater. The combination of water treatment technologies such as nitrification and algae bioremediation to treat intensive fish pond wastewater has begun to gain importance in recent years. However, there are a lot of unknowns.

In summary, according to the analysis in the previous context, the assessment of target 3 was listed below (**Table 2.8**).

Table 2.8. The assessment of Target 3.

Target 3	Indicator	Progress
Improvement of mariculture techniques to reduce environmental stress	Reduced environmental stress as a result of the widespread adoption of environment-friendly and sustainable mariculture techniques	Inshore IMTA is demonstrated in YS region but land-based IMTA is just at primary stage.

The research and application of high and new technology are the key to ensure the efficient, high-quality and healthy development of marine aquaculture industry. The theoretical basis, technical foundation and practical foundation are the cornerstones of industrial development. In the development of the integrated multi-trophic aquaculture (IMTA) model, more research should be carried out in actual production. In particular, the IMTA model must be expanded, the aquaculture method innovated, and the layout based on the aquaculture capacity rationalized in order to maintain a broad development prospects. The combination of different trophic levels of marine aquaculture species to achieve high efficiency aquaculture at different levels of nutrition can effectively reduce the harm from marine aquaculture to ecosystems, and can also be carried out at different scale levels. It is meaningful to change the monoculture model in the farming process into an IMTA, and increase the biological production of aquatic organisms per unit, which will create a new situation for the development of the aquaculture industry with harmonious environment and sustainable use of resources.

Constructing a land-based recirculating ecological aquaculture model based on ponds and IMTA techniques, an IMTA-ecosystem model and management techniques should be established. An ecological framework for multi-nutrition and high-efficiency aquaculture systems need to be made. Product output and ecological benefits would be improved by improving water use efficiency. There is a need to study the primary productivity assessment and maintenance techniques for ponds in different culture models, and study the impact of pond environment on the nutritional needs of cultured animals and supplement feed preparation techniques for ponds and nutritional balance techniques at low nutrient levels.

2.2 Nutrients, marine litter and contaminants

Target 4 is about "meeting international requirement on contaminants". In the TDA file of YSLME-Phase I, the Regional Working Group–Pollution (RWG-P) identified inorganic nitrogen and phosphate, faecal substances, heavy metals, persistent organic pollutants (POPs), polycyclic aromatic hydrocarbons (PAHs) and marine litter as the major contaminants in the Yellow Sea.[1] The related actions include: (1) conduct intensive monitoring and assessment; (2) control contaminants discharge; and (3) Implement MARPOL 1973/78.

2.2.1 Current status

2.2.1.1 Status of marine litter monitoring in China

Since 2007, National Marine Debris (Litter) Monitoring Program was carried out by the State Oceanic Administration (SOA), according to "Technical guideline for monitoring and assessment of marine litter".[2] This guideline stipulated the field sampling, classification, analysis, processing, record, and QA/QC procedure of marine litter monitoring.

Monitoring content included litter in the surface water, on the beach and seafloor. Totally, 50 coastal areas were monitored, among which are 11 stations located along the coastal line of the Yellow Sea.

[1] UNDP/GEF, 2007. Transboundary Diagnostic Analysis for the Yellow Sea LME. UNDP/GEF project: Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem, Ansan, Republic of Korea. p. 98

[2] SOA Technical Guideline for Monitoring and Assessment of Marine Litter. 2015

2.2.2 Efforts made since 2009

2.2.2.1 Monitoring and Assessment

Action 4-1: Conduct intensive monitoring and assessment

(1) Monitoring network

According to the "Marine Environment Protection Law of the People's Republic of China", the SOA implements the national marine environment survey, monitoring and surveillance annually. SOA established a comprehensive network, which includes regional centers, branch stations and local agents, to conduct marine environmental monitoring, using the same technical guideline and QA/QC methodology. The annually monitoring data reached up to 2 million items.

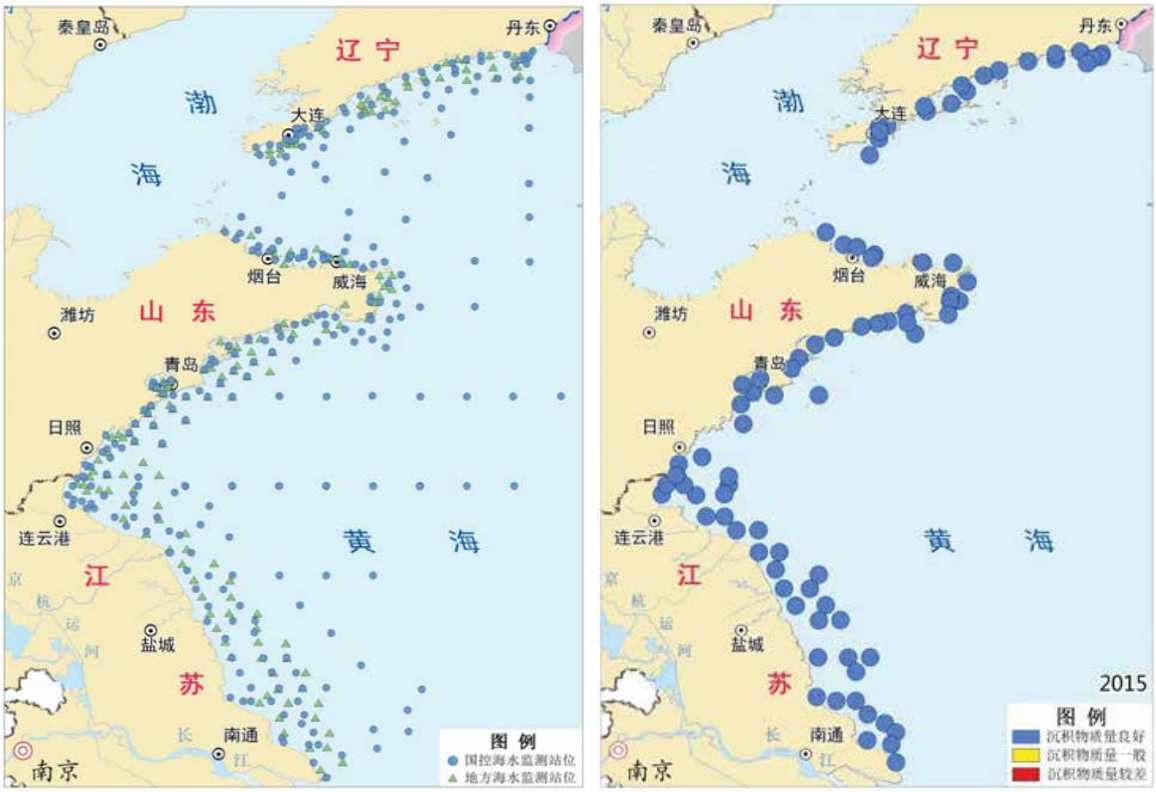
Ministry of Environment Protection (MEP) has established an "Environmental quality monitoring network" to monitor the quality of coastal waters. This network focused on the environmental quality of seawater near the shoreline and mariculture zones in the coastal zone of China.

In addition, coastal provinces and cities also have their own monitoring system. In the Yellow Sea area, Department of Ocean and Fisheries of Liaoning Province, Department of Ocean and Fisheries of Shandong Provinces, Jiangsu Ocean and Fisheries Bureau also organize marine environmental monitoring activities and evaluate the marine environment status of the local area under jurisdiction.

- **Monitoring Sites**

The contents of marine environment quality monitoring include: seawater, sediment, biological system, rivers entering the sea, sewage outlet to the sea, mariculture zone, ecological fragile zone, and bathing beach. Based on the monitoring results, a comprehensive analysis and evaluation of the marine environment quality status was carried out. **Figure 2.8** shows the monitoring sites conducted by SOA in the Yellow Sea Region.

Figure 2.8. Monitoring Sites in the Yellow Sea (SOA).



(Left: seawater; Right: sediment)

- **Monitoring Parameters**

To monitor and assess the quality of seawater and sediment, called "Status and trend monitoring", various monitoring parameters were conducted (**Table 2.9**).

Table 2.9. Monitoring Parameters in "Status and Trend Monitoring.

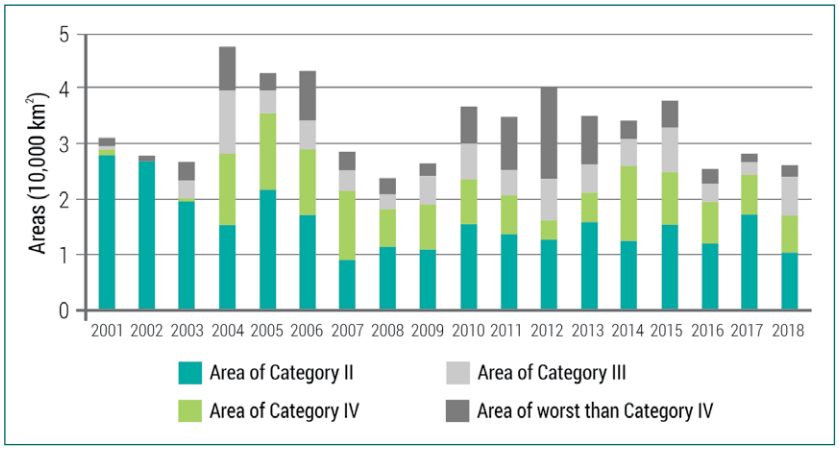
Matrix	Parameter		Month
Seawater	Hydrological and meteorological Parameters	Wind direction, speed, Water Temperature, depth, Transparency	February, May, August, October
	Chemical Parameters	Sal, pH, DO, COD, PO_4-P, NO_2-N, NO_3-N, NH_4-N, Oil, chl-a, SS, TN, TP, SiO_2-Si	February, May, August, October
		TM (Cu, Zn, Cr, Hg, Cd, Pb, As)	August
Sediment	General Parameters	Sulfate, Organic Carbon, Grain Size	1/2years
	Chemical Parameters	TM (Hg, Cd, Pb, As, Cu, Zn, Cr), Oil, DDTs, and PCBs	1/2years

(2) Environmental quality status

Sea water

From 2001 to 2018, the annual area of water pollution in the Yellow Sea had been fluctuating. In 2018, the average area of seawater that had not reached the first grade of seawater quality standard was about 26,090 km^2 (**Figure 2.9**). In recent years, the first grade of seawater quality standard sea declined; in 2016, it has not reached the first grade of seawater quality standard sea area of the "12th five-year" period (2011-2015), reduced by 1.5 km^2, the highest polluted sea area dropped 37%.

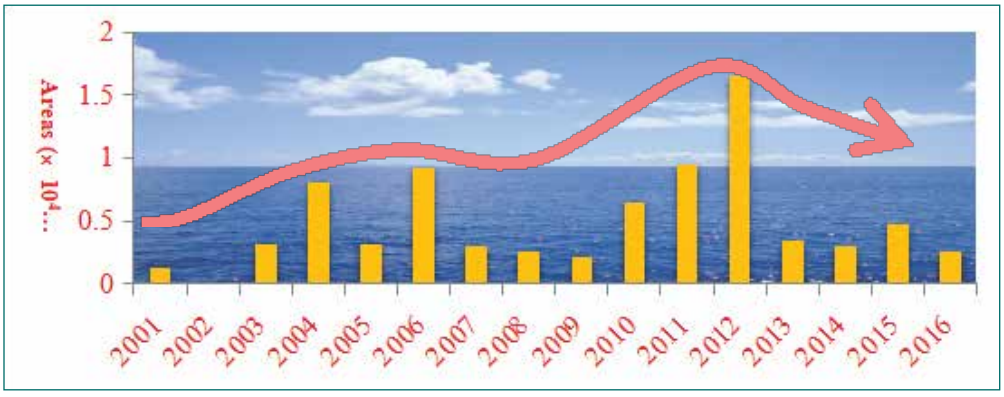
Figure 2.9. Annual change of seawater quality in the Yellow Sea (2001-2018).



(From above to bottom, sea area of above the 2nd, 3rd, 4th, under the 4th grade, ×10^4 km^2)

Since 2001, the area of the Yellow Sea under the fourth grade of quality standard of seawater (highest polluted area) is less than 14% of the total water area that meet the first grade of seawater quality standard (the clean area). Before 2012, the sea area of fourth grade of water quality was generally fluctuating, which increased from 1,260 km^2 in 2001 to 16,530 km^2 in 2012, which increased 12 times. Due to the implementation of pollution control measures in recent years, in 2016, the highest polluted sea area reduced 14,000 km^2 compared that in 2012, the highest serious marine pollution by 84%. Areas above seawater quality grade I increases 37% compared to the values during 2011-2016 (the 12th five-year plan).

Figure 2.10. Areas of worse than grade IV seawater quality in summer (2001-2016).

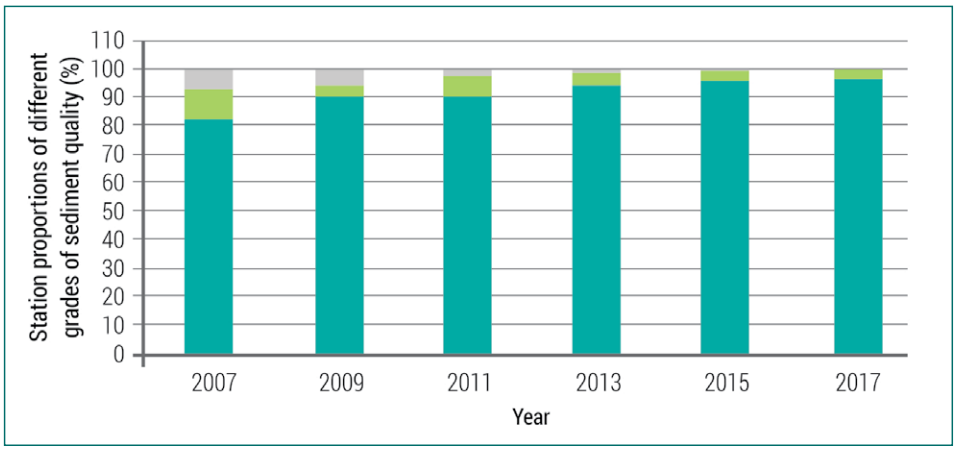


The main pollutants of the seawater in the Yellow Sea were inorganic nitrogen, active phosphate and oil.

Marine sediment

From 2006 to 2015, about 91.7% of marine sediment sites in the Yellow Sea coastal region meet comprehensive quality grade I (good quality). **Figure 2.11** shows the marine sediment quality distribution. The marine sediment quality condition of the Yellow Sea coastal region is quite good, and annual variations were insignificant.

Figure 2.11. Annual variations of integrated quality of sediments of the Yellow Sea (2006-2015).



Blue = Good, Light blue = Neutral, Grey = Bad.

(3) Standards for environment monitoring and assessment

China has established a relatively comprehensive marine environment monitoring and evaluation standard system. The standard is mainly composed of: Standard of seawater quality; Standard of marine sediment quality; Standard of marine biological quality; Specification of marine survey; Specification for Marine monitoring; Regulations of marine monitoring technology; Technical guidelines of marine environmental quality assessment; etc.

The current marine environment quality standards were published more than ten years ago. Since implementation, there are some technical problems: (1) most of the value of standards referred to international standards, not fully considering the floristic characteristics of the marine biological and sensitivity problem in the coastal zone of China, some standard limits for marine ecosystems maybe "under-protected" or "over-protected"; (2) with industrial development, more new pollutants are discharged into the sea, meanwhile, the analytical instruments are more sensitive than before, there are a large number of "new" types of pollutants, or emerging pollutants were detected, but these pollutants are not included in the current standard. To meet the demand to manage the marine ecological environment protection in China, these environmental quality standards should be revised and improved on the basis of environmental quality benchmarks.

(4) Information Dissemination

There are several kinds of routes to get the environmental status information of the marine environment. SOA issued the "China Marine Ecological Status Bulletin" each year ("China Marine Environmental Status Bulletin", before 2016). The Ministry of Environmental Protection (MEP) published the "Environmental Quality Bulletin of Coastal Waters of China" from 2001. All coastal provinces and most of coastal cities published similar bulletins on the marine environment. Most of these bulletins are available on the Internet. Although most original data were ignored in these bulletins, the status and trends of the marine environment could be in a different scale, from city level to provincial and national level.

All these bulletins can easily be found on the internet. For government departments, or scientific research institutions, the original data and the evaluation results, to manage policy formulation and scientific research, can be obtained from the technical support unit or the corresponding information center. The public can access the evaluation results openly and easily. If raw data is needed, these can be obtained through the application and approval process.

2.2.2.2 Complying with international conventions

Action 4-2: Control contaminants discharge with reference to Codex alimentarius and Stockholm Convention

1. Control contaminants discharge –– stricter standards.

To improve environmental barriers upon entry, promote industrial structure and layout optimization, enhance the level of water pollution prevention and control technology, 64 environmental protection standards related to water pollutant discharge are issued. The control project reaches 158 items, which is equivalent to the control level of major developed countries and regions.

Combined with pollutant emission reduction work, especially COD and ammonia nitrogen, pollutant emission standards of 25 kinds of industries (such as textile, synthetic ammonia, phosphate, citric acid, iron and steel, and chemical industry) are releasing and revising. Key industries contribute more than 80% COD and ammonia nitrogen, up to 90% heavy metals such as mercury, cadmium, lead, arsenic and chromium emissions have industry wastewater emission standards.[3]

[3] 13th five-year plan for environmental protection standard

2. Codex alimentarius and Stockholm Convention

Codex Alimentarius

Codex Alimentarius Commission (CAC) was established in 1963 by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO), specifically responsible for the coordination between the government's food standards, establish a complete set of food international standards system. The CAC currently has 180 members, covering 98 percent of the world's population. To protect consumer health, most countries have maximum legal limits for pesticide residues in foods. The Codex Committee on Pesticide Residues (CCPR) is responsible for establishing Codex Maximum Residue Limits (MRLs) for pesticide residues in specific food items or in groups of food or feed that move in international trade. Since 1966, the committee has established over 5,000 MRLs for pesticide residues covering 303 pesticides.

China formally joined the CAC in 1984 and established the CCAC (Chinese Codex Alimentarius Commission) in 1986, which is composed of several departments related to food safety. The committee secretariat is located in the National Food Safety Risk Assessment Center (NFSRAC). The 50th session of the Codex Committee on Pesticide Residues was held in Haikou, China on 9-10 April 2018.

In 2015, the Ministry of Agriculture (MOA) formulated the "Action Plan for the zero-growth of pesticide use by 2020".[4] In the Yellow Sea area, the key step is to implement green control combined with chemical control, specialized control combined with general control, ground

Figure 2.12. 50th session of the CCPR (9-10 April 2018, Haikou, China).

[4] Ministry of Agriculture (MOA). 2015. "Action Plan for the zero-growth of pesticide use by 2020".

pesticide control machinery combined with aircraft navigation operation, focused on promoting biological control technology on locusts, returning straw crushing technology.

Stockholm Convention

China signed the Stockholm Convention on POPs on 23 May 2001. In April 2007, the State Council of China approved the "National Implementation Plan" (NIP) of China. For the performance of the convention, to promote the realization of the performance goal, surrounding DDT, chlordane and mirex remobilized elimination and substitution, China has formulated several management policies and technical standards, eliminated a large number of POPs production, developed alternative technologies, and carried out various forms of propaganda and training courses. On April 16, 2009, China announced that from May 17, 2009, the production, circulation, use and import and export of DDT and chlordane and mirex and hexachlorobenzene are fully prohibited (except for vector control of DDT emergency use).

3. Investigation

In 2007, MEP launched the first survey of POPs in China. The survey was conducted on 17 types of enterprises emitting dioxin-like POPs in the country. In 2009, an updated survey was carried out. In addition to the abovementioned enterprises, a survey of pesticides in circulation was carried out for the first time. In 2010, waste incineration, iron ore sintering, steelmaking production and non-ferrous metals industry were updated. Since 2011, a statistical reporting system for POPs has been established. Each year, the use of dioxin emission sources in 10 major industries and the use of PCBs power equipment, the number of PCBs wastes, storage conditions and distribution were investigated.

4. BEP/BET Practice

MEP, cooperated with the U.S. EPA, carried out POPs and other toxic substances reduction projects in the cement industry, antifouling ship DDT substitute project, pesticides remobilized safe disposal of waste and soil restoration demonstration project in China. In the Yellow Sea area, Weihai City of Shandong province is listed as one of the DDT replacement projects in the National Yellow Sea & Bohai sea area. Two demonstration projects were conducted for safe disposal and restoration of contaminated soil contaminated by DDT in Shandong province.

5. Reduction target

By 2015, the reduction targets of POPs should be:

a. The growth trend of dioxin emission in key industries will be basically controlled, key industry dioxin unit output intensity reduction rate of 10%;
b. PCB power equipment should be identified and under-supervised –– 100%;
c. Safe disposal of identified pesticide wastes –– 100%;
d. Innocuous management of high-risk sites contaminate by pesticides –– 85%;
e. Strengthen the supervision capacity building of POPs;
f. To establish a long-term mechanism for the prevention and control of POPs;
g. To promote the investigation and management of new POPs;
h. To effectively prevent, control and reduce the risk of POPs, ensure environmental safety and people's health.

6. POPs in Yellow sea

In China, POPs are mainly discharged into the sea by means of land-based sources, such as sewage, river, garbage and non-point source, as well as atmospheric settlement. Because POPs have strong stability, low water solubility, and hydrophobic lipophilic characteristics, they may exist in the marine environment from a very long time period.[5] In the Yellow Sea region, POPs, especially relative "new" POPs, such as PBDEs, HBCD and PFASs, some areas were heavily polluted due to local production and application.[6]

Action 4-3: Implementing MARPOL 1973/78 effectively

Ship emissions (such as domestic sewage, oily sewage, air pollutants, etc.) will affect the environmental quality in the coastal area. The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78) is one of the most important international marine environmental conventions. It was developed by the International Maritime Organization (IMO) in an effort to minimize pollution of the oceans and seas, including dumping, oil and air pollution. The objective of this convention is to preserve the marine environment in an attempt to completely eliminate pollution by oil and other harmful substances and to minimize accidental spillage of such substances.

[5] Fang. 2007. Research of persistent organic pollutants and heavy metals in the sediment and biological sample of Zhejiang coastal zone. Doctoral Dissertation, 2007, Zhejiang University.

[6] Meng, S.J. Hong, and T.Y. Wang, et al. 2017. Traditional and new POPs in environments along the Bohai and Yellow seas: An overview of China and South Korea. Chemosphere: (169) 503-515.

Table 2.10. Annex of MARPOL 73/78.

Annex	Title	Entry into force	Entry into force (For China)
Annex I	Prevention of pollution by oil & oily water	2 October 1983	2 October 1983
Annex II	Control of pollution by noxious liquid substances in bulk	6 April 1987	6 April 1987
Annex III	Prevention of pollution by harmful substances carried by sea in packaged form	1 July 1992	13 December 1994
Annex IV	Pollution by sewage from ships	27 September 2003	2 February 2007
Annex V	Pollution by garbage from ships	31 December 1988	21 February 1989
Annex VI	Prevention of air pollution from ships	19 May 2005	23 August 2006

1. Current status of Implementation of MARPOL 73/78

China has conducted actively management about ship-source pollution to marine environment, strengthened related environmental standards of ships and their facilities and equipment. According to law, a ship should be forced to discard more than its useful life. International shipping vessels sailing in the waters of the country should carry out ballast water exchange or install ballast water inactivated treatment system.

In 1983, China promulgated the "Regulations on the Prevention of Marine Pollution from Ships of the People's Republic of China", which plays an important role in preventing marine pollution and protecting marine ecology. In order to do a better job of prevention and control of marine environmental pollution by ship and related activities, according to the requirements of MARPOL 73/78 and relevant international convention on prevention and control of marine environmental pollution by ship and related activities, the regulation conducted a comprehensive modification in 2009. The new regulation took effect on March 1, 2010 and was revised five times between 2013 and 2017.[7]

2. Other pollution sources: Port and offshore platform

China also enhanced the prevention and control of pollution in port terminals. The Bureau of Maritime of the Ministry of Transport (MOT) has compiled and implemented pollution prevention and control plans for national ports, wharfs and loading and unloading stations. The construction of waste reception, transport and disposal facilities will be sped up, and the capacity for handling of pollution accidents, such as oily wastewater, chemical washing water, etc., will be improved.

[7] Regulations on the Prevention of Marine pollution from Ships of the People's Republic of China. 2017.

In China, the related pollution management of offshore platforms complied with the Regulations on environmental protection and management of offshore oil exploration and development.

There are two specific technical standards to be carried out: (1) Emission standards of water pollutants discharge by ships (GB3552- 2018); (2) Concentration limits of pollutant discharge by offshore oil exploration and development (GB4914-2008).

2.2.2.3 Conducting total loading control actions

Target 5 on the "Reduction of total loading of nutrients from 2006 levels" include related actions such as: control total loading from point sources, non-point sources and ship-based sources, and new technology in water treatment.

Action 5-1: Control total loading from point sources

The total loading from point sources has been controlled in recent decades. The continuation of the strict control of pollution loading from point sources is encouraged. Liaoning, Shandong and Jiangsu Provinces are major commercial zones in eastern China, and have undergone massive urbanization and industrialization. As one of the most developed zones, intensive anthropogenic activities in those regions have severely deteriorated environmental quality. Industrial and municipal wastewater from surrounding cities discharged directly to the rivers or outlets. Local government has done a lot of work, however, under pressure of rapid economic increase, the actual effectiveness may not be very significant from 2010 to 2016.

Action 5-2: Control total loading from non-point sources and sea-based sources

(1) Atmospheric deposition

The atmospheric deposition and inputs from the watershed are considered important sources of Yellow Sea pollution. Currently, there are three marine atmosphere monitoring stations in the Yellow Sea. Among them, the earliest station started in 1994 and has been stable since its operation, which can serve as the representative station of marine air pollution in the north Yellow Sea. In 2002, SOA set up a marine atmosphere monitoring station on Xiaomaidao Island, Qingdao City, which can serve as one of the representatives of the south Yellow Sea. In 2015, Lianyungang marine atmosphere monitoring station was added, which became another representative monitoring station in the south Yellow Sea. The monitoring indicators were developed from the first few common heavy metals, and extended to the monitoring of nutrients and other heavy metals as well as some new organic pollutants. The monitoring content is dry deposition and wet deposition from precipitation.

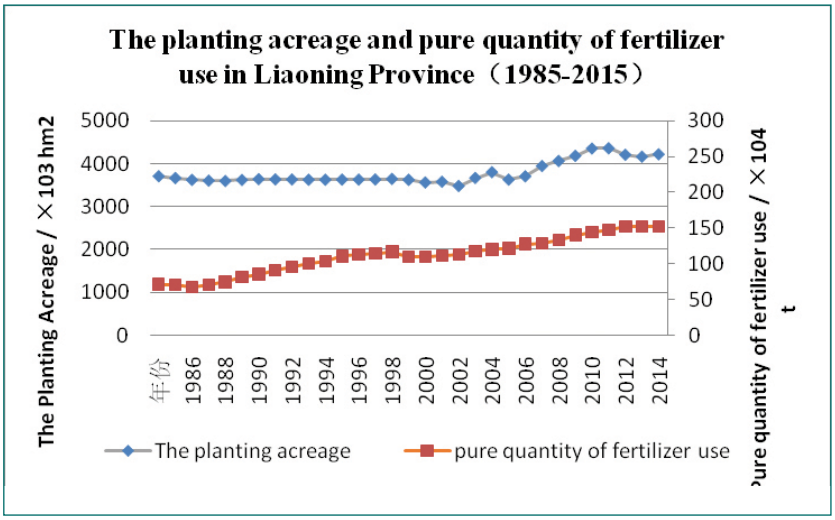
Qianliyan Island is located in the middle of the Yellow Sea, 57 nautical miles from Qingdao. Qianliyan Island's ecosystem structure and function is perfect, the surrounding waters preserve the marine ecosystem integrity and naturalness. SOA established a marine environment monitoring station, continuously monitoring the weather and ocean data, such as temperature, humidity, wind direction, wind, visibility, salinity, and pressure.

Qianliyan Island, which is located on the atmospheric transmission channel between Chinese mainland, Republic of Korea, and Japan, without human interference, is an ideal atmosphere monitoring station. In recent decades, the Ocean University of China (OUC) has conducted long-term and continuous atmospheric monitoring work on the island, including: nutrients,[8] heavy metals,[9] NO_x,[10] ions,[11] etc.

(2) Fertilizer usage

China is a huge fertilizer production and use country. According to the National Bureau of Statistics, the amount of fertilizer production in 2013 was 70.37 million tons, and the amount of agricultural fertilizer applied was 59.12 million tons. China's arable land foundation is low, fertilizer application to grain yield increase, generally more than 40%. The amount of fertilizer used in China's crops per acre is 21.9 kg, which is far higher than the world average (8 kg/acre), 2.6 times that of the United States and 2.5 times that of the European Union. **Figure 2.13** is an example of fertilizer use in the past 30 years.

Figure 2.13. The planting acreage and fertilizer use in Liaoning Province.



[8] L.J. Han, Y.M. Zhu, S.M. Liu, J. Zhang, and R.H. Li. 2013. Nutrients of atmospheric wet deposition from the Qianliyan Island of the Yellow Sea. China Environmental Science, 2013, 33(7), 1174-1184.

[9] C.L. Liu, H.B. Ren, H.T. Chen, and N. Xia. 2003. Heavy metals in precipitation from the Yellow sea and East China Sea Regions Marine Sciences, 2003,27(9),64-68.

[10] L.X. Dan, X.Y. Shi, S.K. Liang, and C.S. Zhang. 2010. Seasonal distribution of NOx over the north Yellow Sea. Environmental Protection Sciences, 2010, 5, 1-3.

[11] J.L. Zhang, N. Chen, Z.G. Yu, J. Zhang. 2000. Ion balance and composition of atmospheric wet deposition (precipitation) in Western Yellow Sea. Marine Environmental Science 2000, 19(2), 10-13.

In 2015, the Ministry of Agriculture (MOA) formulated the "Action Plan for the zero-growth of pesticide use by 2020"[12] to strictly control the use of chemical fertilizers. The aim is to gradually control the annual growth rate of fertilizer use within 1% from 2015 to 2019; to achieve zero growth in the use of fertilizers by 2020, and the utilization rate of major crop fertilizers is more than 40%.

The technical routes are included to:

- rationally formulate the limits of fertilization for each region and crop unit area;
- guide the optimization and upgrading of fertilizer products, and vigorously promote efficient new type of fertilizers;
- improve the method of fertilization; and
- promote organic fertilizer usage, to combine organic and chemical fertilizer.

In the Yellow Sea Region, the rules of fertilization are: reducing nitrogen; controlling phosphorus; stabilizing potassium; and supplementing trace elements (sulfur, zinc, iron, manganese, boron, etc).

(3) Sea-based pollution – Mariculture

Mariculture has shown great promise for meeting the need of protein food and providing some relief to wild species threatened by overfishing. Mariculture production in the world was about 25 million tons (about 19 million tons in China).

However, mariculture also leads to negative impacts on environmental quality. During the breeding process, emission of N, P, and COD to the marine environment, beyond the nearshore marine environmental capacity and self-purification ability, as a result of eutrophication and the marine ecological environment destruction and exception. In addition, mariculture may produce large amounts of self-pollutants, including particulate matter (residual feed and faeces) and dissolved metabolic wastes (ammonia and phosphorus).

Action 5-3: Apply new approaches for nutrient treatment

In 2015, China issued "Water Pollution Control Action Plan", which is an ambitious plan. WPCAP will strengthen pollution control in industrial agglomeration areas. Industrial effluent must be pretreated to meet the requirement of centralized treatment before entering the centralized sewage treatment facility. New and upgraded industrial agglomeration areas should be planned, including construction of sewage and garbage centralized treatment and other pollution

[12] Ministry of Agriculture (MOA). 2015. "Action Plan for the zero-growth of fertilizer use by 2020".

treatment facilities. By the end of 2017, the industrial agglomeration area should be built into a centralized sewage treatment facility, and an automatic online monitoring device will be installed. The urban sewage treatment facilities in the sensitive areas (key lakes, reservoirs and offshore areas of the coastal waters) should meet grade I - level A emission standards by the end of 2017.

Coastal zone is one of the most sensitive regions to global environment change, most of the physical phenomena and ecological process changes took place because of coastal wetland exploitation and coastal land use changes. Wetland ecosystems have the function of purifying the nutrients. It is significant to study coastal wetland changes and its effects on the eco-environment to better understand the regional eco-environment under global changes.[13]

According to the analysis in the previous context, the assessment of target 4 &5 was listed below (**Table 2.11**).

Table 2.11. The Assessment of Target 4 and 5.

Target 4&5	Indicator	Progress
Target 4: Meeting international requirement on contaminants	Well-operated regional monitoring network	National level: YES Regional level: NO
	Provision of access to reliable monitoring information on environmental quality for state governance bodies and the public	YES
Target 5: Reduce contaminants, particularly in bathing beaches and other marine recreational waters, to nationally acceptable levels	Significant reduction of total loading of pollutants	Input from land-based sources of pollutants still be a very serious threat to marine environment
	Significant improvement of seawater quality with reduction of human health risk	Partly, Seawater quality is not stable, but compared with 2012, there is a good trend. No data is available on the human health risk.

2.2.2.4 Reduction of Marine litter

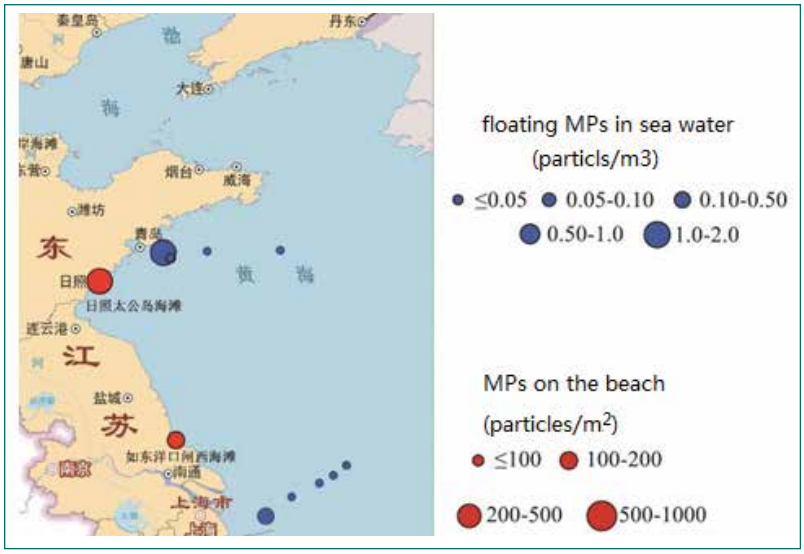
Target 6 is about "Reduced standing stock of marine litter from current level". The management actions include: (1) Control source of litters and solid wastes; (2) Improve removal of marine litter; and (3) Increase public awareness of marine litter.

[13] W.X. OU, G.S. Yang, and L.H. Gao. 2006. Retention Effect of Wetland for Nitrogen and Phosphorus Nutrients in the Coastal Zone of the Yancheng. Wetland Science 2006, 4(3), 179-186.

Action 6-1: Control source of litters and solid wastes

From 2016, SOA launched a pilot monitoring program of marine microplastics in marine environment. In May 2017, the first marine microplastics survey was conducted in the Yellow Sea. **Figure 2.14** shows the results of floating microplastics.

Figure 2.14. Floating and beach microplastics distribution in Yellow Sea Marine litter in Yellow Sea.

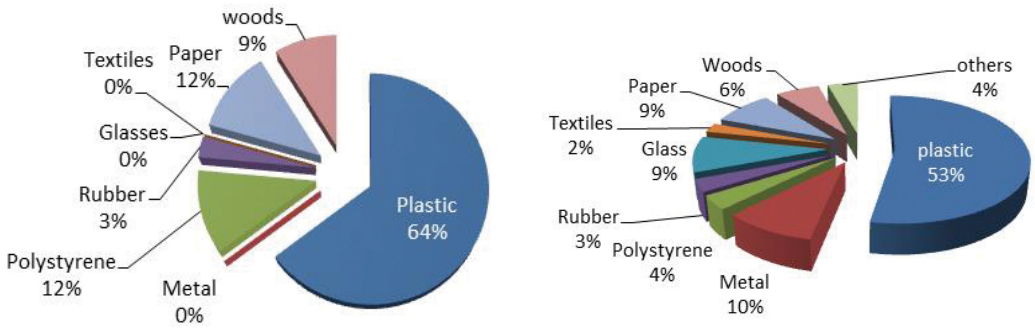


The monitoring results have been published in "Bulletin of Marine Environment Status of China" every year. In recent years, the overall density of marine garbage has fluctuated. In 2016, the overall densities of floating, beach and marine litters were lower than in previous years.

1. Composition

The main types of floating litter along the coast of Yellow Sea of China were plastic, which accounted for 64% of the total amount of collected litter. **Figure 2.15** shows the types of floating litter in the surface water of the Yellow Sea of China. **Figure 2.16** shows the types of beach litter in the surface water of the Yellow Sea of China. Main plastic litters are polystyrene foam, plastic bags, plastic bottles and cigarette filters.

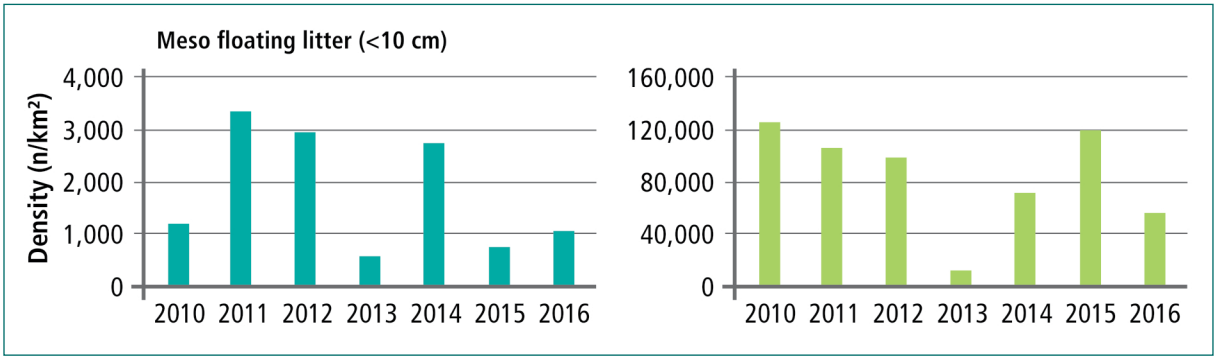
Figure 2.15. Main types of marine litter along the coast of Yellow Sea.



(Left: floating litter; Right: Beach litter)

2. Mass

Figure 2.16. Marine litter in Yellow Sea (2010 to 2016).



(Left: floating litter; Right: Beach litter)

Action 6-2: Improve removal of marine litter

As the representative city of the coastal cities of the yellow sea, Weihai City issued the implementation work plan of the "Marine Debris Program Participates in U.S./China Sister Cities" in 2016. Taking the cooperation of "sister cities" as the opportunity to prevent and control marine debris and protecting the ecological environment, Weihai City focused on establishing marine debris prevention and control program and capacity building. In order to improve the quality of ecological environment, Weihai City learned from the advanced concepts and experiences of marine debris prevention and control at home and abroad, and established a long-term mechanism for the prevention and control of marine debris. From 2017 to 2019, Weihai City carried out the priority project of solid waste treatment. Plastic debris in the marine surface and beach was salvaged and cleaned normally, and salvaging of the plastic debris on the seabed was exploratory. Environmental governance and ecological restoration of river channels and beaches were carried out. Weihai City made an example of the coastal cities of the Yellow Sea to establish a marine debris prevention and control program.

Action 6-3: Increase public awareness of marine litter

A good beach environment closely related not only with tourists but also represents the image of the city. Clean beaches, are not only public welfare, environmental protection, but also are the action of civilization.

China actively encourages local governments or NGOs to organize clean beach activities. Propaganda and education were carried out by celebrating World Environment Day, Earth Day, World Oceans Day, International Coastal Cleanup Day and China Ocean Day. On September 17 to

25, 2016, "2016 international coastal cleanup day joint action", in 18 Chinese cities (including Hong Kong, Macao), more than 70 social groups, nearly 10,000 volunteers organized nearly 40 beach cleaning activities. Propagandistic brochure for the hazardous and prevention of marine debris and microplastics were distributed to the public. Warning signs were set up in specific locations of shipping, fishing, tourism and other areas. Special exhibitions on marine debris pollution prevention and control were built. Volunteer activities for beach cleaning were organized. These methods effectively raised the public awareness of prevention and control of marine debris.

2.2.2.5 Reduction of contaminants in marine recreational waters

Target 7 is about "Reduce contaminants, particularly in bathing beaches and other marine recreational waters, to nationally acceptable levels". The management actions are: (1) Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters; and (2) Control pollution in bathing beaches and other marine recreational waters.

Action 7-1: Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters

Since 2002, SOA has conducted pilot continuous monitoring of 10 key seawater bathing beaches across the country. In 2004, there were 23 bathing beaches. Starting in 2006, monitoring of 16 coastal tourist resort areas along the coast was conducted.

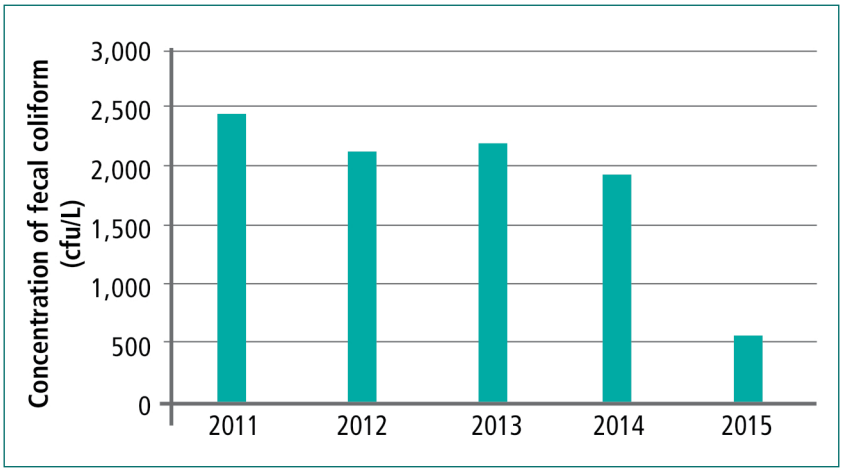
At present, six bathing beaches and five coastal tourist resort areas have been carried out in the YS area. Monitoring contents include: hydrometeorology (water temperature, wave height, wind direction, wind speed, total cloud, precipitation, temperature, visibility, etc.), water quality (Fecal coliform, transparency, DO, floatation, color, odor, taste, etc.), hazardous biology (jellyfish, etc.) and beach (garbage, oil, etc.). The monitoring time is from June 24 to October 7 every year.

(1) Weihai International Bathing Beach (WIBB)

From 2011 to 2015, the average number of days of water quality in the swimming season of WIBB was 86% (good) and 13% (regular), and 1% (bad). The average of the fecal coliform group (95th) in the water body is 2,073/L, and the comprehensive grade of water quality is "regular". In recent years, the content of fecal coliform in the water of WIBB has decreased year by year, and the comprehensive grade of water quality in the bathing beach in 2015 is "good".

From 2011 to 2015, the average number of days of swimming in WIBB was 28% (suitable) and 23% (not suitable) for swimming. WIBB has a small wind and waves, with an average wave height of 0.4 m. The water temperature and temperature are suitable for swimming in July and October.

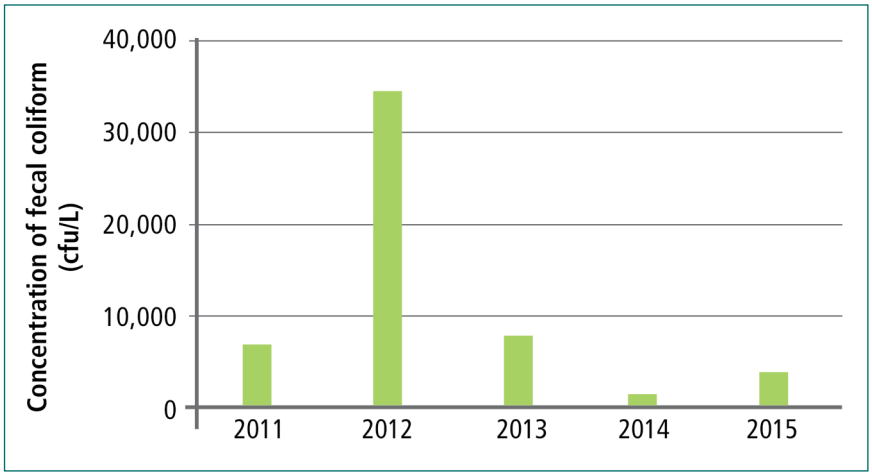
Figure 2.17. Annual average of the fecal coliform group in WIBB (2011-2015).



(2) Lianyungang-Liandao Bathing Beach (LLBB)

From 2011 to 2015, the average number of days of water quality in the swimming season of LLBB was 10% (good) and 74% (regular), and 16% (bad). In 2012, fecal coliform group (95th) in the water body reached above 30,000/L, the comprehensive grade of water quality was "bad". Probable causes could be that some facilities, such as bird garden, was in the surrounding mountains of LLBB, pollutants such as bird droppings after rainfall have been transferred into the water body of the beach with rainwater runoff, which has certain impact on water quality.

Figure 2.18. Annual average of the fecal coliform group in LLBB (2011-2015).



Water quality in recreational waters will directly impact human health. To minimize health risks, the local government established intensive monitoring, early-warning, assessment system for bathing waters and other marine recreational waters, when the water quality is not suitable for swimming, the administrative department will make control measures at different levels, until it closes the beach.

Action 7-2: Control pollution in bathing beach

China issued "The Implementation Plan of Garbage Sorting" in 2017. Dalian City and Qingdao City, the coastal cities of the YS, began to carry out mandatory garbage sorting within the urban district, setting a goal for the recycling rate in cities where household garbage is sorted to reach 35 percent by 2020. The garbage treatment system for sorted collection, transportation and disposal was established. The garbage classification system was formed based on related laws and regulations, government promotion, public participation, urban and rural harmonious and local conditions. Efforts were enhanced to improve the coverage of the garbage classification system, promote green development, improve city management and services, and create a better living environment. The marine debris was reduced and constrained at source.

Action 7-3: Legislation on waste and litter management

From April 1, 1996, "Law on the prevention and control of environmental pollution by solid waste" came into force. It stipulated the prevention and control of solid waste (including industrial waste, household waste) and hazardous waste, but there is no specific provision for marine waste.

From 22 June 1990, the State Council issued "Regulations on the prevention and control of pollution by land-based pollutants", which came into force on 1 August 1990. This regulation focused on land-based pollutants (mainly liquid, such as wastewater) discharged through river or outlets. There are only two Articles relates to solid waste: (1) Article 11 *Without authorization, it is forbidden to stack, treatment and dispose of solid wastes in coastal beaches;* and (2) Article 12 *Approved waste yards, treatment units and individuals must build leakage protection dam, dust protection and other facilities*.

Table 2.12. The Assessment of Target 6 and 7.

Target 6&7	Indicator	Progress
Target 6: Reduced standing stock of marine litter from current level **Target 7:** Reduce contaminants, particularly in bathing beaches and other marine recreational waters, to nationally acceptable levels	Regional guidelines for marine litter monitoring and assessment	Marine Litter: YES Microplastics: On going.
	Establishment of operational mechanism for beach cleaning	YES, need to be more efficient
	Published educational information package	Data is limited
	Improved legislation on waste and litter management	Partly, not enough for litter management No legislation on marine litte

2.3 Ecosystem changes

Data/information of current status and progress related to Target 8-11 were collected and reviewed. For each target, there are related indicators. Below is a summarized progress of those indicators to clarify the implementation progress of NSAP in YSLME region.

This report was mainly separated into two sections: ecosystem change and habitat/species. Ecosystem change includes currents status related to Target 8: Better understanding and prediction of ecosystem changes for adaptive management. In this section, the monitoring of nutrients, HAB and drifting macroalgae blooms, jellyfish bloom, development of adaptive management strategies and policy regarding the climate change was included.

The second section covers the indicators related to Target 9-11: Maintenance and improvement of current populations/distributions and genetic diversity of living organisms including endangered and endemic species; Maintenance of habitats according to standards and regulations of 2007; Reduction of the risk of introduced Species. In this section, the current status of coastal wetlands, endangered and threatened migratory species, marine protected area, and invasive alien species will be included.

2.3.1 Current status

China pays great attention to marine environmental monitoring. Marine ecological environmental monitoring is the basis of ecosystem conservation and management, and supports building the marine ecological civilization of China. Each year, continuous monitoring of marine environment status was conducted across China. Currently, China has primarily built the marine ecology environmental monitoring network, covering the sea area under Chinese jurisdiction. National level and local (provincial, city, county) level monitoring institutions carry the responsibility of marine environmental quality monitoring, marine ecological monitoring, marine ecological risk monitoring and forecasting. The reports are available to the public online. **Figure 2.19** shows the monitoring sites across Yellow Sea.

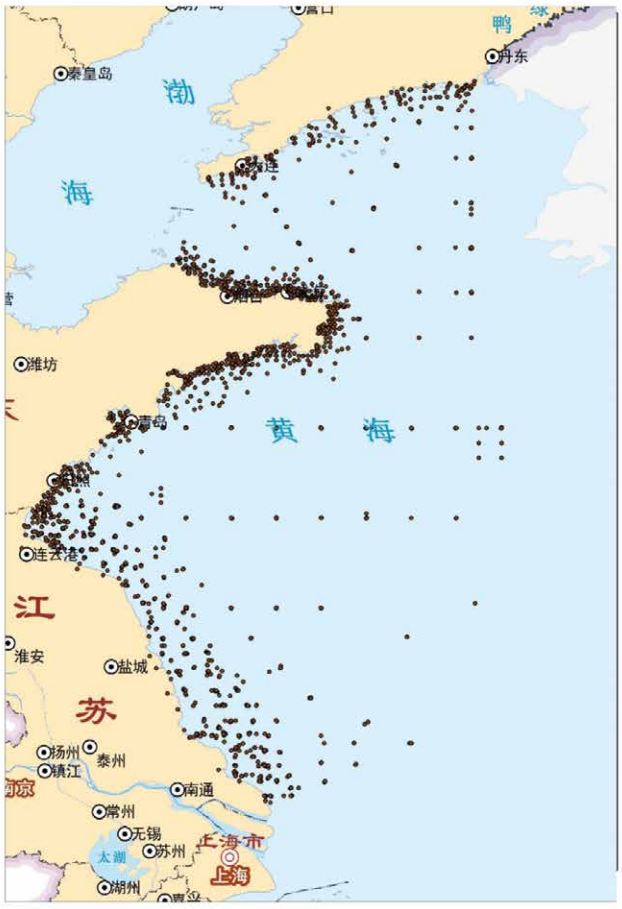


Figure 2.19. Monitoring sites across Yellow Sea.

(N, P and Si were regular monitoring elements. **Figure 2.20–2.22** show the annual changes of these three nutrients)

Figure 2.20. Annual changes of DIN concentration in Yellow Sea, both surface and bottom.

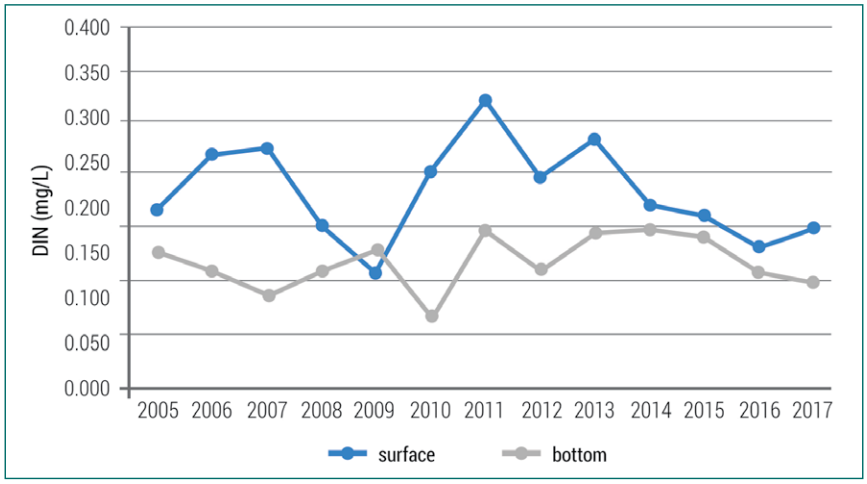


Figure 2.21. Annual changes of phosphate concentration in Yellow Sea, both surface and bottom.

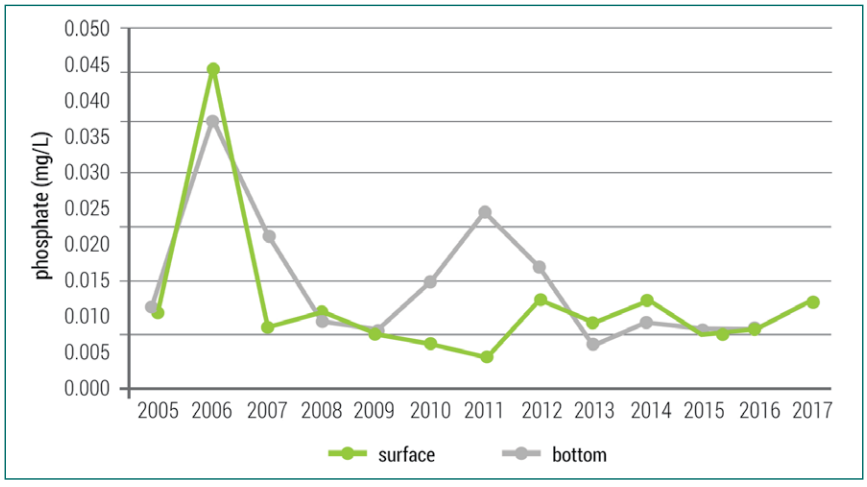
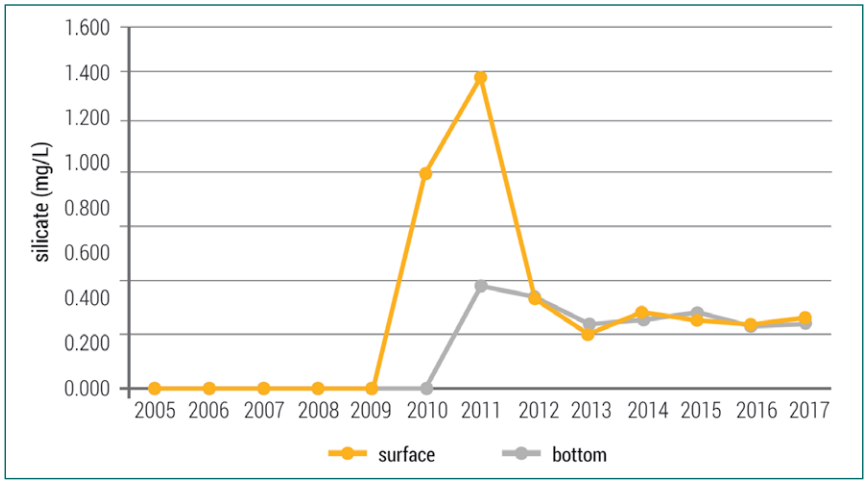
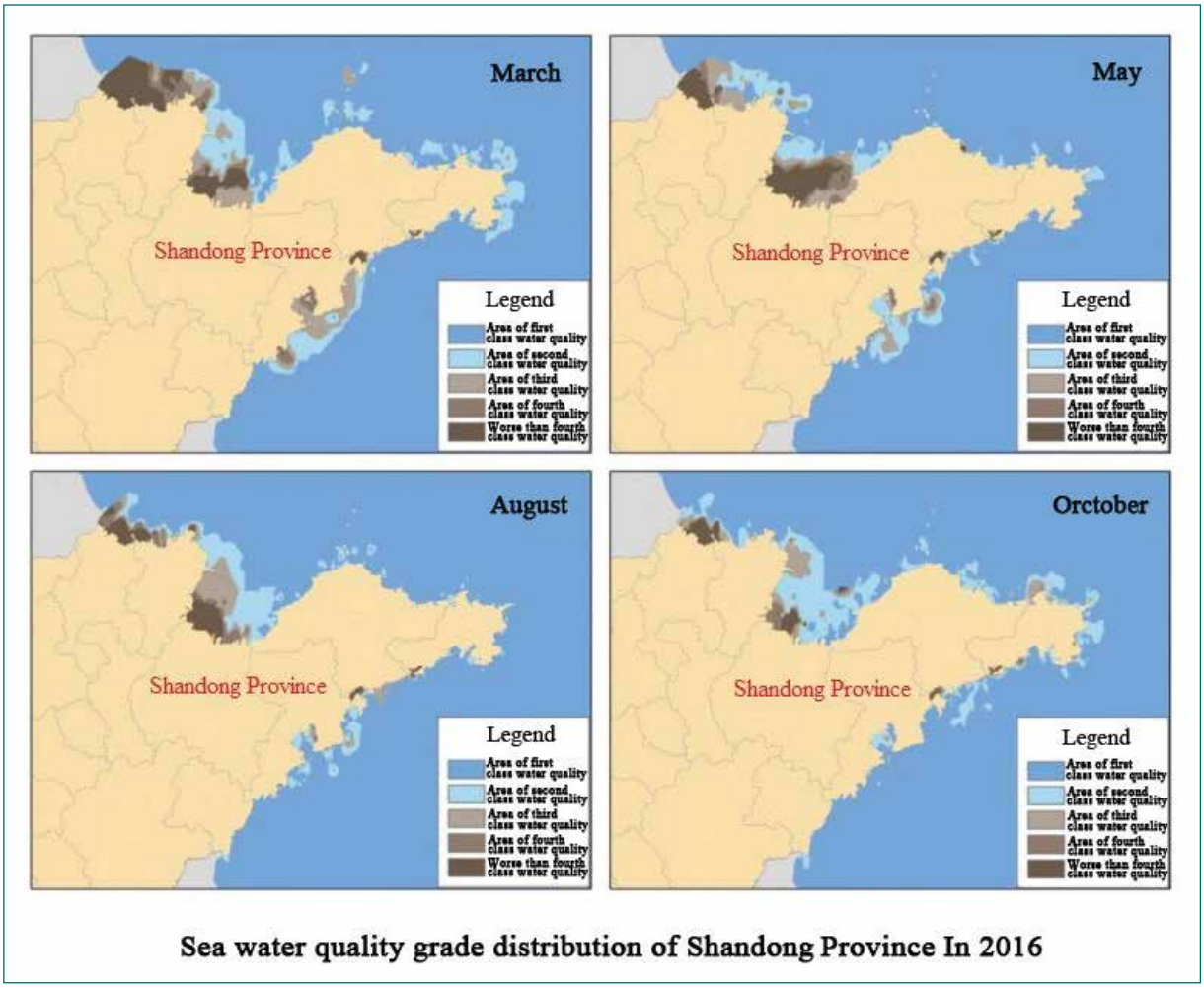


Figure 2.22. Annual changes of silicate concentration in Yellow Sea, both surface and bottom.



State Oceanic Administration of China published the "China Marine Ecological Status Bulletin" each year. In coastal provinces and cities, these kinds of bulletins were also available online. In the YSLME region, the ocean and fishery department of Shandong, Liaoning and Jiangsu Provinces published their marine environmental status bulletin, in which the seawater quality and status (N, Pi, COD, et al.), marine biodiversity, marine functional zoning and marine environmental disaster (HAB) were all included in the bulletin. **Figure 2.23** shows the seawater quality in Shandong Province, the majority of the sea area (more than 90%) satisfy the first class seawater quality requirement (first row in the legend, in blue color).

Figure 2.23. 2016 Shandong Province seawater quality distribution.



(Data from 2016 Shandong Province marine environmental status bulletin)

The ecosystem was greatly influenced by the increasing effects of climate change and human activities. The response of the marine organisms and their redistributions under climate change scenarios are of great importance to ecosystem-based management. Related researches have been carried out in YSLME to predict the ecosystem change under different scenarios.

According to Chen (2014), a study was carried out to investigate the anchovy *Engraulis japonicas*, a key species in food web of the Yellow Sea. Its interannual variations in biological characteristics, its resources density and the redistribution of anchovy were evaluated using a modified dynamic bioclimate envelope model under climate change scenarios. Four climate change scenarios were analyzed, including Representative Concentration Pathways (RCP), RCP 2.6, RCP 4.5, RCP 6, and RCP 8.5. These four scenarios represent low, relative low, modest and the highest emission scenarios. The wintering anchovy stock showed the obvious northward trend, reached as much as to 2.5-2.7 degree in the next 30 years. The average speed of shift to northward could be 0.09 degree per year. There were no significant differences among the four climate change scenarios (**Figures 2.24** and **2.25**).

Figure 2.24. Distributions of anchovy under RCP2.6 scenarios in the year 2013, 2023, 2033 and 2043 (Chen, 2014). RDI is Resource Density Index.

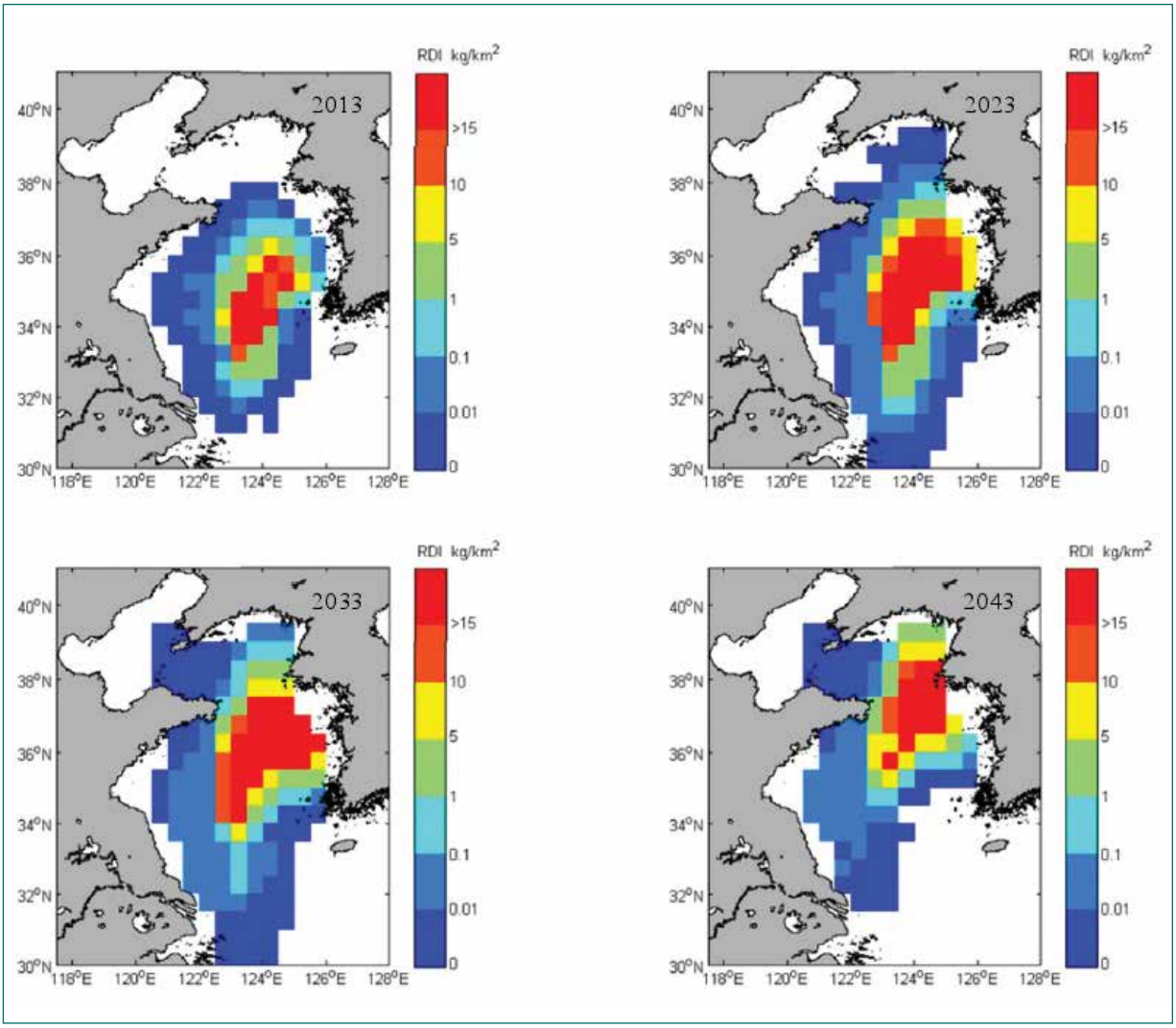
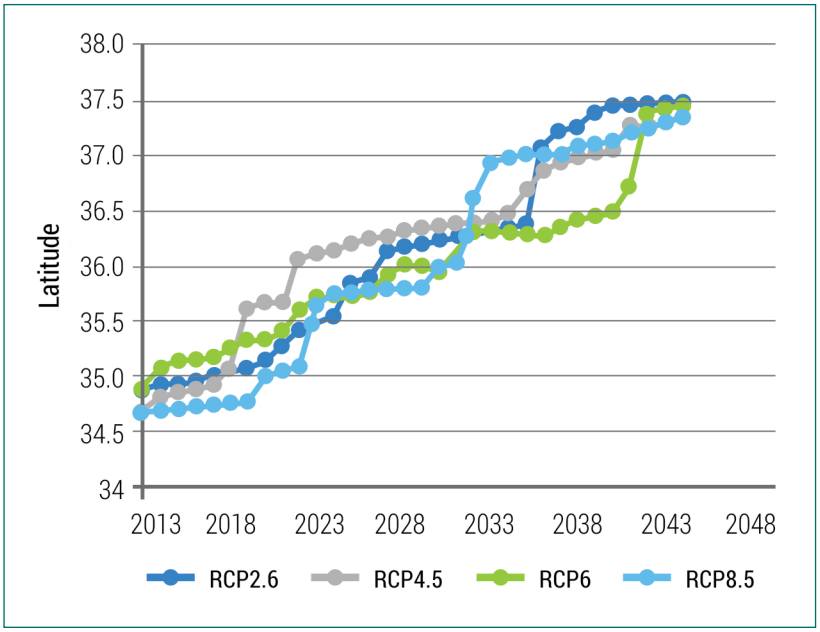


Figure 2.25. Redistributions of wintering anchovy under different scenarios (Chen, 2014).



The earliest successful record of integrated coastal management (ICM) in China was in 1994 (Xue, et al., 2004; Ye et al., 2014 a), which motivated the Chinese government to scale up the ICM programmes in China's coastal areas with continued cooperation with the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). After a successful launch of the ICM fourth phase in China in 2014, 22 coastal cities (**Figure 2.26**) have officially declared adoption of the ICM framework to different degrees, covering about 12% of China's coastline (Ye, et al., 2014b). The China-PEMSEA Sustainable Coastal Management Cooperation Center (CPC), established on 9 December 2014, is the first national center organized by PEMSEA. Supported and guided by the State Oceanic Administration of PR China and PEMSEA jointly, CPC serves as a technology provider for coastal sustainable management and coordinator for China to implement the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA). The Center focuses on the efficient conduct of SDS-SEA and fosters the combination of international ICM and marine ecological civilization construction of China. Replicating successful patterns that conduce to the blue economy and providing technical support for the promotion of ICM are also CPC's responsibilities.

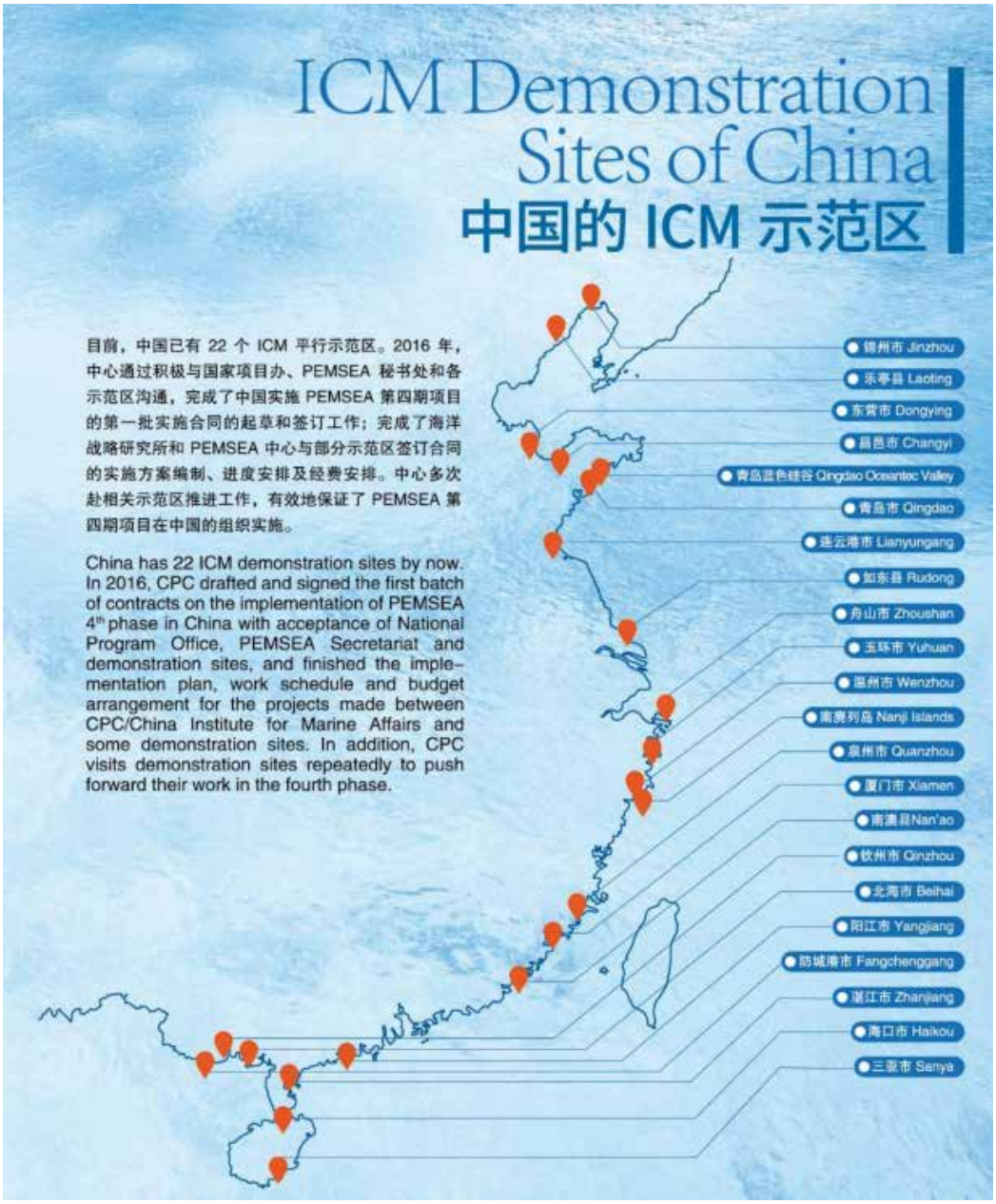
Its four basic functions are:

1. To guarantee the effective implementation of SDS-SEA in China;
2. To provide certification and trainings related to ICM for the region;
3. To provide technical support of ICM to local governments of coastal areas;
4. To conduct international cooperation related to ICM.

In October 2015, six Chinese ICM demonstration sites (Lianyungang, Fangchenggang, Quanzhou, Haikou, Xiamen, and Dongying) received the ICM First Level Audit in Qingdao and got approved.

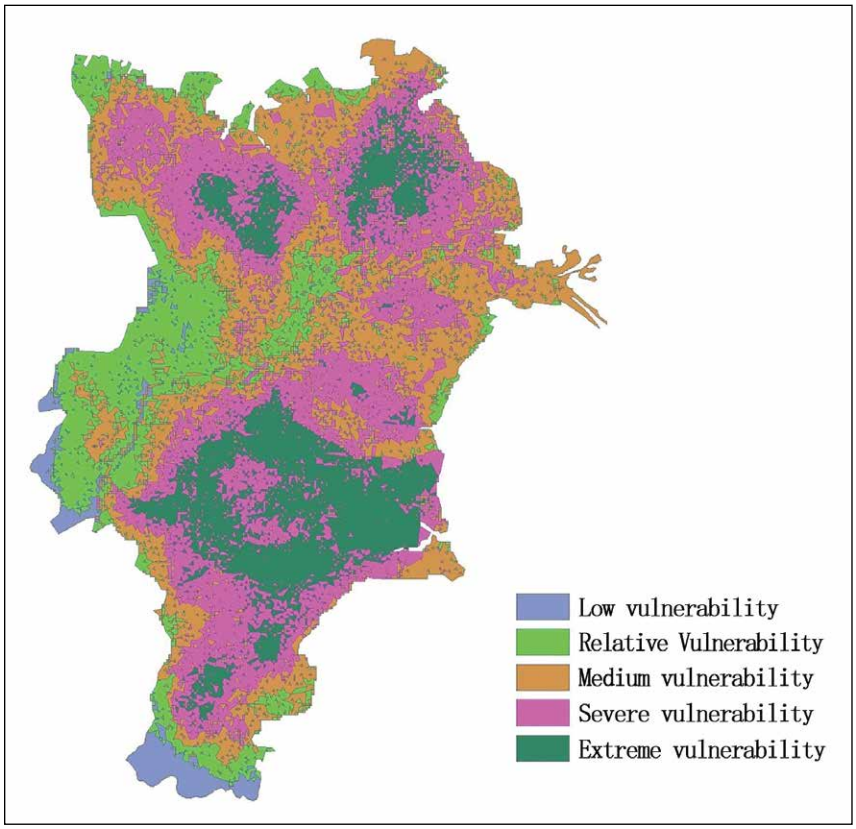
Addressing climate change is also included in CPC's work. According to the 4th phase plan of PEMSEA, as well as the need for a demonstration site, CPC finished the Report on Vulnerability Assessment of Coastal Zone in Dongying addressing the sea level rise (**Figure 2.27**). CPC also finished the emergency plan for natural disaster relief for Dongying City.

Figure 2.26. ICM Demonstration sites in China.



Source: CPC brochure

Figure 2.27. The vulnerability assessment of Dongying by CPC.



2.3.2 Efforts made since 2009

2.3.2.1 Jellyfish bloom

Jellyfish blooms are increasing around the world. In East Asia, however, these blooms are considered one of the most serious ecological disasters, together with harmful algae blooms (HABs), both of which are impacting the marine ecosystems, environmental safety, and the development of the maritime economy. The occurrence of jellyfish blooms has been increasing in frequency and in geographical range, influencing the maritime economy in many ways: increasing incidents of jellyfish stinging adversely affecting coastal tourism; and jellyfish blooms at times block cooling systems in coastal factories, as well as those of nuclear power plants, causing significant economic losses. Jellyfish blooms are changing the way marine ecosystems function. As top predators, once jellyfish become the dominant species in the ecosystem, they may cause catastrophic regime shifts in the ecosystem. Jellyfish blooms are now a global issue. Because of their wide geographic range and serious consequences, jellyfish blooms have been one of the most sensitive and complex issues concerning ecological and environmental safety, and even international political cooperation.

A National Basic Research Program on Giant Jellyfish Blooms in Chinese Seas was established for 2011–2015 by China's Ministry of Science and Technology. Chinese seas principally affected are the Yellow Sea (YS), the East China Sea, and the Bohai Sea, which are where the National Program has been concentrated. The key overall scientific aims of the jellyfish project have been: (1) to understand the main controlling factors, key processes and driving mechanisms of jellyfish blooms in Chinese coastal waters; (2) to discover how jellyfish blooms influence the marine ecosystem and their mechanisms of causing harm; and (3) evaluating ecological disasters and discovering how to put in place mitigating measures (Sun et al., 2015).

New technology has been applied in jellyfish bloom monitoring, such as: underwater photography, sonar imaging and aerial image. In China, the jellyfish bloom disaster monitoring and early warning system was preliminary set up. Typical jellyfish bloom areas were selected as pilot sites: Qingdao, Qinhuangdao and Xiamen. According to the 2016 Report on Marine Environmental Quality of Qingdao, in 2016, the dominant jellyfish species was *Nemopilema nomurai*. It was distributed from Lingshan Island to Shilaoren area. The peak period was from July to August. The average density of jellyfish was less than 1 ind./ha, which was the same as 2015. No jellyfish bloom was observed around water intake of Qingdao power plant for four years after the moon jellyfish bloom in 2012.

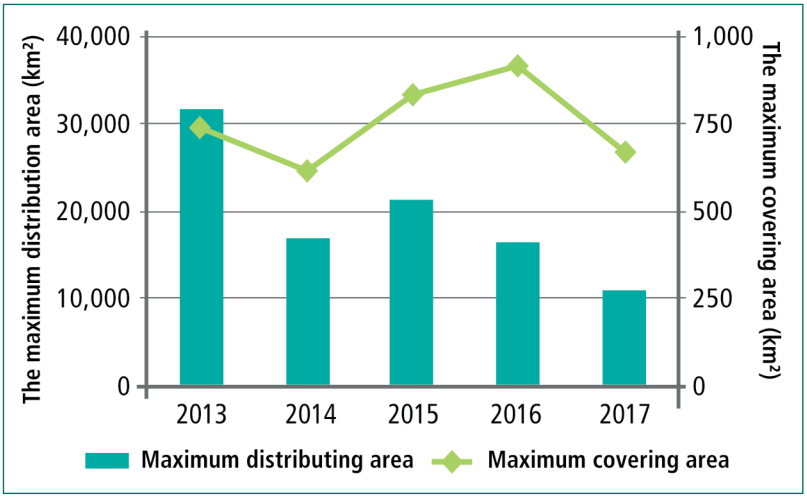
China and Korea both suffered from the influence brought by jellyfish bloom, so there were long-term international cooperation and communication between two countries. In 2015, National Fisheries Research and Development Institute of Korea and Liaoning Fisheries Science Research Institute signed an MOU on joint research for preventing jellyfish attack. According to the MOU, the two institutes will exchange jellyfish information regularly, jointly explore the plan addressing the huge jellyfish mass distributed in the West Sea area of Korea and China's Bohai Sea.

2.3.2.2 HAB and drifting macroalgae blooms

China started the research on HAB in the 1970s. A monitoring network on HAB was also established by SOA. HAB is routinely included in marine environment monitoring. In the bulletins, the content related to HAB has been included.

In 2007, the first large-scale green tide caused by Ulva broke out in Qingdao coast. From then on, green tide affected Qingdao coast each year. **Figure 2.28** shows the maximum distribution area and maximum covering area of green tide from 2013 to 2017 in Shandong Province.

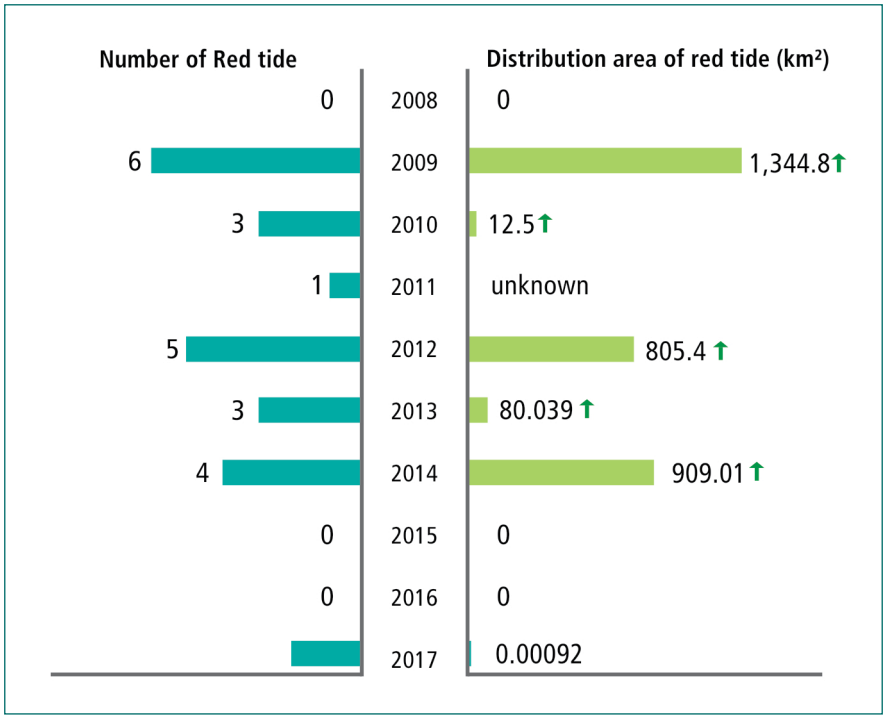
Figure 2.28. The maximum distribution area and maximum covering area of green tide from 2013 to 2017 in Shandong Province.



(Data from 2017 Shandong Province marine environmental status bulletin)

Figure 2.29 shows the red tide number and distribution area in Shandong Province from 2008-2017. Red bars indicate the number of red tide occurrences, while blue bars indicate the area (km²) of red tide.

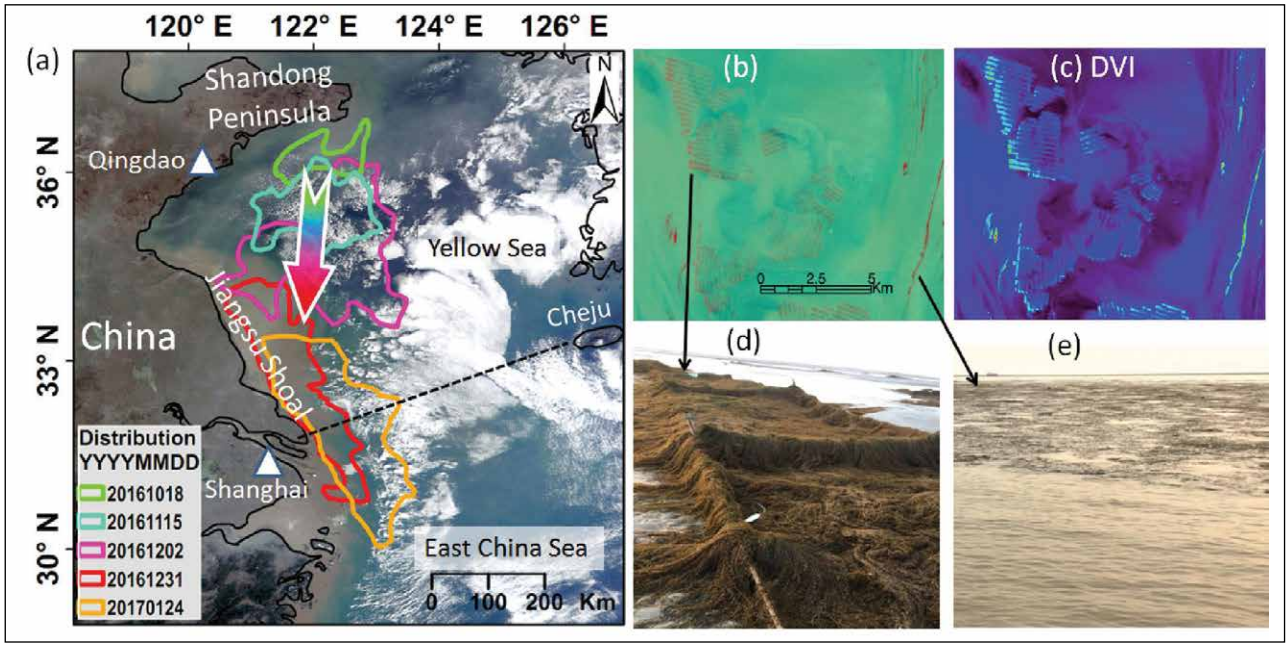
Figure 2.29. 2008-2017 Shandong Province red tide number and distribution area.



Source: Data from 2017 Shandong Province marine environmental status bulletin

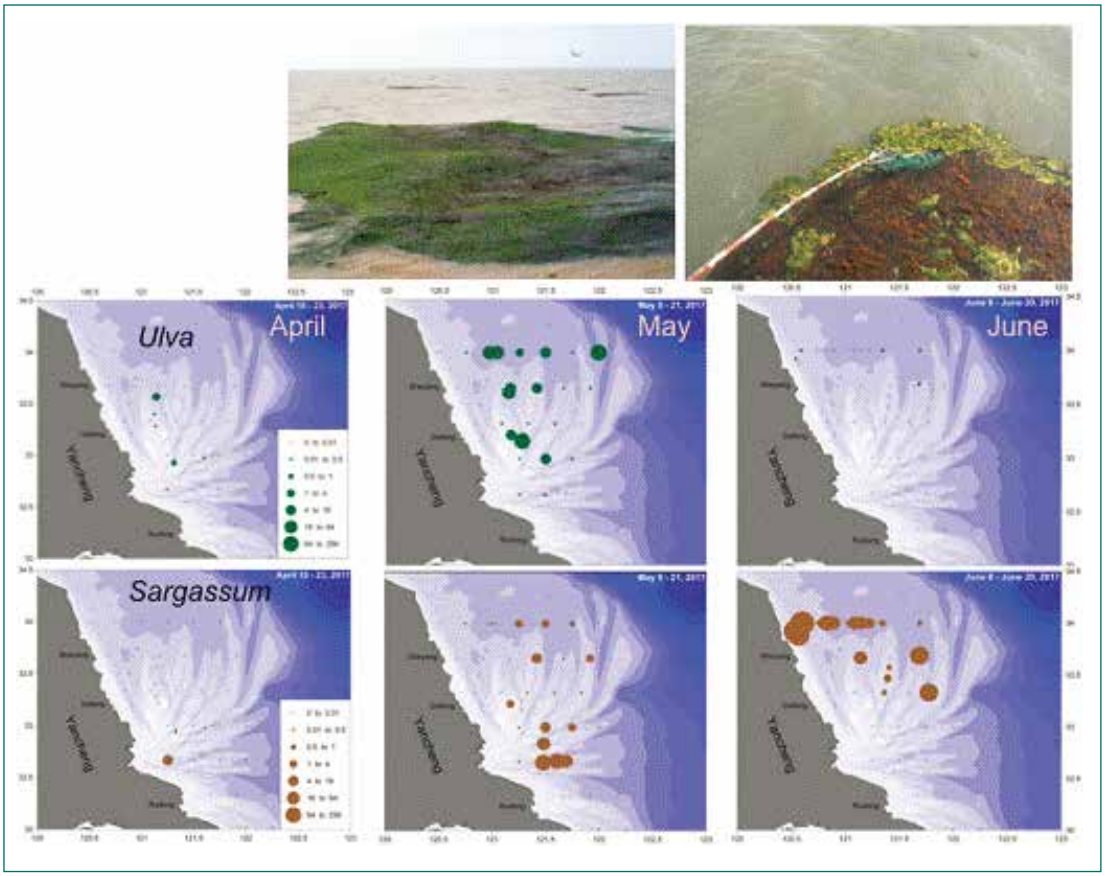
From May to July 2017, green tide happened in the south coast of Shandong Peninsula, jointly caused by Ulva and Sargassum. Golden tides caused by brown macroalgae (*Sargassum*) were reported to have increased in recent years. At the end of December 2016, a seaweed farming area of *Poryphyra yezoensis* in the Jiangsu Shoal of the Yellow Sea was severely affected by floating brown macroalgae, which was identified as *Sargassum horneri*. At the sites severely affected by drifting Sargassum, the Poryphyrayezoensis aquaculture facilities were taken over by Sargassum and collapsed. By a rough estimate, the area of Poryphyrayezoensis aquaculture zone that was affected by the floating *Sargassum horneri* in Jiangsu Province was about 22,700 ha. An economic loss of 0.5 billion CNY (about U.S. $73 million) was estimated due to the damaged seaweed aquaculture, which is the largest direct economic loss in seaweed aquaculture caused by floating Sargassum in China (Xing et al., 2017).

Figure 2.30. (a) Southward drifting path of Sargassum patches from October 2016 to January 2017. The background image is a true-color composite by MODIS bands acquired on December 31, 2016. (b) False-color image over the Jiangsu Shoal on the same day, which is a composite of GF-1 band 4(R), band 3(G), and band 2(B); the regularly distributed red strips are the seaweed aquaculture rafts while the irregular red slicks or patches are floating Sargassum. (c) Image of DVI that ranges from −0.090 to 0.076. (d) and (e) In situ photographs of Sargassum covering the seaweed facilities and in the turbid waters, respectively. (Xing et al., 2017)



Related studies have been conducted on distribution (Fig. 2.31), drifting pathway, inter-annual change and its genetic diversity.

Figure 2.31. The distribution and biomass of Ulva and Sargassum in the western Yellow Sea from April 2017 to June 2017.

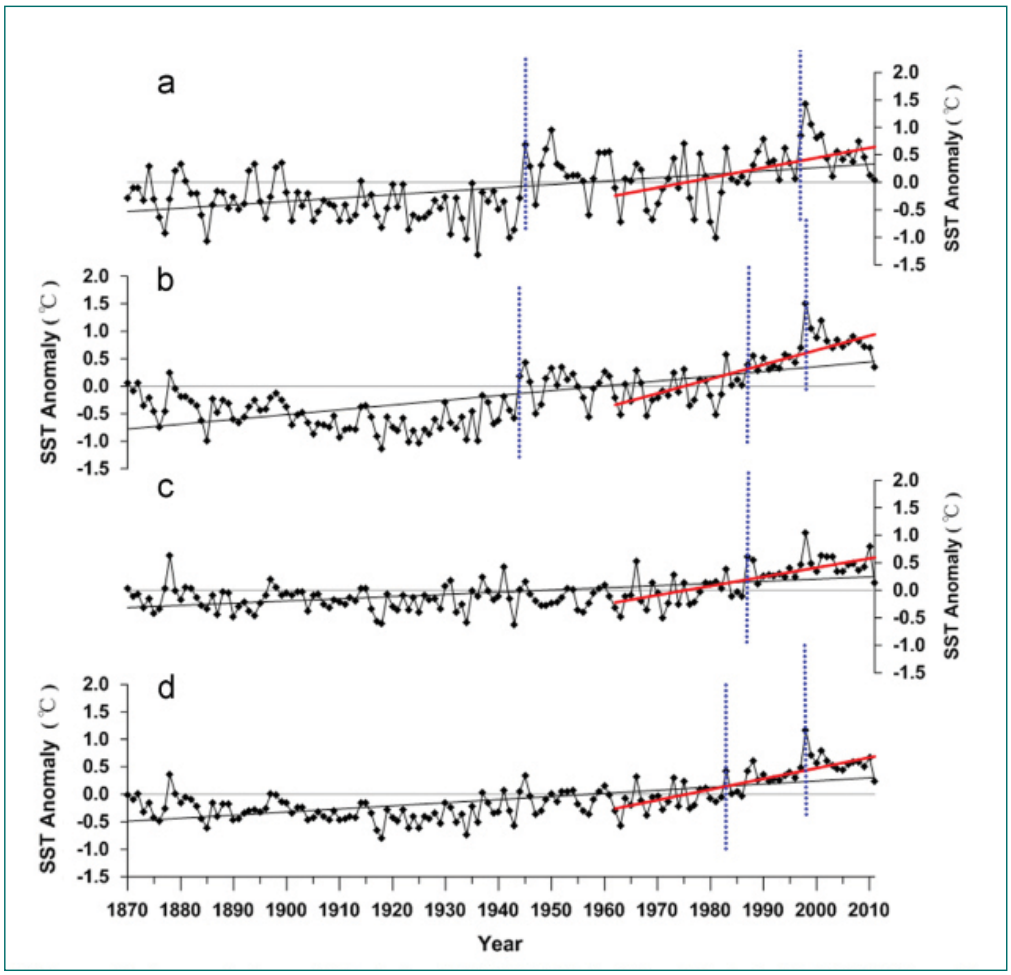


2.3.2.3 Adaptive management

Climate change is one of biggest challenges facing mankind in the 21st century. Climate change will greatly influence the marine ecosystem. **Figure 2.32** shows the estimated trend of sea surface temperature (SST) changes over almost three decades (1981 to 2009). All pixels in the study area demonstrated positive values from 0.01 to 0.08 °C year–1. The increasing trends during 1870–2011 reached 0.06 1C/10 yr for the whole region, 0.09 1C/10 yr for the East China Sea, 0.06 1C/10 yr for the Bohai and Yellow Sea, 0.04 1C/10 yr for the South China Sea, and all of the trends are significant at the 99% confidence level.

In the past 150 years, all the four areas show increasing trends of annual mean SST anomalies. **Figure 2.32** also indicates the linear trends of annual mean SST anomalies for the last 50 years, and shows the generally larger warming for the last 140 years for all the seas. (Bao et al., 2014)

Figure 2.32. Regional mean annual SST anomalies for marginal seas of China during 1870-2011. Black (red) lines indicate the latest 140 (50) years linear trends; blue dashed lines indicate regime shift years. (a) Bohai and Yellow Sea; (b) East China Sea; (c) South China Sea; (d) Whole region. All of the linear trends passed 99% significance test. (Bao et al., 2014)

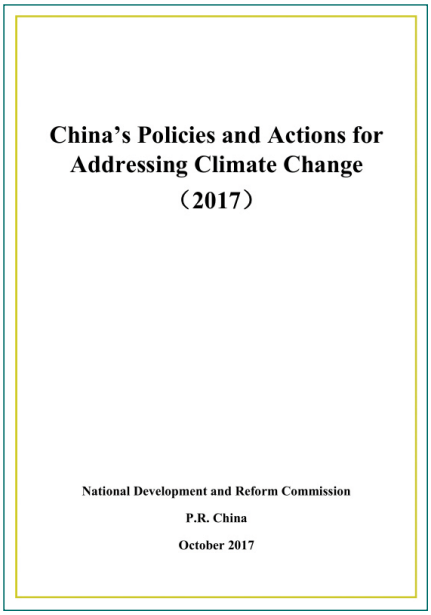


According to a research conducted in north YS, the plankton structure has greatly changed from 1959 to 2011. Some warm water species, such as: *Sagitta enflata* and *Doliolum denticulatum*, which were distributed in south YS in 1959, now distributed in north YS and has became a dominant species. (Zou et al., 2013).

The Chinese Government has always attached great importance to tackling climate change and strengthened the work on low-carbon development and climate change adaptation since the beginning of 13th Five-Year Plan (FYP) period (2016-2020). As an important part of the FYP for national economic and social development, the Work Plan for Controlling Greenhouse Gas Emissions During the 13th FYP Period has been formulated and implemented. Regional governments formulated and decomposed greenhouse gases (GHG) controlling targets, ministries and departments implemented policies and measures, sectors and enterprises took innovative actions, and the public participated actively.

In 2007, China published the National Climate Change Programme, in which the current status and forecasting of climate change in China, the effects of addressing climate change, challenge and influence of climate change, principle and targets of addressing climate change, and China's basic position on several questions were included. Then, China published the China's police and actions for addressing climate change in the following years (**Figure 2.33**). In 2013, China published the National Strategy for Adapting Climate Change. Then the three coastal provinces of YS also published their own plans for addressing climate change in 2009 by their provincial people's government. According to the China's police and actions for addressing climate change in 2016, the carbon intensity decreased by 6.6% from the 2015 level and the proportion of non-fossil energy sources increased to 13.3%.

Figure 2.33. China's policies and actions for addressing climate change, 2017.



To addressing the natural disaster, China published the National Emergency plan for natural disaster relief, the three coastal provinces of YSLME also prepared their own emergency plan for natural disaster.

China has launched several activities to adapt to climate change, such as improvement of the adaptation capacity in coastal zones and related sea areas. The SOA strengthened the planning and examination of sea use by construction projects and regions, and strictly restricted the occupation of important marine eco-spaces, including key eco-redlined areas such as key bays and important coastal wetlands and natural shorelines. In Shandong, Liaoning and Jiangsu provinces, the Yellow Sea Marine Ecological Redline Plan were also set up.

In Shandong Province, 151 redline zones were designated in Yellow Sea areas, in which 36 were development-prohibited zones and 115 were development-restricted zones. Development-prohibited zones include marine protected areas (MPAs), important estuary systems, important coastal wetlands. Important fishery areas were ascribed to development-restricted zones. The total area of redline zones were 3,134.84 km^2, which is 10.1% of the total Yellow Sea area of Shandong. Each redline zone has its own pollution control and management rule and environmental protection rule. By 2020, all the sewage outlets must meet the discharge regulations, no more new industry sewage outlets can be added, total amount of land-based pollutant discharged into sea will be reduced by 10-15%.

In Jiangsu Province, 73 eco-redline zones were designated, including MPAs, important estuary ecosystems, important coastal wetlands, important coastal recreational zones, important islands, and important fishery areas, et al. Total area is 9,676.07 km^2, equals to 27.83% of the sea area of Jiangsu Province.

In Liaoning Province, 52 eco-redline zones were designated. The total area is 6,796.9 km^2. Also, in YSLME area, the capacity building was also carried out to coupe with climate change. In 2016, SOA carried out the pilot monitoring of ecosystem response to climate change in the north Yellow Sea and the sea area of south Dalian, which laid the foundation for monitoring and evaluating the response of marine ecosystems to climate change in the country.

2.4 Habitat and species

2.4.1 Current status

Habitat loss, including degradation and fragmentation, is the most important cause of biodiversity loss globally. Natural habitats in most parts of the world continue to decline in extent and integrity, although there has been significant progress to reduce this trend in some regions and habitats. Reducing the rate of habitat loss, and eventually halting it, is essential to protect biodiversity and to maintain the ecosystem services vital to human wellbeing.

The ever-increasing population and human activity have profoundly changed the environment, which has experienced biodiversity decline, natural resource depletion, ecological degradation, and environmental pollution. Nature and environmental conservation have been advocated as the main approaches to mitigate these severe problems.

China, as the largest developing country, has experienced ecological degradation largely driven by an imbalance between high population and economic growth pressures as well as limited natural resource reserves and environmental capacity. The widespread ecological degradation has raised serious concerns from both the Chinese government and the general public. As a result, the Chinese government has launched several large-scale ecological rehabilitation and conservation programs since the late 1990s. With the promotion of these programs, China is becoming a greening nation. Here, greening means the process of ecosystem restoration as measured by the increasing greenness of land cover. The extended meaning of greening is the overall improvement of the ecological and environmental qualities of a region (UNEP, 2016).

Along with the greening trend, a paradigm of redlining in natural resource and ecosystem management has emerged. Here, redlining is the planning for natural resource use and conservation with certain targeting constraints, such as the lowest level of a natural resource or

ecosystem reserve that needs to be preserved. In the 11th five-year plan, China put forward Major Function Oriented Zoning (MFOZ) to optimize the spatial pattern of regional development and conservation. In 2010, the Chinese Central Government formally issued the MFOZ report, which demarcated the Development Prohibited Zones (DPZ, 12.5% of China's landmass) and Development Restricted Zones (DRZ, 40.2% of China's landmass). The DPZ include national nature reserves, national forest parks, national geo-parks, national tourism resorts, and world cultural and natural relics. Therefore, industrial and urban development is generally prohibited in DPZ to sustain good ecological functioning and environmental quality. With the establishment of new national nature reserves and parks, the DPZ will be enlarged accordingly. The DRZ are composed of 25 regions with high potential for ecological functions, including biodiversity conservation, freshwater provisioning, soil and nutrient conservation, and carbon sequestration. The DRZ hosts 8.5% of the human population in China, and the functional roles of the DRZ include ecological conservation and demonstrating the harmonization of human–nature relationships; subsequently, large-scale and intensive resource extraction, urbanization, and industrial development are highly restricted in DRZ.

The Government of China launched on 17 September 2010 the National Biodiversity Strategy and Action Plan (2011-2030) (abbreviated as "NBSAP"). Together with relevant national plans developed with a view to building an ecological civilization, NBSAP has provided a relatively comprehensive set of national targets for biodiversity conservation. According to the Fifth National Report on the Implementation of the Convention on Biological Diversity, in recent years China has been implementing several actions to conserve its biodiversity: Improving legal and regulatory system and institutional mechanisms; Launching and implementing a series of plans for biodiversity conservation; Strengthening conservation systems; Promoting sustainable use of biological resources; Conserving and restoring habitats; Developing and implementing incentives favorable for biodiversity conservation; Enhancing establishment of biosafety management system; Controlling environmental pollution; and Promoting public participation.

In 2015, the State Council issued the Suggestions on speeding up the construction of eco-civilization, in which strict guard on resource and environment redline, scientifically design the forestry, grassland, and wetland and marine redline were suggested. Then, in 2016, SOA issued the Suggestions on national-wide construction of the marine redline mechanism. Until now, the 11 coastal provinces/cities have established their marine redline designation. The marine redline mechanism has been fully established in China. More than 30% sea area under jurisdiction and 35% coastal line have been included in the redline paradigm.

Generally, there are two types of marine ecological redline areas: DPZ and DRZ. DPZ means the area prohibits any kind of development activity. It mainly includes core area and buffer area of nature reserve, and important protected area and reserve zone of marine special protected area. In nature reserve DPZ, no construction of production facilities is allowed. No organization or individual is allowed entry without special reason. In marine special protected area, the important protected area prohibits any construction project not related to protected area. In reserve area, human disturbance

is strictly controlled, no constructions allowed. Any production activities that might change the natural ecological condition will be prohibited.

Other areas of the MPAs, important estuary system, important coastal wetland, important fishery area, important sandy coastal line, special protected island, natural landscape and historical culture relics, and important coastal recreational areas were ascribed to development-restricted zones (DRZs).

Table 2.13 shows the Yellow Sea eco-redline designation in three provinces. In each province more than 10% of the sea area are designated as redline areas. Those area will be strictly protected. According to the redline design for Shandong, Jiangsu and Liaoning provinces, the development prohibited redline area bans all construction activities. The development restricted redline area strictly controls construction activities, reclamation is prohibited. This regulation will help prevent the habitat loss in YSLME area.

Table 2.13. Yellow sea eco-redline designation in three Provinces.

Province	Number	Area (km^2)	% of YS area in that Province
Shandong	151	3,134.84	10.10
Jiangsu	73	9,676.07	27.83
Liaoning	52	6,796.90	25.40

2.4.2 Efforts made since 2009

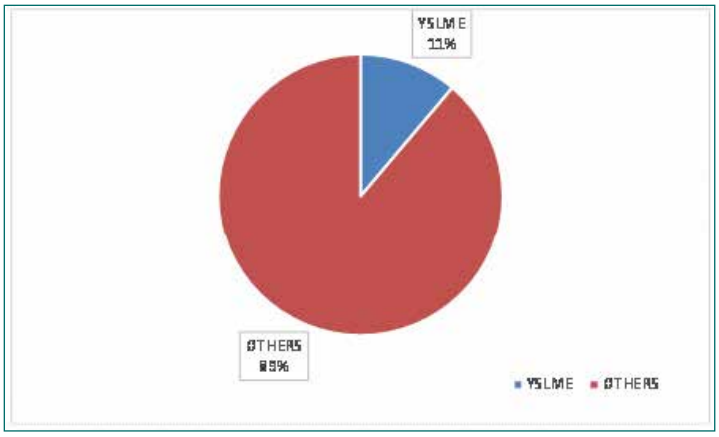
2.4.2.1 Coastal wetlands

Intensified human activities such as reclamation have been leading to severe wetland loss. According to the second national wetland resources survey, the YSLME area approximately accounts for 11.15% of the total wetlands in China. **Table 2.14** and **Figure 2.34** gives the information on the wetland in Shandong, Jiangsu and Liaoning Provinces.

Table 2.14. The wetland information in three YSLME coastal provinces.

Province	Area(million ha)	% of total wetland
Jiangsu	2.82	5.28
Shandong	1.74	3.25
Liaoning	1.39	2.61
Total	5.95	11.15

Figure 2.34. The percentage of wetland in YSLME region.



Currently, in China, 49 wetlands have been listed in to the International important wetland. Two wetlands are in YSLME region: The National Nature Reserve for Rare Birds in Yancheng, Jiangsu; and National Nature Reserve for David's Deer in Dafeng, Jiangsu. These were listed into the International important wetlands in 2002.

China launched several wetland conservation projects to mitigate the impact of reclamation. In Yellow Sea area, great effects have been made to prevent natural habitat loss. According to the redline policy in the three coastal provinces of YSLME, a total of 19,607.81 km^2 sea area were designated as DRZ or DPZ. According to the redline design in Shandong, Jiangsu and Liaoning provinces, the development prohibited redline areas banned all construction activities. The development restricted redline areas strictly control construction activities, reclamation is prohibited. This regulation will help prevent habitat loss in the YSLME.

The South Red and North Willow project is a wetland restoration project, implemented during the 13th FYP (2016-2020). Red means mangrove, while willow mainly means tamarix. This project is a wetland restoration project. In the south part of China, mangrove, seagrass, salt algae will be planted to restore the degrading wetland. In the North part, tamarix, reed and suaeda will be the main wetland restoration plants. By the end of the project, 2,500 ha of mangrove, 4,000 ha of reed, 1,500 ha of suaeda and 500 tamarix will be planted to restore the wetland.

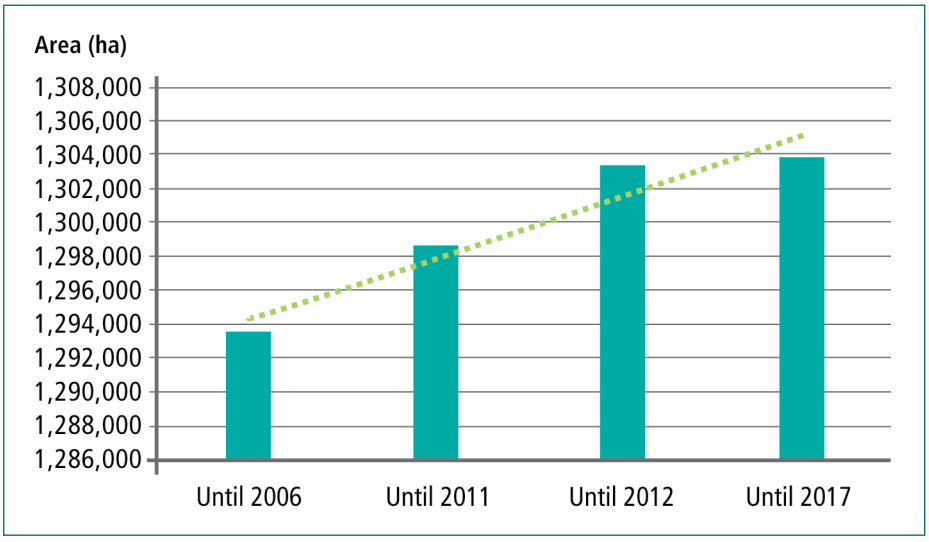
There are increasing protected wetlands in the YSLME region, as shown in **Figure 2.35**. The wetland protection areas are growing continuously. Before 2007, there are three wetland protection area, with a total area of $3.87x10^5$ ha. By the end of 2016, the number increased to nine and the total area was $4.22x10^5$ ha.

Figure 2.35. The increase in wetland protection MPAs from 2007 to 2016.

2.4.2.2 Priority endangered and threatened migratory species

In the YSLME area, more MPAs have been designated, aiming to protect rare marine species. Before 2006, the total area of this kind of MPA was 1,293,601 ha, until 2017, this number increased to 1,303,929.33 ha, indicating more rare species being protected (**Figure 2.36**).

Figure 2.36. The increase in area of rare marine species protection MPA after 2006.

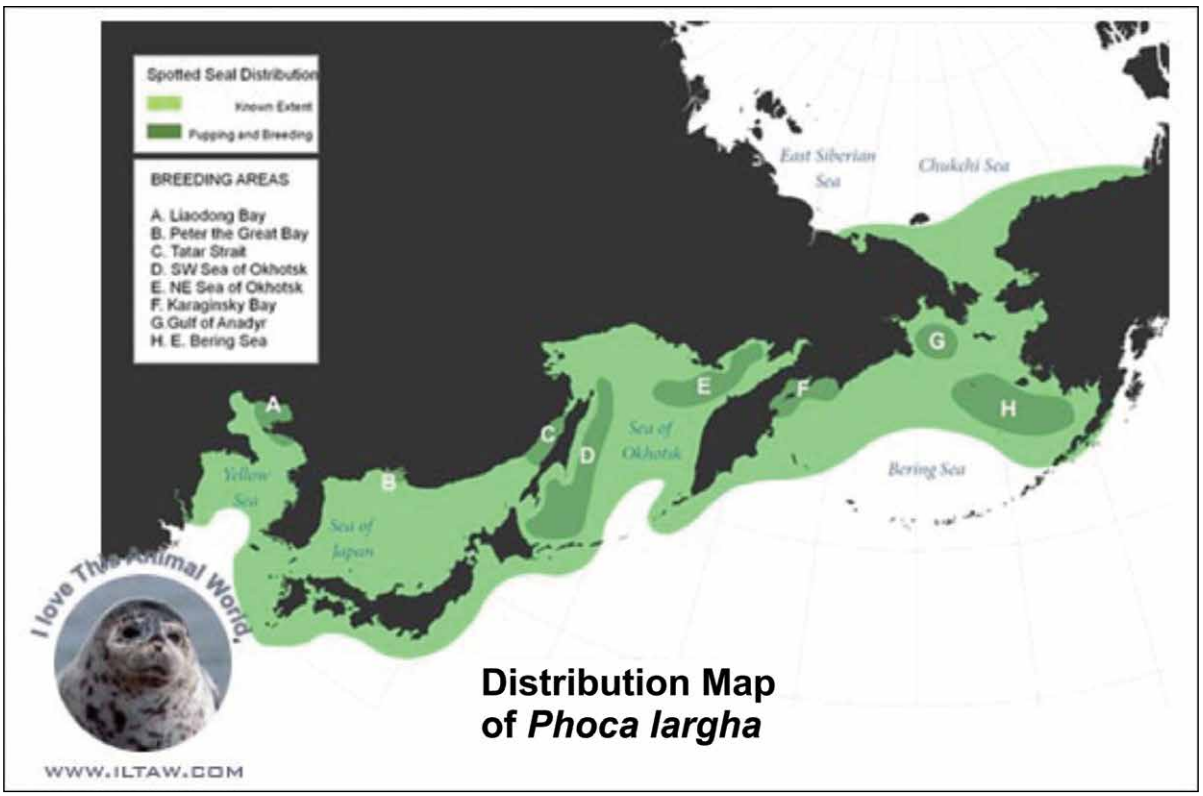


One of the best-known functions of wetlands is to provide a habitat for birds. Rudong wetland is critical to the survival of many migratory water bird species using the East Asian-Australasian Flyway (EAAF), by providing staging and over-wintering habitats for migratory waterbirds. Xiaoyangkou wetland is the most important habitat for waterbirds in China according to the recent study conducted by the Institute of Geographical Sciences and Natural Resource Research of Chinese Academy of Sciences (Xia et al., 2017): the study found that 67 of the 110 priority sites in accordance with the criteria of RAMSAR and Important Bird Areas lie outside protected areas, and some critical habitats for waterbirds are not covered in any type of protected area especially in Jiangsu. Xiaoyangkou wetland has an Irreplaceability index of 523.05, which is the highest value among wetlands studied. So the Xiaoyangkou wetland is the most important area of waterbirds conservation in China. Many rare birds can be found in the proposed protected area, such as: red-crowned crane, white crane, white-headed crane and grey crane. About 30 species were listed as first and second class national protected animals of China. In Rudong area, the recorded first class national protected animals are: oriental white stork, relict gull, white crane and red-crowned crane. According to the IUCN Red List of Threatened Species 2015, some critically endangered species can be found in this area, such as: spoon-billed sandpiper, Baer's pochard and white crane. Also, some endangered species were recorded in this area: oriental white stork, black-faced spoonbill, Nordmann's greenshank, red-crowned crane, eastern curlew and great knot. Currently, about 370 birds have been recorded in Xiaoyangkou area.

The effects of MPA construction can be seen by the increase rare species population, such as spotted seals.

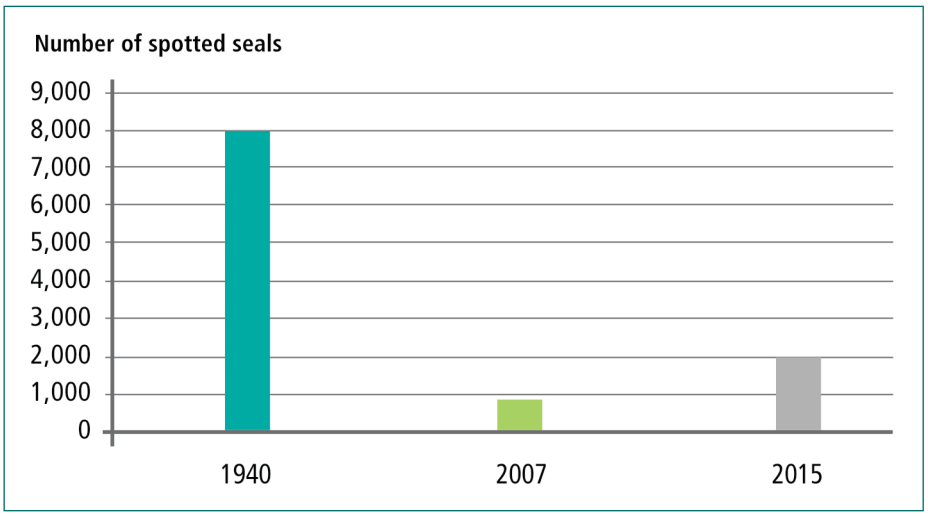
The spotted seal inhabits ice floes and waters of the north Pacific Ocean and adjacent seas. Liaodong Bay is one of its breeding areas (**Figure 2.37**). Historically, the spotted seal resource in Liaodong Bay was abundant, up to more than 8,000 in the 1940s. But, over-hunting and wetland habitat loss decreased their population dramatically. China listed it as second class protected animal and the National Nature Reserve for spotted seal in Dalian was designated in 1992. By 2007, the number of spotted seal was 890. Under the effects of the MOA, SOA, Spotted seal MPA, Liaoning Ocean and Fisheries Science Research Institute and all sectors of society, the recovery of spotted seal population is effective. According to a recent survey, in 2015, the number of spotted seals was 2,000 (**Figure 2.38**). China and Korea both pay attention to spotted seal protection. Satellite tracking indicates spotted seal bred in Dalian and then went southward to Korea (**Figure 2.39**). So more intense communication and cooperation among countries along its migratory route are needed, to enhance the ecological connectivity in YSLME. MOA published the spotted seal protection action plan (2017-2026). On March 29th 2017, a YSLME Phase II project seminar of spotted seal networking and conservation was held in Dalian, people from China, Korea, and all sectors of society joined this meeting, and the spotted seal protection alliance was founded (**Figure 2.40**).

Figure 2.37. The distribution map of spotted seal.



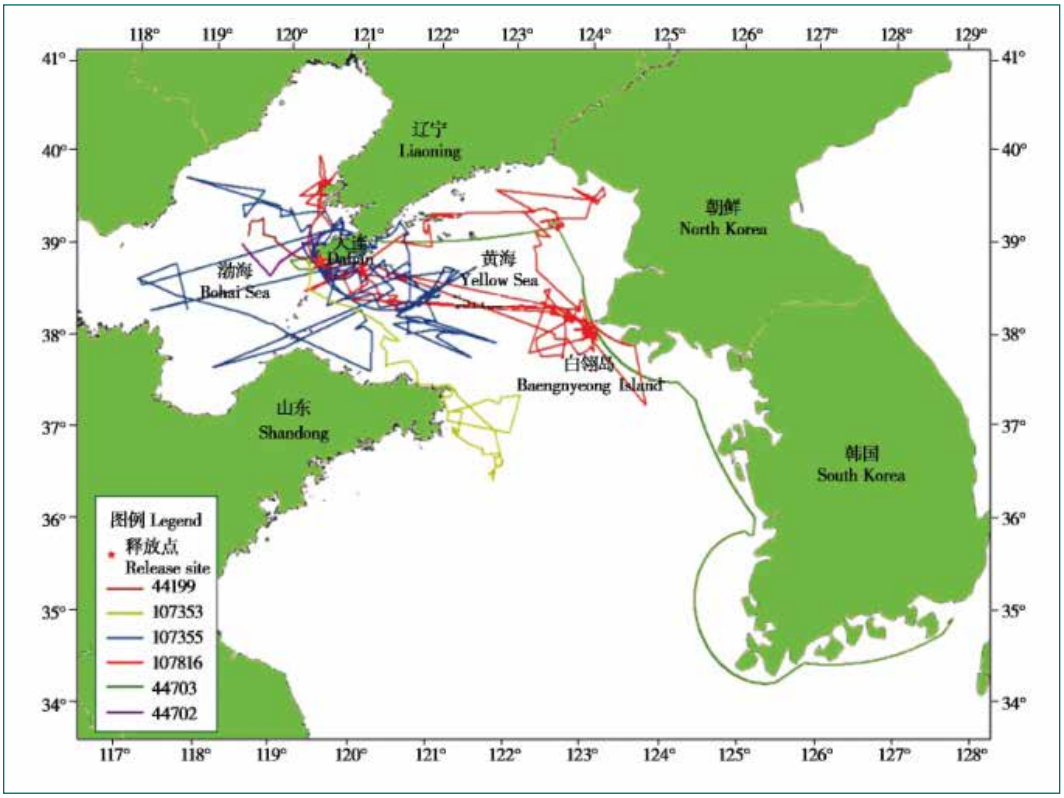
Source: www.iltaw.com

Figure 2.38. The long-term change in number of spotted seals in Dalian.



Source: 1940 and 2007 data are from Wang, et al., 2012. The 2015 data is from People.cn).

Figure 2.39. The movement route of spotted seal tracked by satellite telemetry tracking.



Different colors of route indicate seal with different Position Transmitting Tags.
Source: Han, et al., 2013

Figure 2.40. YSLME Phase II project seminar of spotted seal networking and conservation.

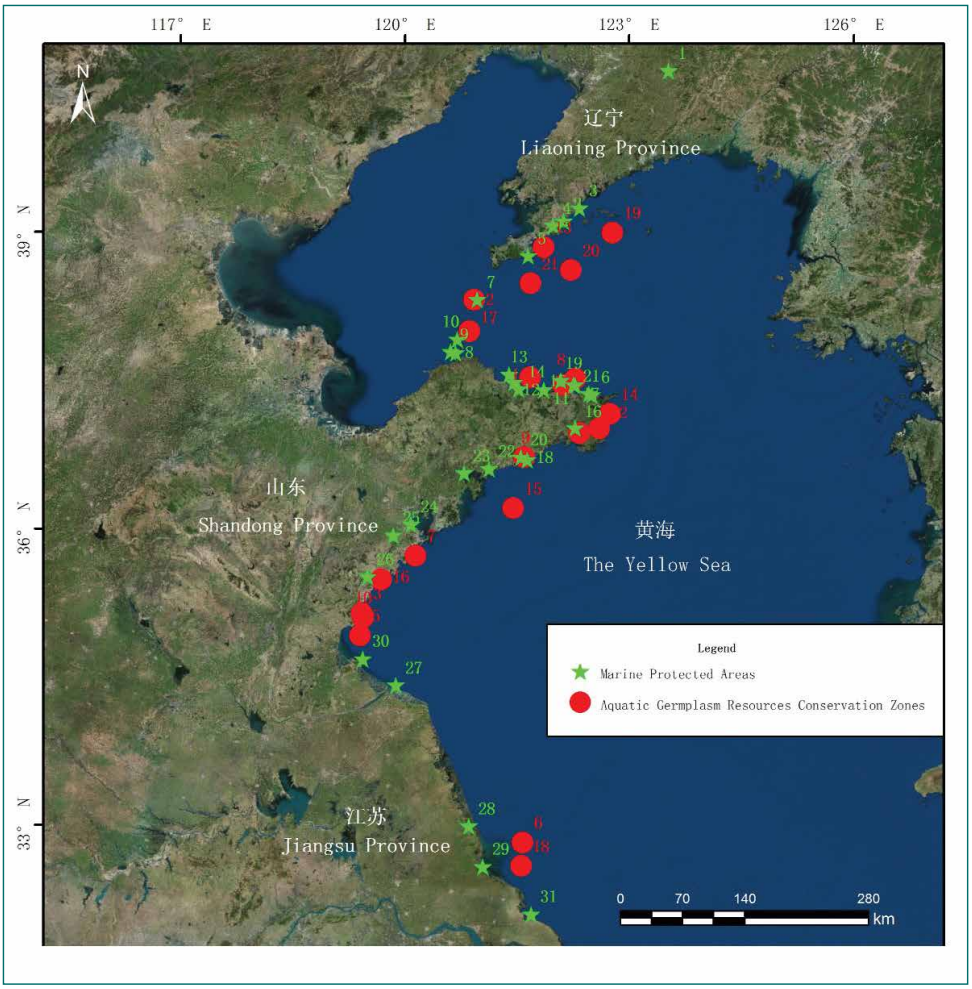
Table 2.15. The national level MPA targeted at rare marine species protection listed in chronological order.

No.	Name	Province	Area(ha)	Protection Target	Time of Approval
1	National Nature Reserve for Rare Birds in Yancheng, Jiangsu	Jiangsu	284,179	Rare birds and coastal wetland	1983
2	National Nature Reserve for David's Deer in Dafeng, Jiangsu	Jiangsu	2,667	David's deer and wetland ecosystem	1986
3	National Nature Reserve for Coastal Wetland in Yalu River Delta	Liaoning	101,000	Coastal wetland and waterbirds habitat	1987
4	National Nature Reserve for Yellow River Delta in Shandong	Shandong	153,000	Rare birds	1990
5	National Nature Reserve for Spotted Seal in Dalian	Liaoning	672,275	Spotted Seal	1997
6	National Nature Reserve for Shell Bay and Wetland in Binzhou, Shandong	Shandong	80,480	Rare birds	1999
7	National Marine Special Protected Area for Costal Wetland in Wulong River Estuary Laiyang, Shandong	Shandong	1219	Coastal wetland and rare birds	2011
8	National Marine Park in Liugong Island	Shandong	3828	Rare birds	2011
9	National Marine Park in Xiaoyangkou, Jiangsu	Jiangsu	4700	Rare bird habitat	2012
10	National Marine Park in Laishan, Yantai	Shandong	581.33	Rare marine organisms germplasm repository	2016

2.4.2.3 Marine Protected Area

In 2012, the State Council authorized the National Marine Functional Zoning (2011–2020), setting a goal to improve the marine environment with an expansion of the MPA coverage in the sea areas under national jurisdiction to 5%. Until the end of 2016, there were 31 national level MPAs, and 21 National level Aquatic Germplasm Resources Conservation Zones in the Yellow Sea area. And this number will keep increasing to reach the 5% goal. (See **Figure 2.41**)

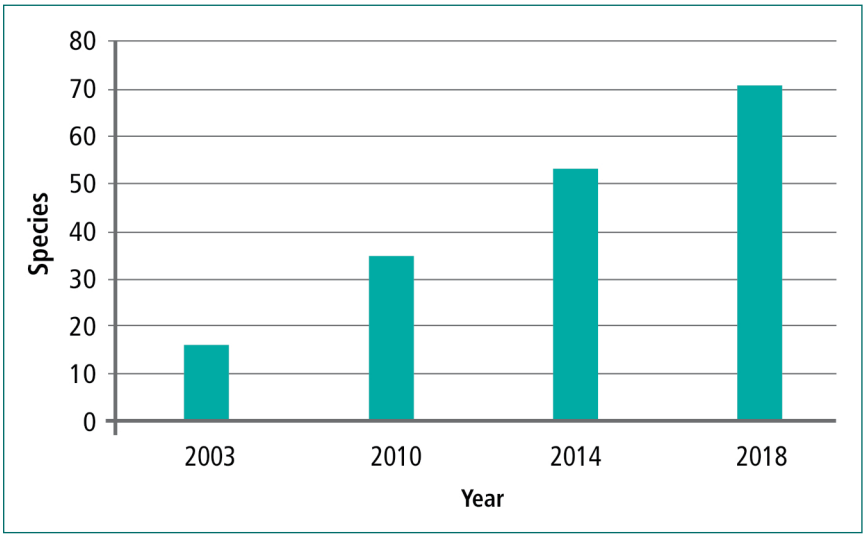
Figure 2.41. National level MPA and Aquatic Germplasm Resources Conservation Zones in YS.



2.4.2.4 Invasive Alien Species

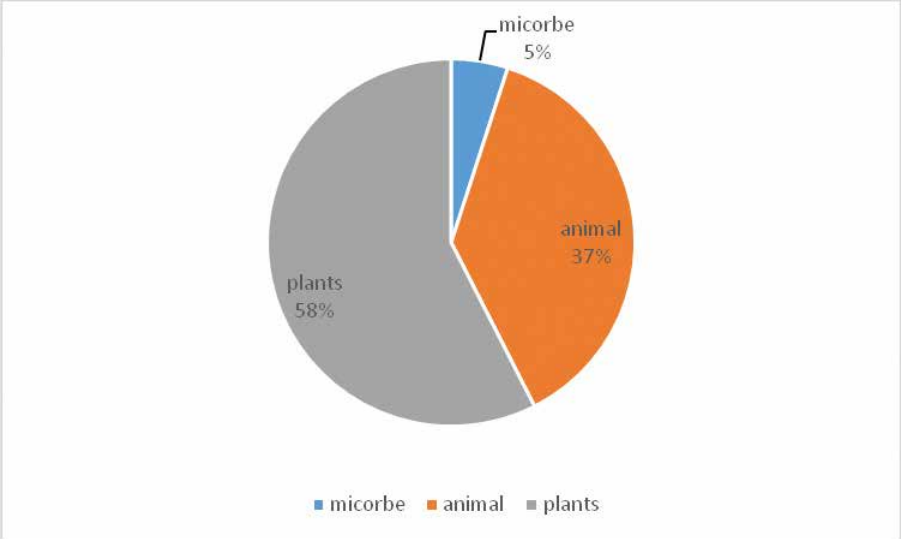
Invasion of alien species is one of the main causes of biodiversity loss. China is one of the countries in the world most severely affected by invasion of alien species. Due to China's vast land area that covers nearly 50 latitudes and 5 climatic zones, as well as diversity of its ecosystems, China is more vulnerable to invasion of alien species, and species from any part of the world may find suitable habitats in China. In 2003, 2010, 2014 and 2018, China published four batches of invasive species with severe impact to the ecosystem. The species newly included into this list in each batch was 16, 19, 18 and 18 respectively (**Figure 2.42**).

Figure 2.42. The increase in the number of invasive species in China with severe impact to the ecosystem.



According to Bai and Ma, 2015, the number of marine invasive species in YSLME was 120, in which, 6 species were microbes, 45 species were animals and 69 species were plants.

Figure 2.43. The marine invasive species composition in YSLME.



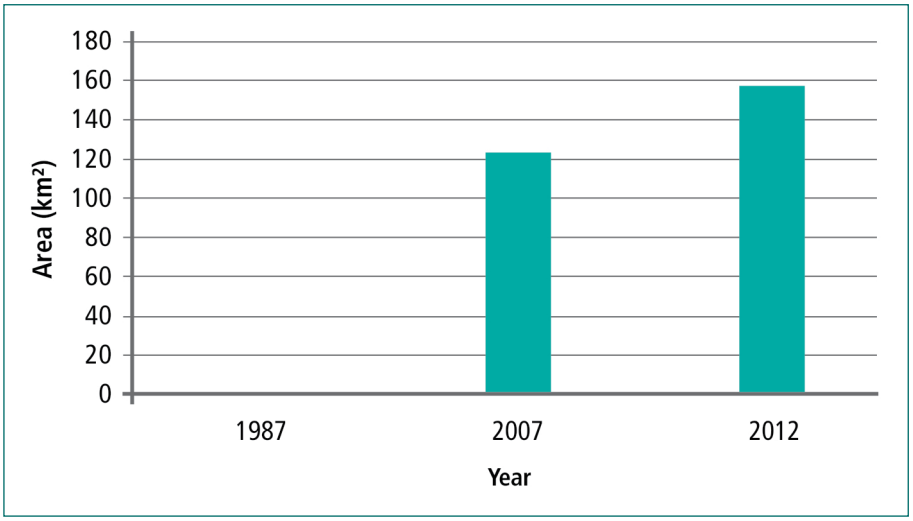
S.alterniflora (**Figure 2.44**) is listed in the first batch of China invasive species list. It was originally distributed in the coast of the American Atlantic. It was introduced into China from U.S. in 1979 for its ability in ecological restoration. But, due to its strong adaptability and high reproduction, it spread extensively in the coast of China, especially in Jiangsu coastal wetland, resulting in significant impact on wetland ecosystem health and safety.

Figure 2.44. *Spartinaalterniflora*.

Source: https://baike.so.com/doc/6533705-6747443.html)

According to Wang et al., 2018, the area of *S. alterniflora* was only 0.49 km^2 in 1985, then in 2007, it was as high as 123.17 km^2, in 2012, the expansion was still increasing, with an area of 153.8 km^2 (**Figure 2.45**).

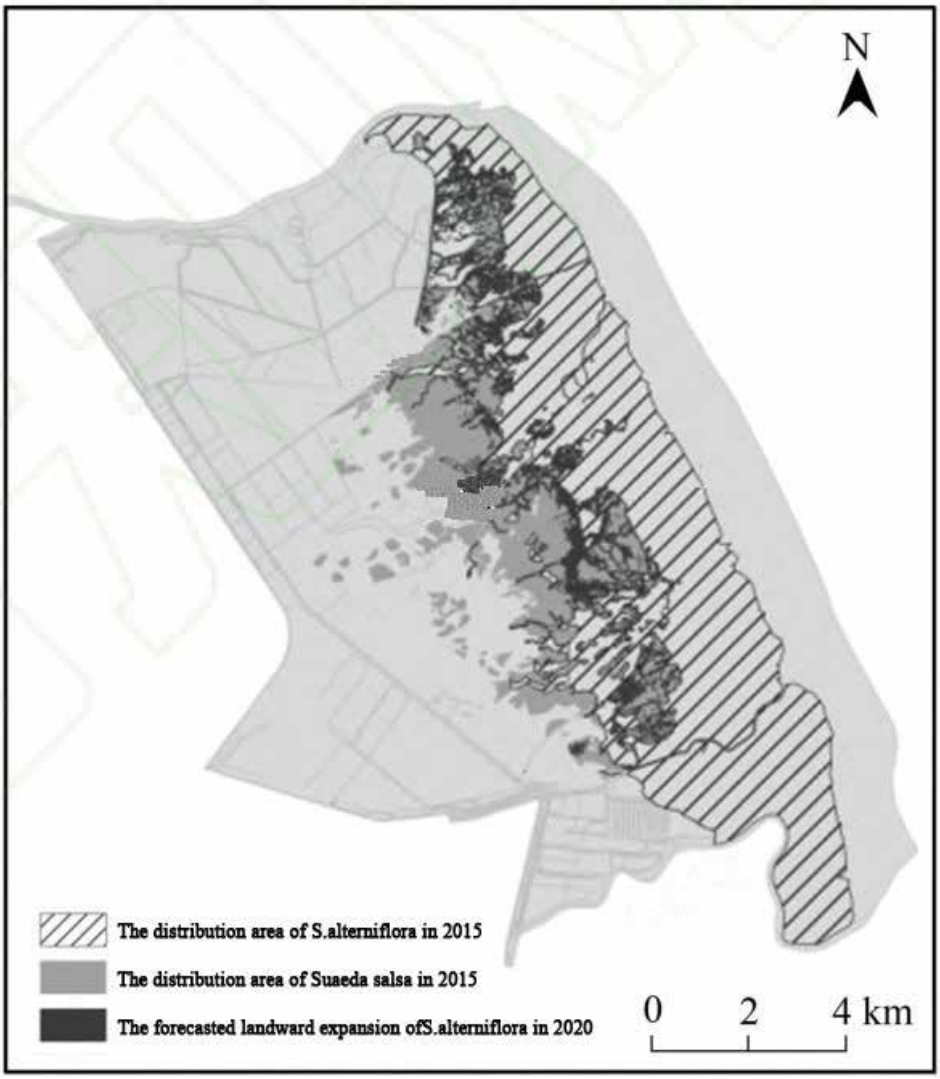
Figure 2.45. The area of *S. alterniflora* in Yancheng, Jiangsu.



Source: Wang, et al., 2018.

According to a study conducted in the core area of Yancheng National Nature Reserve (Wang et al., 2018), over the period of 2006 to 2015, patch density of *S. alterniflora* was increasing. In the study area, the expansive rate of *S. alterniflora* was 1.35 km^2/year. Also, the forecast of its expansion trends was also conducted. **Figure 2.46** shows the forecasted landward expansion trend. In 2020, more than 11.45 % area of *Suaeda salsa* will be occupied compared with 2.28% in 2016.

Figure 2.46. The forecasted landward expansive trend of S. alterniflora in year 2020.



In this figure, the slash area was the distribution area of *S. alterniflora* in 2015, the dark grey area was distribution area of *Suaeda salsa* in 2015, the black area is the forecasted landward expansion of *S. alterniflora* in 2020.
Source: Wang, et al., 2018.

3

China's developments in policy and legal framework

3.1 Institutional development

Ecological civilization was listed along with economic, political, cultural and social progress as one of the five goals in the country's overall development plan at the 18th National Congress of the Communist Party of China in 2012.The key tenets of ecological civilization include the need to respect, protect and adapt to nature; a commitment to resource conservation; environmental restoration and protection; recycling; low-carbon use; and sustainable development. Lucid waters and lush mountains are as valuable as gold and silver.

The 13th FYP period is crucial for China to accelerate eco-civilization construction and to complete the construction of the moderately prosperous society. The key tasks include developing a green economy to promote economic transformation and upgrading, improving efficiency of energy and resource to build an environment-friendly and resource-efficient society, implementing ecological construction projects to promote ecosystem services capability, solving outstanding environmental problems that threaten people's health, setting and strictly observing ecological redline, promoting new-type urbanization to coordinating urban and rural development, carrying out national ecological assets accounting and building up monitoring platform for ecological assets, carrying out national ecological civilization new culture movement, and implementing national science and technology major project of ecological civilization. China set up several goals for marine eco-civilization to be achieved during its 13th FYP (2016-2020). During the 13th FYP, more than 2,000 km shoreline and 66 bays will be remediated, more than 85 km^2 coastal wetland will be restored. Expansion of the MPA coverage in the sea areas under national jurisdiction to 5%. China has been implementing three major ecosystem restoration projects during the 13th FYP:

Blue bay project: 25.9 hundred million RMB was approved for 18 coastal cities to conduct blue bay actions. This project plans to restore the key bays and island with important ecological values. Aiming that 70% of the seawater quality is better than standard level 2, remediation of 400 km sand beach, repair 400 k ha damaged sea area. Twelve coast parks will be built and 300 km landscape will be constructed.

South Red and North Willow project: red means mangrove, while willow mainly means tamarix. This project is a wetland restoration project. In south part of China, mangrove, sea grass, salt algae will be planted to restore the degrading wetland. In the North part, tamarix, reed and suaeda will be the main wetland restoration plant. By the end of the project, 2,500 ha of mangrove, 4,000 ha of reed, 1,500 ha of suaeda and 500 tamarix will be planted to restore the wetland.

Ecological reef project: China will conduct restoration on damaged island, plant, shoreline, sandy beach, survey and nursery on island, rare and endangered animal and plant habitat in order to restore island and surrounding water ecosystem service function.

With all these effects of China, it is believed that in the near future, China will reach her long term marine eco-civilization goal of "clear water, green shoreline, clean beach, beautiful bay, abundant bioresources".

Gulf chiefs – China has been launching a new mechanism to protect marine ecology. China has initiated a pilot mechanism of appointing "gulf chiefs" to tackle pollution on coastlines and offshore areas. The protection mechanism for maritime pollution control outlined by the SOA is similar to the approaches of "river chiefs" and "lake chiefs" which have been widely adopted nationwide since 2016 and have achieved visible results in combatting pollution. Under the mechanism, top officials at provincial, city, county, and township levels are appointed as chiefs, accountable for the effects of water pollution control. The SOA selected the province of Zhejiang and cities of Qinhuangdao, Qingdao, Lianyungang, and Haikou to pilot the gulf-chief mechanism at the start of 2017.The pilot should be extended and expanded in the near future, and a national standard system to evaluate the work of gulf chiefs should be established based on the pilot results.

Ecological redlines – The State Council, China's Cabinet, recently approved a plan to establish ecological redlines in 15 provinces, municipalities and autonomous regions. The State defines ecological redline for strict protection on key ecological functional zones, areas of sensitive and fragile ecological environment. In 2017, a report by the UN Environment Programme, titled "Strategy and Actions of China's Ecological Civilization", offered an explanation of the model and highlighted innovations such as the "ecological redline" — boundaries imposed to prevent construction or other human activities within specified areas, aimed at allowing flora and fauna to develop naturally. The marine ecological redlines in China were clearly defined in 2011, which is an important safeguard for the sustainable development of marine economic growth and sustainable utilization of marine resources.

3.2 China's Compliance of International Conventions– from the Perspective of a Legal and Regulatory Framework

The report examined the legal systems established by the major international legal instruments on marine environmental protection and sustainable use of marine resources, including: (1) United Nations Convention on the Law of the Sea; (2) Convention on Biological Diversity and its protocols; (3) Convention on Wetlands of International Importance Especially as Waterfowl Habitat; (4) United Nations Framework Convention on Climate Change and its protocols; and (5) FAO Code of Conduct for Responsible Fisheries.

Through the study of the issues discussed recently in conferences organized by each convention, it was found that there were many common and intercrossed topics: Conservation and management of living marine resources, especially fishery resources and control of pollution are topics discussed constantly; integrated management, spatial planning and EIA are tools recommended frequently; the importance of monitoring, assessment, sharing of information, cooperation, public participation and enhancing scientific knowledge are addressed; ecosystem-based approach, precautionary approach and area-based approach are introduced; and the effects of climate change on marine environment, biodiversity, wetland protection and fishery resources are discussed widely.

The People's Republic of China, as a contracting party of the above international conventions, has been working to improve national laws, regulations and policies to fulfill the obligations under those conventions. After 20 to 30 years of construction, PR China has set up a basic legal and regulatory framework for the conservation of the marine environment and sustainable use of living resources.

The fundamental legislation in the marine environmental protection area is the Marine Environment Protection Law of PR China, which provides an overall regulation on pollution control, ecosystem protection and resources conservation. To supplement, laws and regulations include:

- On the management of living resources: Fisheries Law and Wild Animal Conservation Law;
- On the protection of biodiversity and wetlands: Island Conservation Law, Regulation on the Management of Nature Reserves, Rule for Management of Marine Special Protected Areas and Rule for Wetland Protection;
- On spatial management: Law on the Administration of Sea Areas; and
- Other laws, such as Law on Prevention and Control of Water Pollution, Law on Prevention and Control of Air Pollution, Environmental Impact Assessment Law, Planning Law, that relate to or provide useful tools for the protection and conservation of marine environment and resources.

In order to implement the laws issued by the National People's Congress and its Standing Committee, or to regulate the issues which have not been addressed in the current laws, the State Council, administrative departments of central government, local people's congress and local people's government issued about 80 regulations and rules of all levels, which, to a large extent, enriched the legal system on marine environmental protection.

Besides the laws, the Government of China has issued a variety of national policies and plans, and launched a number of projects to protect the marine environment, e.g., nearshore pollution control plan, blue bay environmental improvement project, the cross-sectoral working mechanisms to implement the CBD, marine ecological monitoring zone, marine ecological redline, ecological island and reef project, wetland restoration projects, national plan on marine functional zoning, national plan on the proliferation and releasing of aquatic living resource,s and marine inspection system, etc.

Although laws and policies have been much improved in the last ten years, there are still some gaps existing which prohibit China from fully implementing its obligations in the international conventions and protect its marine environment and resources. The gaps include:

- Lack of an ecosystem-based point of view;
- Lack of laws in certain areas, e.g., national regulation on wetland conservation, national regulation on mariculture, laws to mitigate climate change, laws to prevent and control of marine debris;
- Lack of detailed implementation rules, e.g., implementation rules on fishery, control of invasive species in wetland protection, marine ecological protection compensation system, etc.;
- Lack of a cross-sector implementation mechanism; and
- Lack of international cooperation in developing laws and policies.

In order to address the above gaps, it is suggested that the following legal improvements should be carried out:

- Develop a cross-sector implementation mechanism by: (1) establishing an International Convention Implementation Committee as an ad hoc body to deal with the overall implementation of the environment-related international convention; and (2) by requiring different administrative sectors to coordinate with each other, both in information sharing and strategy development through regular or specific meeting mechanisms.
- Enhance the legal system on risk assessment by: (1) expanding the EIA to cover the risk assessment for major environmental decisions; (2) strengthening the legal system on marine observation, disaster forecasting and risk assessment.

- Improve cooperation in developing laws, policies, guidelines with neighboring countries.
- Establish regulations on prevention and control of marine debris by: (1) improving the laws on solid waste control and cleaner production; (2) strengthening the planning system in coastal zone management.
- Improve laws on the protection of marine biodiversity by: (1) establishing rules on how to build and manage the MPA network; (2) establishing rules on the selection and management of a marine national park.
- Upgrade laws on the protection of wetlands.
- Improve fisheries law by: (1) establishing implementation rules on TAC, mesh size and fishing methods; (2) amending the Implementation Rules on Fisheries Law; (3) enhancing legal systems on mariculture, e.g., the EIA system, pollution control system, invasive species control system and mariculture permit system.

Strengthen laws to address climate change adaption by enacting a coastal zone management law.

As a contracting party of the mentioned international conventions, the legislative body and governments of PR China have been working very hard to improve national laws, regulations and policies to fulfill the obligations under those conventions. After 20 to 30 years of construction, PR China has set up a basic legal and regulatory framework for the conservation of the marine environment and sustainable use of living resources.

3.2.1 Laws Issued by the National People's Congress and Its Standing Committee

The fundamental legislation in the marine environmental protection area is the Marine Environment Protection Law of PR China, which provides an overall regulation on pollution control, ecosystem protection and resources conservation. To supplement that, several legislations were formulated, such as:

- On the management of living resources: Fisheries Law and Wild Animal Conservation Law;
- On the protection of biodiversity and wetland: Island Conservation Law, Regulations on the Management of Nature Reserves, Rule for Management of Marine Special Protected Areas and Rule for Wetland Protection;
- On spatial management: Law on the Administration of Sea Areas; and
- Other laws: Law on Prevention and Control of Water Pollution, Law on Prevention and Control of Air Pollution, Environmental Impact Assessment Law, Planning Law, and others that relate to or provide useful tools to the protection and conservation of marine environment and resources.

3.2.1.1 The Marine Environment Protection Law

The Marine Environment Protection Law of PR China has undergone three amendments (1999, 2013 and 2016) since its promulgation on August 23, 1982. The law currently has 10 chapters, including: (1) General Provisions, Supervision and Control over the Marine Environment; (2) Marine Ecological Protection; (3) Prevention and Control of Pollution Damage to the Marine Environment Caused by Land-based Pollutants; (4) Prevention and Control of Pollution Damage to the Marine Environment Caused by Coastal Construction Projects; (5) Prevention and Control of Pollution Damage to the Marine Environment Caused by Marine Construction Projects; (6) Prevention and Control of Pollution Damage to the Marine Environment Caused by Dumping of Wastes; (7) Prevention and Control of Pollution Damage to the Marine Environment Caused by Vessels and Their Related Operations; (8) Legal Liabilities and Supplementary Provisions, for a total of 97 articles. The law is PR China's basic law for the protection of marine environment.

1. Management System of Marine Environment Protection

The Law established the management system of marine environment protection of PR China. It provides that the administrative department in charge of environment protection under the State Council, shall guide, coordinate and supervise the nationwide marine environment protection work and be responsible for preventing and controlling marine pollution damages caused by land-based pollutants and coastal construction projects. SOA shall be responsible for supervision and control over the marine environment, organizing survey, surveillance, supervision, assessment and scientific research of the marine environment and be responsible for the nation-wide environment protection work in preventing and controlling marine pollution damages caused by marine construction projects and dumping of wastes in the sea.[14] The other departments, such as department in charge of maritime affairs, fisheries, armed forces, etc., shall be responsible for the supervision and control over marine pollution within their own limits of power.[15]

2. General Regulations

The law established many legal systems on the protection of the marine environment. On spatial planning, the law established the marine functional zoning system and environmental protection planning system. The marine administrative department shall work out a national marine functional zonation scheme according to the national major marine functional zoning plans.[16] And in

[14] However, according to the Plan for Restructuring State Council issued in March 2018, the responsibility to protect the marine environment, including pollution control has been transferred to the Ministry of Ecology and Environment from the State Oceanic Administration.

[15] Marine Environment Protection Law, Art. 5.

[16] *Ibid.* Art. 7

accordance with the marine functional zonation scheme, the State shall draw up a national marine environment protection plan and regional marine environment protection plans in key sea areas.[17]

On ecosystem protection, the law set up the ecological redlines system, which requires the State to delineate the red lines of ecological importance in key marine ecological function zones, ecologically-sensitive areas and fragile areas, and other sea areas to conduct strict protection.[18] The law also established the marine nature reserves system[19] and the ecological compensation system.[20]

On pollution control, the law set up the marine environmental quality standard system, total quantity control system and regional limits system. For the key sea areas where the State has established and put into practice the system of controlling the total sea-disposed pollution discharge, the standards for controlling the total sea-disposed main pollutants discharge shall also be taken as an important basis in determining the water pollutant discharge standards. In key sea areas where the indicators for the control of the total quantity of key pollutants discharged into the sea are exceeded, the environment protection administrative departments shall suspend the approval of the environmental impact reports (forms) for the construction projects which will newly increase the total quantity of corresponding types of pollutants discharged into the sea.[21]

On fisheries, the law requires the State to develop an ecological fishery system, popularize multiform ecological fishery production methods and improve marine ecological conditions. In mariculture, breeding density shall be scientifically determined, bait and manure shall be rationally spread, medicines be accurately applied, and pollution to the marine environment be prevented.[22]

3. Prevention and Control of Pollution

Prevention and control of pollution is a core part of the Marine Environment Protection Law, which is stipulated in five chapters separately as: (1) Prevention and Control of Pollution Damage to the Marine Environment Caused by Land-based Pollutants; (2) Prevention and Control of Pollution Damage to the Marine Environment Caused by Coastal Construction Projects; (3) Prevention and Control of Pollution Damage to the Marine Environment Caused by Marine Construction Projects; (4) Prevention and Control of Pollution Damage to the Marine Environment Caused by Dumping of Wastes; and (5) Prevention and Control of Pollution Damage to the Marine Environment Caused by Vessels and Their Related Operations. The 2016 revision of the law specifically requires that

17 *Ibid.* Art. 8
18 *Ibid.* Art. 3
19 *Ibid. Art. 21*
20 *Ibid. Art. 24*
21 *Ibid. Art. 11*
22 *Ibid. Art. 28*

Vessels and their relevant operations shall take effective measures to prevent marine environment pollution, while increasing the provisions. "An administrative department of maritime affairs and other relevant departments shall strengthen the supervision and administration of vessels and their relevant operations."[23] To implement the provisions of the Marine Environmental Protection Law, the State Council formulated the following regulations respectively:

a. Administrative Regulation on the Prevention and Control of Pollution Damages to the Marine Environment by Vessels (Revised in 2017).
b. Administrative Regulation on the Prevention and Control of Pollution Damages to the Marine Environment by Coastal Engineering Construction Projects (Revised in 2017).
c. Administrative Regulation on the Prevention and Treatment of the Pollution and Damage to the Marine Environment by Marine Engineering Construction Projects (Revised in 2017).
d. Regulations of PR China on the Control over Dumping Wastes into the Sea Waters (Revised in 2017).
e. Regulations on Prevention of Environmental Pollution by Ship Breaking (Revised in 2017).
f. Regulations of PR China Concerning Environmental Protection in Offshore Oil Exploration and Exploitation.

For maritime pollution incidents, the law requires the State to draw up State contingency schemes to cope with major marine pollution accidents.[24]

5. Others

The law also provides regulations on the development of science and technology, environmental monitoring and supervisory, EIA, information disclosure and the development of the comprehensive marine information system, etc.[25]

3.2.1.2 The Fisheries Law

Adopted at the 14th Meeting of the Standing Committee of the National People's Congress and promulgated by Order No. 34 of the President of PR China on January 20, 1986, the Fisheries Law has been amended four times, in 2000, 2004, 2009 and 2013. The Law includes six chapters, namely: General Provisions, Aquaculture, Fishing, Increasing and Protection of Fishery Resources, Legal Liability, and Supplementary Provisions.

The Law calls for a simultaneous development of aquaculture, fishing and processing, with a special emphasis on aquaculture,[26] and established the unified leadership of the Fisheries Bureau

[23] *Ibid.* Art. 5
[24] *Ibid.* Art. 18
[25] *Ibid.* Art. 13, 14, 16, 43
[26] The Fisheries Law of People's Republic of China, Art. 3

under the Ministry of Agriculture and decentralized administration system of the fishery department and subordinate fishery superintendence agencies.[27]

The Law sets up the basic legal systems in aquaculture and fishing industry, including the aquaculture permit system, total allowable catch system and fishing permit system. Individuals who wish to carry out aquaculture need to get permit from the local government on both the breeding production and the right to use sea areas.[28] In the ocean fishery industry, the State determines the total fishable amount of the fishery resources and implements a fishing quota system in accordance with the principle that the fishing amount shall be lower than the increasing amount of the fishery resources. The total amount of the fishing quota is distributed level by level to local governments and reflected in the fishing permit granted by the fishery administration. Fishing permits may not be sold, leased or transferred by other illegal means, and they may not be altered.[29]

Another major legal system in Fisheries Law is the fish banning system. It is prohibited to go fishing in the banned fishing areas or within the banned fishing periods. It is prohibited to sell illegally fished fishing gains in the banned fishing areas or within the banned fishing periods.[30]

There are also regulations in place on breeding density, fertilizer and medicament usage, net size, fishing methods, germplasm resources protection areas, etc., in order to protect the fishery resources and marine environment.

3.2.1.3 The Law on the Administration of Sea Areas

Adopted at the 24th meeting of the Standing Committee of the National People's Congress on October 27, 2001, the Law on the Administration of Sea Areas has entered into force on January 1, 2002.

The Law established the functional zoning system on the sea and requires that the use of sea areas shall be in conformity with the functional zones of the sea. The use of seas which changes the natural attribute of sea areas such as reclamation shall be strictly controlled.[31]

The State Oceanic Administration and other relevant administrative departments of the State Council, together with the governments of the coastal province, autonomous region and municipality, shall develop the national functional zoning plan of sea areas, and the marine

[27] *Ibid.* Art. 7

[28] *Ibid.* Art. 11

[29] *Ibid.* Art. 20-23

[30] *Ibid.* Art. 30

[31] The Law of the People's Republic of China on the Administration of Sea Areas, Art. 4

administrative departments of the local government shall elaborate the national plan based on the local conditions to develop the local zoning plan.[32] The functional zoning plan shall consider: (1) the natural attributes of the sea area including the location, natural resources and natural environment, etc.; (2) the use of the seas by various industries in accordance with the demand of economic and social development; (3) the protection of ecological environment, sustainable utilization of sea areas and the development of the marine economy; (4) the security of maritime traffic; and (5) national security.[33]

3.2.1.4 The Island Protection Law

In order to protect the ecosystems of islands and their surrounding waters, rationally develop and exploit the natural resources of islands, protect the oceanic rights and interests of the state, and promote sustainable economic and social development, the Island Protection Law of PR China was adopted at the 12th session of the Standing Committee of the 11th National People's Congress on December 26, 2009, and came into force on March 1, 2010.

The Law clearly set down the principle of "scientific planning, giving priority to protection, rational development and sustainable utilization" to islands. To implement "scientific planning", the law requires the State Council and the coastal local people's governments at all levels to include the protection and rational development and utilization of islands in the national economic and social development plan, and take effective measures to strengthen the protection and administration of islands and prevent the ecosystems of islands and their surrounding waters from being damaged.[34]

The Law, for the first time, gives priority to protection rather than development. In general, governments at all levels shall take measures to protect the natural resources, natural landscapes, and historical and cultural relics of islands. It is prohibited to change the coastlines of islands in natural reserves, to excavate or destroy coral and coral reefs and to fell mangroves in the surrounding waters of islands.[35] The state shall protect island vegetation, and promote the conservation of freshwater resources of islands.[36] The state shall also conduct registration of species on islands, and protect and manage the biological species on islands.[37]

According to the principle of "rational development and sustainable utilization", the Law puts islands into three categories, namely: inhabited island, uninhabited island and island for special

[32] *Ibid.* Art. 10
[33] *Ibid.* Art. 11
[34] The Island Protection Law. Art. 3
[35] *Ibid.* Art. 16
[36] *Ibid.* Art. 17
[37] *Ibid.* Art. 19

purpose. For inhabited island, investigation and assessment shall be made on the land resources, water resources and energy status of the islands to decide the environmental capacity of the island and total pollutant discharge amount. Priority shall be given to the use of renewable energy such as wind, ocean, solar and other renewable energy, as well as rainwater harvesting, seawater desalination, sewage recycling and other technologies. To protect the habitats of marine life and prevent the degradation of island vegetation and reduction of biodiversity, prohibited and restricted areas for development shall be delimited on the inhabited islands and in their surrounding waters.[38] Sea filling, sea enclosure and other acts changing the coastlines of inhabited islands shall be strictly restricted.[39]

For uninhabited islands, if its use has not been approved, the status as an uninhabited island shall be maintained; and such activities as quarrying, excavating sea sand, felling trees, production, construction and tourism shall be prohibited.[40]

For special purpose islands, such as islands where the territorial sea base points are located, islands for the purpose of national defense, islands within the marine natural reserves and other islands for special purposes or with special conservation value, special protection measures shall be taken.[41]

3.2.1.5 Wild Animal Conservation Law

The Wild Animal Conservation Law has been adopted at the 4th Session of the Standing Committee of the Seventh National People's Congress on November 8, 1988, amended twice in 2004 and 2009, and revised in 2016. This Law regulates the conservation of wild animals and associated activities within the territory of PR China and other sea areas under the jurisdiction of PR China. "Wild animals" conserved in this Law means the rare and endangered species of terrestrial and aquatic wild animals and the terrestrial wild animals of significant ecological, scientific, or social values. The conservation of aquatic wild animals other than the rare and endangered species of aquatic wild animals shall be governed by the Fisheries Law of PR China and other relevant laws.[42]

The Law declares the state ownership of wild animal resources,[43] sets up the principle of "conservation first, regulated utilization, and stringent supervision"[44] to wild animals and establishes rules in the management of wild animal and its habitats.

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38 *Ibid.* Art. 24
39 *Ibid.* Art. 27
40 *Ibid.* Art. 28
41 *Ibid.* Art. 36
42 Wild Animal Conservation Law, Art. 2
43 *Ibid.* Art. 3
44 *Ibid.* Art. 4

The state conducts conservation of wild animals by classification and grading. The state places the rare and endangered species of wild animals under priority conservation. Species of wild animals under state priority conservation are divided into wild animals under Grade I conservation and wild animals under Grade II conservation and the list of wild animals under state priority conservation shall be developed accordingly based on scientific evaluation, and adjustments to the list shall be determined every five years according to evaluation results. The list of wild animals under state priority conservation shall be reported to the State Council for approval and publication.[45]

The relevant management departments shall, on a regular basis, organize, or authorize relevant scientific research institutions to conduct, survey, monitor and evaluate the status of wild animals and their habitats. Based on the results of the survey, monitoring and evaluation, the lists of major habitats of wild animals will be issued.

The government can either conserve the listed wild animals and their important habitats by establishing nature reserves or by delimiting no-hunting (or no-fishing) zones or prescribing closed hunting (or fishing) seasons or other means.[46]

The state shall also strengthen the conservation of genetic resources of wild animals, and conduct rescuing conservation of the endangered species of wild animals.[47]

The Law prohibits any hunting, catching, or killing wild animals under state priority conservation and any sale, purchase, or utilization of wild animals under state priority conservation and their products.[48]

3.2.1.6 Other Relevant Laws

Besides the laws analyzed above, there are some other laws that are closely related to the conservation of the marine environment.

The Law on Prevention and Control of Air Pollution regulates pollution from atmospheric deposition. The Law on Prevention and Control of Water Pollution regulates land-based pollution by carrying out the discharge standard system, total quantity control system and discharge permit system. And the Law on Environmental Impact Assessment provides the EIA as a useful tool to control the environmental impact of coastal and sea projects etc.

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45 *Ibid.* Art. 10

46 *Ibid.* Art. 11-12

47 *Ibid.* Art. 17

48 *Ibid. Art. 21 and Art. 27*

3.2.2 National Regulations Issued by the State Council

In order to implement the laws issued by the National People's Congress and its Standing Committee or to regulate the issues which have not been addressed in the current laws, the State Council issued about 15[49] national regulations (See Table 1 National Regulations Issued by the State Council) since the 1980s. Of these 15 regulations, 6 regulate marine pollution from different sources, such as vessel, ship breaking, coastal and marine engineering projects, dumping, oil exploitation; 4 regulate the protection of nature reserve, wild animal and plant and agricultural genetically modified organisms which fall into the regulate objectives of CBD and Ramsar Convention; and 3 regulate fishery resources or fishing activities. This shows that pollution, fishery and nature conservancy are the three areas that attract more attention of the State Councils.

Besides the above regulations, one regulation on the administration of ocean observation and forecasting was issued in 2012 to implement the UNFCCC, since the Convention calls for the participating countries to enhance ocean observation and forecasting to mitigate the effect of climate change and increase the ability to predict disasters.

Due to the comprehensive amendments of the Environmental Protection Law and Marine Environment Protection Law in 2015 and 2016, many of the regulations, especially the ones that relate to pollution control and protection of nature reserve and wild life, have been revised in 2017 to keep consistent with laws.

The Regulation on Nature Reserves sets up the basic legal systems on the establishment and management of nature reserves in China. It reflects the efforts of China to fulfill its obligations under CBD as a participating country. The major legal systems established in this Regulation are as follows.

3.2.2.1 Regulations on Nature Reserves

The Regulations on Nature Reserves has been issued by Order No. 167 of the State Council of PR China on October 9, 1994; and amended twice in 2011 and 2017 (**Table 3.1**).

The regulation gives the authority to the Ministry of Environment Protection to conduct integrated management of the nature reserves throughout the country, and gives the authority to the competent departments of forestry, agriculture, geology and mineral resources, water conservancy, and marine affairs and other departments concerned the respective responsibilities to manage relevant nature reserves under their jurisdiction.[50]

[49] According to incomplete statistics from the websitehttp://www.pkulaw.cn

[50] Regulations on Nature Reserves, Art. 8

Table 3.1. National Regulations Issued by the State Council.

No.	Name	Issuing Authority	Date Issued	Effective Date
1	Regulations of the People's Republic of China Concerning Environmental Protection in Offshore Oil Exploration and Exploitation.	State Council	1983.12.29	1983.12.29
2	Implementation Rules of the Fisheries Law of the People's Republic of China	State Council	1987.10.19	1987.10.19
3	Provisions of the People's Republic of China on Administration of Foreign-related Marine Scientific Research	Decree No. 199 of the State Council	1996.06.18	1996.10.01
4	Regulations of the People's Republic of China on Fishing Vessel Inspection	Order No. 383 of the State Council	2003.06.27	2003.08.01
5	Measures for the Collection and Use of Proliferation Protection Fees of Fishery Resources (2011 Revision)	Order No. 588 of the State Council	2011.01.08	1989.01.01
6	Regulation on the Administration of Ocean Observation and Forecasting	Order No. 615 of the State Council	2012.03.01	2012.06.01
7	Regulations of the People's Republic of China on the Protection of Aquatic Wild Animals (2013 Revision)	Order No. 645 of the State Council	2013.12.07	1993.10.05
8	Administrative Regulation on the Prevention and Control of Pollution Damages to the Marine Environment by Vessels (2017 Revision)	Order No. 676 of the State Council	2017.03.01	2010.03.01
9	Regulations on Prevention of Environmental Pollution by Ship Breaking (2017 Revision)	Order No. 676 of the State Council	2017.03.01	1988.06.01
10	Administrative Regulation on the Prevention and Control of Pollution Damages to the Marine Environment by Coastal Engineering Construction Projects (2017 Revision)	Order No. 676 of the State Council	2017.03.01	1990.08.01
11	Administrative Regulation on the Prevention and Treatment of the Pollution and Damage to the Marine Environment by Marine Engineering Construction Projects (2017 Revision)	Order No. 676 of the State Council	2017.03.01	2006.11.01
12	Regulations of the People's Republic of China on the Control over Dumping Wastes into the Sea Waters (2017 Revision)	Order No. 676 of the State Council	2017.03.01	1985.04.01

Table 3.1. National Regulations Issued by the State Council. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
12	Regulations of the People's Republic of China on the Control over Dumping Wastes into the Sea Waters (2017 Revision)	Order No. 676 of the State Council	2017.03.01	1985.04.01
13	Regulations of the People's Republic of China on Wild Plants Protection (2017 Revision)	Order No. 687 of the State Council	2017.10.07	1997.01.01
14	Regulations of the People's Republic of China on Nature Reserves (2017 Revision)	Order No. 687 of the State Council	2017.10.07	1994.12.01
15	Regulation on Administration of Safety of Agricultural Genetically Modified Organisms (2017 Revision)	Order No. 687 of the State Council	2017.10.07	2017.10.07

3.2.3 Department Rules Issued by the Administrative Departments under the State Council

To fulfill the obligations in laws and regulations and carry out the management duties set down by the State Council, the administrative departments which have authorities over the sea issued about 28[51] department rules (See **Table 3.2** Department Rules Issued by the Administrative Departments under the State Council) within the last 30 years.

Of these 28 department rules, 14 of them are related to fishery resources and activities which were issued by the Ministry of Agriculture. They addressed areas, such as: (1) the management of fishing permits, fishers and fishing boats; (2) the report and investigation process and procedures of fishing boat accident and the qualification of expertise to carry out the investigation; (3) quality management and permits system of mariculture; (4) propagation and release of aquatic organisms; (5) special licenses for exploitation of aquatic wild animals; (6) management of nature reserves for aquatic plants and animals; (7) safety evaluation of agricultural GMOs; and (8) management of boats that carry out fishery administration duties.

The next largest area that has been addressed by five regulations is pollution control regarding pollution from vessels and related activities, exploitation of offshore oil, and dumping. Besides the 19 regulations, the rest mainly addressed wetland management, usage of sea area, marine observation, maritime administrative punishment, supervision and inspection of national nature reserves, management of MPAs, etc.

[51] According to the incomplete statistics from the website: http://www.pkulaw.cn.

Table 3.2. Department Rules Issued by the Administrative Departments under the State Council.

No.	Name	Issuing Authority	Date Issued	Effective Date
1	Provisions of the People's Republic of China on the Administration of Prevention and Control of Marine Environmental Pollution by Vessels and Their Operations (2017 Amendment)	Order No. 15 [2017] of the Ministry of Transport	2017.05.23	2017.05.23
2	Provisions of the People's Republic of China on the Administration of Emergency Preparedness for and Emergency Response to Vessel-Induced Pollution to the Marine Environment (2016 Amendment)	Order No. 84 [2016] of the Ministry of Transport	2016.12.13	2011.06.01
3	Measures for the Administration of the Ocean Observation Data	Order No. 74 of the Ministry of Land and Resources	2017.06.07	2017.06.07
4	Measures for the Administration of the Ocean Observation Stations	Order No. 73 of the Ministry of Land and Resources	2017.06.07	2017.06.07
5	Measures for the Implementation of the Regulations of the People's Republic of China on the Dumping of Wastes at Sea (2016 Amendment)	Order No. 64 of the Ministry of Land and Resources	2016.01.05	1990.09.25
6	Measures for the Implementation of the Regulation of the People's Republic of China on the Administration of Environmental Protection for Offshore Oil Exploration and Exploitation (2016 Amendment)	Order No. 64 of the Ministry of Land and Resources	2016.01.05	1990.09.20
7	Measures for the Administration of Entrusted Issuance of Licenses for Dumping Wastes into the Sea	Order No. 25 of the Ministry of Land and Resources	2004.10.20	2005.01.01
8	Implementing Measures for Maritime Administrative Punishments	Order No. 15 of the Ministry of Land and Resources	2002.12.25	2003.03.01
9	Measures for the Administration of the Safety Evaluation of Agricultural Genetically Modified Organisms (2016 Revision)	Order No. 7 [2016] of the Ministry of Agriculture	2016.07.25	2002.03.20
10	Measures of the People's Republic of China for the Administration of Fishermen in the Fishery Industry	Order No. 4 [2014] of the Ministry of Agriculture	2014.05.23	2015.01.01
11	Administrative Measures of the People's Republic of China for Nature Reserves for Aquatic Plants and Animals (2014 Revision)	Order No. 3 [2014] of the Ministry of Agriculture	2014.04.25	1997.10.17

Table 3.2. Department Rules Issued by the Administrative Departments under the State Council. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
12	Provisions on the Administration of Fishery Licensing (2013 Revision)	Order No. 5 [2013] of the Ministry of Agriculture	2013.12.31	2002.12.01
13	Measures of the People's Republic of China for Special Licenses for Exploitation of Aquatic Wild Animals (2013 Revision)	Order No. 5 [2013] of the Ministry of Agriculture	2013.12.31	1999.09.01
14	Measures of the People's Republic of China on the Registration of Fishing Vessels (2013 Revision)	Order No. 5 [2013] of the Ministry of Agriculture	2013.12.31	2013.01.01
15	Provisions on the Reporting, Investigation and Handling of On-Water Safety Accidents of Fishing Vessels	Order No. 9 [2012] of the Ministry of Agriculture	2012.12.25	2013.02.01
16	Measures for the Licensing and Registration of Aquaculture in Waters and Tidal Flats	Order No. 9 [2010] of the Ministry of Agriculture	2010.05.24	2010.07.01
17	Provisions on the Propagation and Release of Aquatic Organisms	Order No. 20 of the Ministry of Agriculture	2009.03.24	2009.05.01
18	Provisions on the Quality and Safety of Aquaculture	Order No. 31 of the Ministry of Agriculture	2003.07.24	2003.09.01
19	Measures for the Administration of the Fishery Administrative Law Enforcement Ships	Order No. 33 of the Ministry of Agriculture	2000.06.13	2001.01.01
20	Measures for the Administration of Fishery Pollution Accident Investigation Qualification	Ministry of Agriculture	1998.07.30	1998.07.30
21	Provisions on the Procedures of Fishery Water Pollution Accident Investigation and Handling	Order No. 13 of the Ministry of Agriculture	1997.03.26	1997.03.26
22	Provisions on Disciplinary Action for Violations of Law and Discipline on Administration of Sea Use	Order No. 14 of the Ministry of Supervision, the Ministry of Personnel, the Ministry of Finance, State Oceanic Administration	2008.02.26	2008.04.01
23	Provisions on the Administration of Wetland Protection	Order No. 32 of the State Forestry Administration	2013.03.28	2013.05.01
24	Measures for the Supervision and Inspection of National Nature Reserves	Order No. 36 of State Administration of Environmental Protection	2006.10.26	2006.12.01

Table 3.2. Department Rules Issued by the Administrative Departments under the State Council. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
25	Measures for the Administration of the Environmental Functional Zones in Coastal Offshore	Order No. 8 of State Administration of Environmental Protection	1999.12.10	1999.12.10
26	Provisions on the Administration of the Marine Standard	Order No. 8 of the State Oceanic Administration	1997.01.30	1997.01.30
27	Measures for the Administration of the Construction Project of China Marine Environment Monitoring System – Ocean Station and Voluntary Vessel Observation System	Order No. 10 [2013] of the State Oceanic Administration Ecological Environment Protection Division	2000.01.12	2000.01.12
28	Measures for the Administration of the Marine Nature Reserve	Order No. 251 [1995] of the State Oceanic Administration Policy and Legal System and Island Rights Division	1995.05.29	1995.05.29

3.2.4 Local Laws and Regulations

Besides the national laws and regulations, local coastal provinces and cities have also issued local laws and local regulations on marine environment protection. These laws and regulations have further improved the marine environment protection legal system.

3.2.4.1 Local Laws Issued by the Local People's Congress and Its Standing Committee

In the three coastal provinces along the Yellow Sea, namely Liaoning, Shandong and Jiangsu Provinces, about 23 local laws (See Table 3.3 Local Laws issued by the Local People's Congress and its Standing Committee) have been issued by the local People's Congress and its standing committee to protect the marine environment and resources after the beginning of the 21st century. Of these 23 local laws, Liaoning Province issued ten laws which take up almost half of all these laws, while Shandong has six and Jiangsu has seven. Every province has issued a law on the protection of the marine environment, and the ones in Shandong and Jiangsu have been updated after the 2016 revision of the Marine Environment Protection Law.

The major areas addressed by the local laws are marine environment, fishery and port management. Some provinces have developed special laws based on their own development needs. For example, Dongying City in Shandong Province issued the Ordinances for the National Nature Reserve in Shandong Yellow River Delta; Lianyungang City which is the

pioneer in marine ranch issued the Ordinance on the Administration of the Marine Ranch; Liaoning Province issued the Ordinances on the Promotion of the Coastal Economic Zone Development to balance the development and protection in the coastal economic zone area.

Liaoning Province issued the Ordinances on the Protection of the Wetland in Liaoning Province in 2007, six years prior to the issuance of the national regulation on wetland protection which shows that local governments sometimes make one step ahead of the national government in marine environmental protection legislation.

Table 3.3. Local Laws Issued by the Local People's Congress and Its Standing Committee.

No.	Name	Issuing Authority	Date Issued	Effective Date
1	Ordinances on the Protection of the Marine Environment in Shandong Province (2016 Amendment)	Standing Committee of the Shandong Provincial People's Congress	2016.03.30	2004.12.01
2	Ordinances for the Port in Shandong Province	Standing Committee of the Shandong Provincial People's Congress	2009.11.28	2010.04.01
3	Ordinance on the Administration of the Fishery Ports and Fishery Ships in Shandong Province	Standing Committee of the Shandong Provincial People's Congress	2006.09.29	2007.01.01
4	Ordinances for the National Nature Reserve in Shandong Yellow River Delta	Standing Committee of the Dongying Municipal People's Congress	2017.03.29	2017.05.01
5	Provisions on the Protection of the Marine Environment in Qingdao City (2015 Amendment)	Standing Committee of the Qingdao Municipal People's Congress	2015.12.25	2010.05.01
6	Ordinance on the Administration of the Marine Fishery in Qingdao City	Standing Committee of the Qingdao Municipal People's Congress	2004.01.06	2004.03.01
7	Ordinances on the Protection of the Marine Environment in Jiangsu Province (2016 Amendment)	Standing Committee of the Jiangsu Provincial People's Congress	2004.10.20	2005.01.01
8	Ordinances on the Protection of the Wetland in Jiangsu Province	Standing Committee of the Jiangsu Provincial People's Congress	2016.09.30	2017.01.01
9	Ordinances on the Administration of the Fishery in Jiangsu Province (2012 Amendment)	Standing Committee of the Jiangsu Provincial People's Congress	2012.01.12	2012.02.01

Table 3.3. Local Laws Issued by the Local People's Congress and Its Standing Committee. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
10	Ordinances on the Administration of the Fishery Port and Fishery Vessels in Jiangsu Province	Standing Committee of the Jiangsu Provincial People's Congress	2010.09.29	2011.01.01
11	Ordinances on the Administration of the Channel in Jiangsu Province	Standing Committee of the Jiangsu Provincial People's Congress	2010.09.29	2010.11.01
12	Ordinances on the Administration of the Port in Jiangsu Province	Standing Committee of the Jiangsu Provincial People's Congress	2006.11.30	2007.03.01
13	Ordinance on the Administration of the Marine Ranch in Lianyungang City	Standing Committee of the Lianyungang Municipal People's Congress	2016.12.02	2017.02.01
14	Ordinances on the Administration of the Fishing Port in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2016.07.30	1997.09.27
15	Ordinances on the Administration of Fishery in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2015.11.27	2016.02.01
16	Ordinances on the Administration of the Aquatic Products in Liaoning Province (2014 Amendment)	Standing Committee of the Liaoning Provincial People's Congress	2014.01.09	2006.01.01
17	Ordinances on Supervision and Inspection of Fishery Vessels in Liaoning Province (2014 Amendment)	Standing Committee of the Liaoning Provincial People's Congress	2014.01.09	2001.01.01
18	Ordinances on the Protection of the Petroleum exploration and development environment in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2011.07.29	2011.10.01
19	Ordinances on the Promotion of the Coastal Economic Zone Development in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2010.05.28	2010.07.01
20	Ordinances on the Protection of the Wetland in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2007.07.27	2007.10.01
21	Measures on the Protection of the Marine Environment in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2006.07.04	2006.08.01

Table 3.3. Local Laws Issued by the Local People's Congress and Its Standing Committee. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
22	Provisions on the Administration of the Port in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2004.11.26	2005.02.01
23	Ordinances on the Administration of the Marine Fishery Safety in Liaoning Province	Standing Committee of the Liaoning Provincial People's Congress	2003.09.25	2003.12.01

3.2.4.2 Local Rules Issued by the Local People's Government

There are ten local rules (See **Table 3.4** Local Rules Issued by Local Government) issued by the local provincial or city governments along the Yellow Sea, nine of which are issued by local governments in Shandong Province.

Measures on the Administration of the Marine Ecological Compensation in Shandong Province is the first piece of local rules that regulates marine ecological compensation, in order to adjust the balance and relation between marine environment protection and economic development.

Table 3.4. Local Rules Issued by the Local Government.

No.	Name	Issuing Authority	Date Issued	Effective Date
1	Measures on the Protection of the Marine Environment in Liaoning Province	Liaoning Provincial Government	2006.07.04	2006.08.01
2	Measures on the Administration of the Marine Ecological Compensation in Shandong Province	Shandong Provincial Department of Finance, Shandong Provincial Department of Oceans and Fisheries	2016.01.28	2016.03.01
3	Provisional Measures on the Administration of Marine Special Protected Areas in Shandong Province	Shandong Provincial Department of Oceans and Fisheries	2014.01.09	2014.03.01
4	Measures on the Administration of Fishery Vessels in Shandong Province	Shandong Provincial Government	2015.01.09	2015.04.01
5	Measures on the Protection of the Wetland in Shandong Province	Shandong Provincial Government	2012.12.26	2013.03.01
6	Measures on the Administration of Marine Fisheries Resources in Shandong Province (2004 Revision)	Shandong Provincial Government	2004.07.15	1992.06.01

Table 3.4. Local Rules Issued by the Local Government. (continued)

No.	Name	Issuing Authority	Date Issued	Effective Date
7	Measures on the Administration of Prawns in Southern Ocean Area of Shandong Province (2004 Revision)	Shandong Provincial Government	2004.07.15	1998.03.24
8	Measures on the Protection of the Fishery Resources in Shandong Province	Shandong Provincial Government	2002.07.23	2002.09.01
9	Provisions on the Administration of the Channel in Shandong Province	Shandong Provincial Government	1999.12.15	1999.12.15
10	Measures on the Administration of Safe Production of Marine Fishery in Qingdao City	Qingdao Municipal Government	2012.12.09	2013.01.01

3.2.5 Policy Issued by the National and Local People's Governments

The Government of PR China has issued a variety of national policies and launched a number of projects to protect the marine environment, implement laws and regulations and comply with its obligations under the international conventions. Many of the policies and projects can be found in plans developed by national and local governments. The general plan developed by the National Development and Reform Commission (NDRC) under the State Council is the Five-Year Plan for Economic and Social Development. There are also plans focused on a specific area, for example, the National 13th FYP for Protection of Ecological Environment developed by the Ministry of Environment Protection, the National 13th FYP for Marine Economy Development by the NDRC and SOA. Local governments, according to the national plan and based on their own situations, may develop specific plans, for example, the 13th FYP Marine Development of Jiangsu Province, Marine Ecological Redline Protection Plan of Jiangsu Province (2016-2020). (See **Table 3.5** for Local Five-year Plans related to Marine Affairs).

Table 3.5. Local Five-year Plans Related to Marine Affairs.

No.	Name	Issuing Authority	Issuing Date
1	The 13th Five-year Plan for Marine and Fisheries Development of Liaoning Province	People's Government of Liaoning Province	2016. 06. 26
2	Plan on Marine Functional Zoning of Liaoning province	People's Government of Liaoning Province	2017. 08. 03
3	The 13th Five-year Plan for Leisure Fishery Development of Liaoning Province	Oceanic and Fishery Department of Liaoning Provincial Government	2016. 06. 24
4	Island Protection Plan (2012-2020) of Liaoning Province	Oceanic and Fishery Department of Liaoning Provincial Government	2015. 07. 16

Table 3.5. Local Five-year Plans Related to Marine Affairs. (continued)

No.	Name	Issuing Authority	Issuing Date
5	The 13th Five-year Plan for Marine Development of Jiangsu Province	Develop and Reform Commission, Oceanic and Fishery Department of Jiangsu Provincial Government	2017. 08
6	The 13th Five-year Plan for Fishery Development of Jiangsu Province	Oceanic and Fishery Department of Jiangsu Provincial Government	2017.02.21
7	The 13th Five-year Development Plan for Dynamic Monitoring of Sea Areas of Jiangsu Province	Oceanic and Fishery Department of Jiangsu Provincial Government	2017. 05. 02
8	Marine Ecological Redline Protection Plan of Jiangsu Province (2016-2020)	Oceanic and Fishery Department of Jiangsu Provincial Government	2017. 04. 05
9	Coastal Port Layout Plan of Jiangsu Province (2015-2030)	General Office of the People's Government of Jiangsu Province	2017. 04. 20
10	Marine Observatory Construction Plan of Jiangsu Province (2013-2020)	Oceanic and Fishery Department of Jiangsu Provincial Government	2013. 07. 16
11	Plan on Marine Functional Zoning of Shandong Province	People's Government of Shandong Province	2017. 08. 25
12	The 13th Five-year Plan for Ecological Environment Protection of Shandong Province	People's Government of Shandong Province	2017. 04. 27
13	Ecological Redline Protection Plan of Shandong Province (2016-2020)	Environmental Protection Department of Shandong Provincial Government	2016. 10. 20
14	Implementation Plan of Wetland Conservation Project of Shandong Province (2016-2020)	Forestry Department of Shandong Provincial Government	2016.07.20
15	Construction Plan of "Sea Granary" in Shandong Province (2015-2020)	Development and Reform Commission, Oceanic and Fishery Department of Shandong Provincial Government	2016. 08. 05
16	Marine Ecological Civilization Construction Plan of Shandong Province (2016-2020)	Oceanic and Fishery Department of Shandong Provincial Government	2016. 05. 05
17	Marine Environmental Protection Plan of Shandong Province (2008-2020)	Oceanic and Fishery Department of Shandong Provincial Government	2008. 02. 18

After a study on the major national plans, the national policies and projects carried out by all levels of government mainly include the following:

3.2.5.1 Policies and Projects on Pollution Control

Governments at various levels strictly control the land-based pollutants discharged into the sea, only if they meet both the discharge standards and the total amount of pollutants that can be discharged. Governments are working on the establishment of an early warning mechanism to prevent the pollutants discharged from exceeding the carrying capacity of the marine environment.

The Nearshore Pollution Control Plan is implemented to improve the quality of ecological environment in estuary and nearshore areas. The target of the plan is to eliminate the land-based discharge from rivers whose water quality fall below Grade 5 in coastal provinces before the year 2020.[52]

The central government also launched the Blue Bay Environmental Improvement Project, which aims to: (1) Carry out water pollution governance and comprehensive environmental improvement efforts in Jiaozhou, Liaodong, Bohai, Hangzhou, Xiamen, Beibu, and other bays; (2) Increase artificial sand shorelines and restore natural shorelines and original coastal landscapes; (3) Provide compensation for environmental improvement and develop artificial wetlands in land reclamation areas in Liaodong, Bohai, and other bays.[53]

3.2.5.2 Policies and Projects on Biodiversity Conservation and Wetland Protection

PR China's oceanic administrations at various levels have incorporated conservation of marine biodiversity and coastal wetlands into relevant strategies and plans, taken various conservation measures and achieved obvious results.

As one of the important institutional reforms, the cross-sectoral working mechanisms to implement the CBD has been established, including China's Coordinating Group for Implementation of the CBD which is headed by the Ministry of Environmental Protection and composed of 24 departments, and the Inter-ministerial Joint Conference on Conservation of Biological Resources which is headed by the Ministry of Environmental Protection and composed of 17 ministries and commissions.[54]

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[52] Nearshore Pollution Control Plan, *http://www.zhb.gov.cn/gkml/hbb/bgth/201704/W020170419525140514052.pdf*

[53] China will implement the Blue Bay Environment Improvement Project to restore marine ecological environment, *http://www.soa.gov.cn/xw/hyyw_90/201601/t20160125_49933.html*

[54] China's Fifth National Report on the Implementation of the Convention on Biological Diversity.

In the area of biodiversity survey, "China's Marine Species and Atlas" was published, based on a survey of coastal and nearshore marine species in 2006-2008. The Atlas included more than 28,000 marine species and pictures of more than 18,000 species. And for biodiversity monitoring, since 2004, PR China has established 18 marine ecological monitoring zones in a number of ecologically vulnerable and sensitive coastal and nearshore areas, and been undertaking systematic biodiversity monitoring, assessment and conservation in these zones. The area being monitored has reached 52,000 km^2, including typical marine ecosystems such as bays, estuaries, coastal wetlands, coral reefs, mangroves and seagrass beds.

By the end of 2012, China has a total of 240 marine protected areas (MPAs) of various types at different levels, with total area covered reaching 87,000 km^2, accounting for nearly 3% of the marine areas under China's jurisdiction. More than ten protected areas have received more than RMB 100 million from the central government budget to increase the capacity-building projects to improve the management of protected areas. The Chinese government planned to continually strengthen the selection and construction of MPAs, aquatic germplasm reserve and marine park, and further improve the standard management system.[55]

3.2.5.3 Policies and Projects on Biological Protection

In 2012, SOA issued the Provisional Rules for the Management of Demonstration Areas of Marine Ecological Civilization and a provisional set of indicators for the establishment of such demonstration areas. By now the first group of provinces such as Shandong, Zhejiang, Fujian and Guangdong have applied for the establishment of such demonstration areas.

SOA is exploring the establishment of a marine ecological redline, focusing on important marine biodiversity areas such as important estuaries, coastal wetlands, MPAs and fishery areas. Shandong Province has established such a redline in Bo Sea, with strict protection provided to over 40% of Bo Sea's marine areas. Since 2010, SOA has supported 180 projects using funds appropriated from the central government budget for different marine areas totaling about RMB 4.43 billion. The projects included coastal restoration, island conservation and restoration, marine ecological restoration, mangrove and tidal flats restoration, covering an area of more than 2,800 km^2.[56]

The Ecological Island and Reef Project was implemented since 2016. The project aims to restore the physical landscapes and ecosystem of the typical damaged islands by carrying out the restoration projects on vegetation, coastal lines, beach and surrounding sea areas.[57]

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55 *Ibid.*

56 *Ibid.*

57 The 13th National Five-year Plan on Marine Economic Development, *http://www.ndrc.gov.cn/zcfb/zcfbghwb/201705/W020170512615906757118.pdf*

For the ecological protection and restoration of coastal zones, wetland restoration projects were carried out by planting mangroves in the southern part of China while planting Chinese tamarisks in the northern part of China and in the meantime, reclamation was strictly controlled in ecologically sensitive areas. The targets of the restoration projects include the increase the length of natural coastlines to at least 35% of the length of the total coastline and restoring at least 1,000 km coastlines.[58]

3.2.5.4 Policies and Projects on the Integrated Management of Coastal Zones

On August 1, 2015, the State Council issued the National Plan on Marine Functional Zoning to enhance the exploitation of marine resources, develop marine economy, protect marine ecological environment and safeguard national interests. This national plan works as the fundamental basis to form the layout of marine functional zoning and is a basic and binding plan to instruct the exploitation of marine spaces. The range of the plan includes the internal waters, territorial sea, EEZ, continental shelf and other sea areas under China's jurisdiction (not including Hong Kong, Macau and Taiwan).

The sea areas, based on the functions provided, are categorized into areas for industrial and city construction, agricultural and fisheries industries, and providing ecological environment services. According to the major function each sea area provides, the marine space is divided into four categories of zones, namely: (1) optimized exploitation zone: the development intensity of this area is relatively high, but is restrained by its resources and environment; therefore, the industry structure of this area needs to be optimized; (2) key development zone: this area plays a key role in coastal economic development and has a huge development potential with a high environment carrying capacity; therefore, this area can be developed intensively; (3) limited development zone: this area is mainly used to provide aquatic products, including the area used to protect fishery resources and provide marine ecological services; (4) closed zone: the area is very important for the conservation of marine biodiversity and protection of typical marine ecosystem, including MPAs, islands where the territorial sea basepoint locates.

Most of the Liao Dong Peninsula, Bo Sea Bay, Shan Dong Peninsula and the sea areas in the north of Jiang Su Province fall into the optimized exploitation zone.[59]

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[58] The Outline of 13th National Five-year Plan on Ecological Protection, *http://www.zhb.gov.cn/gkml/hbb/bwj/201611/W020161102409694045765.pdf*

[59] National Plan on Marine Functional Zoning, *http://www.soa.gov.cn/zwgk/fwjgwywj/gwyfgwj/201508/t20150820_39597.html*

3.2.5.5 Policies and Projects on the Adaptation and Mitigation of Climate Change

SOA has been regularly monitoring climate change-related phenomenon such as sea water temperature, sea level, sea water erosion and soil salinization. SOA has also strengthened research on how oceans and seas could adapt to climate change, developed methods of calculation of carbon-sequestration and carbon-fixing capacities of coastal wetlands, developed and integrated technologies in this regard.[60]

The adaptation measures that have been taken in China's coastal zones and regions mainly include enhancing basic capacity building for protecting coastal zones and regions in adaptation to sea level rise; heightening and fortifying seawalls against typhoon-induced storm surges, and establishing an emergency response mechanism for typhoon and storm surge preparedness. Other measures include facilitating establishment of an operational marine climate observing (monitoring) system, establishing and improving climate change-related marine hazard monitoring, early warning and climate predictions, enhancing research on climate change impact assessment and adaptation strategies, pursuing marine hazard risk assessment and zoning, and enhancing conservation of ecosystems on islands and in coastal zones.[61]

3.2.5.6 Policies and Projects on the Protection and Utilization of Fishery Resources

According to the National Plan on the Proliferation and Releasing of Aquatic Living Resources (2011-2015), the proliferation and releasing of aquatic living resources have been organized in a large scale, nationwide. Based on the statistics, during the 12th Five Year, the Chinese government invested RMB 49 billion for proliferation and releasing, and released about 1.5 billion fries which has respectively increased 133% and 45% compared with the previous year.

The construction and management of aquatic life protected area have been furthered. There are 272 new national aquaculture germplasm resource protected areas that have been built, making the total 492. Eight (8) new national aquatic life protected areas have been built, making the total 23.

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[60] China's Fifth National Report on the Implementation of the Convention on Biological Diversity

[61] National Strategy to Adapt Climate Change, *http://www.soa.gov.cn/xw/hyyw_90/2013nhyyw/201311/t20131121_27972.html*

Efforts have also been made to improve the fishing-ban system and enhance the law enforcement. According to an uncompleted statistic, until the end of September 2015, 16,000 unregistered fishing boats were banned; 35,000 fishing boats were fined for their law violation; and 330,000 illegal fishing nets were destroyed.[62]

3.2.5.7 Policies and Projects on Marine Administration

A marine inspection system was formally established at the end of 2016 following the issuance of a Marine Inspection Plan approved by the State Council. Marine inspection aims at enhancing the supervision of central government to local governments on the implementation of laws and regulations; implementation of major policies, decisions, arrangements issued by the central government; and prominent problems and the handling. The inspections include regular inspection and inspections targeted at a specific purpose, e.g., reclamation. In 2017, the SOA launched two rounds of inspections, sending nine teams to Hebei, Jiangsu, Fujian, Guangxi, Liaoning, Hainan, Guangdong, Zhejiang, Shandong Provinces and two teams to the city of Tianjin and Shanghai. The inspections focused on reclamation processes as well as marine resource exploitation and utilization.[63] The 13th FYP brought forward that marine inspections shall be carried out on a regular basis.[64]

3.2.5.8 The Level of Compliance of China's National and Local Laws to the International Agreements

Generally speaking, China's national and local laws and policies have, to a large extent, carried out its obligations under the international agreements which China is a member of. A framework describing the relationship between the international obligations and China's laws and policies is provided in Annex 2. The framework could only draw a rough picture on the level of compliance to the international agreements by matching China's major laws and policies to the obligations. Even so, the gaps in the current laws and policies are clearly shown in the framework which forms the basis for the following analysis and suggestions.

3.2.6 Gaps in the Current Laws and Policies

Although laws and policies have been much improved in the last ten years, there are still some existing gaps which prohibit China from fully implementing its obligations in the international conventions and protect its marine environment and resources.

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62 *http://www.cnfm.gov.cn/zljjyzj/yyshierxc/201601/t20160107_4978373.htm*

63 State Oceanic Administration of PR China. *http://www.soa.gov.cn/xw/ztbd/ztbd_2017/2017wthzxdc/xwzx*

64 The 13th National Five-year Plan on Marine Economic Development, *http://www.ndrc.gov.cn/zcfb/zcfbghwb/201705/W020170512615906757118.pdf*

3.2.6.1 Lack an Ecosystem-based Point of View

The ecological character of a large marine ecosystem (LME) determines that the ultimate goal of conservation and management of the LME is to maintain its ecological integrity. This requests that any of the conservation and management activities must be designed based on or derived from an ecosystem-based point of view. Although the principles of "determine the land-based discharge amount based on the carrying capacity of the sea" and "promote land and marine development in a coordinated way" have been raised frequently as the guiding principles for major national policies, due to the limitation of the administrative system, these principles have never been implemented well. The current laws, regulations, policies and plans are enacted based on administrative sectors with inadequate communication and coordination among each other. For example, the discharge permit and total quantity control of land-based pollution in coastal areas are implemented by the environmental protection bureau with little cooperation from the oceanic administrative department.

3.2.6.2 Lack of Laws in Certain Areas

After the examination of current environmental laws and policies, it was found that in China, laws and policies in pollution control were relatively well developed, while laws and policies in the protection of resources and ecosystem are relatively weak. For example, laws in the following areas still need to be further enhanced:

1. National Regulation on Wetland Conservation

The only national law regulating wetland conservation is the department rule issued by the State Forestry Administration: Provisions on the Administration of Wetland Protection. This piece of legislation is low in legal hierarchy which did affect its implementation and make it in a weak position if in conflict with other national laws and regulations. Therefore, lack of a national wetland law or regulation remains a challenge for China's wetland conservation, especially for establishing the institution of specific mechanisms for wetland management, including those related to conservation concession, ecological compensation, supplementing water supply, water pollution treatment, and the wise use of wetland resources. It is high time for China to enact a comprehensive state-level wetland conservation act to guide and mandate wetland conservation and management in a consistent way.

2. National Regulation for Mariculture

As the No.1 mariculture production country in the world, China's legislation in the management of mariculture is severely unmatched with its practices, especially after the fast development of the mariculture industry in the late 1990s. During the amendment of the Fisheries Law in 2000, several

legal systems regarding the mariculture permit system, aquatic fry and fingerling production permits, safety and quality control system, etc., were established. But the legal systems are described in a very general way with only ten articles in the 2013 Fisheries Law Amendment and some department rules and temporary plans issued by the Ministry of Agriculture, e.g., Provisions on the Quality and Safety of Aquaculture, Measures for the Licensing and Registration of Aquaculture in Waters and Tidal Flats. Therefore, a national regulation in mariculture is desperately needed to provide management of pollution in waters for mariculture usage, permits and production process, prevention of alien species, medicine and forage usage, and the construction of marine ranch etc.

3. Laws to Mitigate Climate Change

How to reduce and mitigate the impact of climate change has been paid special attention to by international conventions and agreements. Under the Kyoto Protocol, participating countries are required to take climate change considerations into account, in their relevant social, economic and environmental policies and actions, and employ appropriate methods to mitigate or adapt to climate change. In order to meet this obligation, the State Council has issued the Regulation on the Administration of Ocean Observation and Forecasting, and the Ministry of Land and Resources has issued two measures for the administration of the ocean observation data and station. But these are far from enough. Legal construction needs to be furthered in the area of prevention, reduction and emergency management of natural disasters, risk assessment, forecasting and observation, etc.

4. Laws to Prevent and Control Marine Debris

The prevention and control of marine debris has been focused on more frequently by the international community in recent years. Although China has a set of legal systems in prevention and control of all kinds of marine pollution and a national law regulating solid waste which is the major pollutant source for marine debris, the regulation of marine debris hasn't been well established, because the current solid waste legislation hasn't been integrated with the coastal zone management laws and policies. The legal system to prevent and control marine debris needs to be strengthened in coastal zone management laws.

3.2.6.3 Lack of Detailed Implementation Rules

After more than 30 years of legal construction since the issuance of the Marine Environmental Protection Law in 1982, the legal framework offering a rough line to protect the marine environment, and utilization of natural resources has been established. But many legal systems

are very general with no implementation rules followed, which to a large extent influenced the implementation effect. For example, the Fisheries Law has been amended in 2000, 2004, 2009 and 2013 since its adoption, while the Implementation Rules of the Fisheries Law stayed unchanged since its adoption in 1987. The implementation rules of some systems, like the total allowable catch, were said to be stipulated later by the State Council in the Law, but remains blank until now.

The same situation also existed in the control of invasive species in wetland protection. The survey results from the second national wetland inventory implies that China's wetlands are suffering from ecological threats beyond geographical boundaries, such as invasive species. China has, unfortunately, not developed appropriate national rules for managing alien invasive species, and monitoring and early warning systems for invasive species.

The newly amended Marine Environment Protection Law established the marine ecological protection compensation system, which says that "reasonable layouts shall be made for the development and utilization of marine resources according to the marine functional zonation schemes, the redlines of ecological protection shall be strictly observed, and no damage shall be brought to the marine ecological environment".[65] But what are the ecological redlines? What should be included into the redlines? What criteria shall be referred to for ecological compensation? These questions remain unanswered. This left the law a big room for improvement.

3.2.6.4 Lack of a Cross-sector Implementation Mechanism

As the "global" feature of environmental problems gets more and more apparent and the interaction among these problems goes deeper within an ecosystem, the issues discussed recently by the international environmental conventions intersect with each other, especially climate change, wetland degradation, biodiversity loss, fishery resources depletion, etc. Yet in China, the responsibilities to implement international conventions are assigned to different administrative sectors based on their duties, without having an institution or mechanism to coordinate such implementations. Different implementing bodies separately carry out the rights and obligations for China as a participating country under international conventions. The disadvantage of this system is that the resources spent by the implementation bodies can't generate synthetic effects, therefore, lots of duplication in efforts and activities existed, causing a waste of limited administrative resources.

[65] Marine Environment Protection Law, Art. 24

3.2.6.5 Lack of International Cooperation in Developing Laws and Policies

Every international legal document has a separate chapter or section specifying the responsibility of participating countries to cooperate in developing laws, policies, measures and projects both in the international and regional context. International and regional cooperation started from the cooperation in technology and science, and now gradually expanded to the area of law and policy, as more countries realized that taking the common steps in policy is the right choice for fighting against the global environmental issues. Compared with domestic legal construction, the cooperation to develop common law and policy with other countries is more tough and time consuming. That is why big progress in domestic legal constructions are celebrated, the achievement to reach an international law or policy is quite limited. In the YSLME region, besides fishery, none of the areas have regional guidelines in place, let alone the legally-binding documents. Promoting the generation of regional guidelines or common schemes is beneficial to the fulfillment of China's obligations under the international conventions.

3.3 China's Priorities in Legal Reform to Implement International Conventions

Based on the above analysis, in order to perform PR China's obligation well under international conventions, it is suggested that the following legal improvements be carried out:

3.3.1 Develop a Cross-sector Implementation Mechanism

A cross-sector implementation mechanism is needed to coordinate the implementation of all the international conventions, agreements and guidelines related to environment and natural resources protection. It is suggested to establish an International Convention Implementation Committee as an ad hoc body to deal with the overall implementation of the environment-related international convention. The Committee shall be composed of representatives from different ministries and shall meet once a year or as needed to comprehensively consider the international obligations by developing a general implementation plan and allocating the tasks to different ministries. By doing this, the information and resources will be integrated and optimized among all relevant conventions and a more efficient result will be achieved with limited administrative resources.

This mechanism is a good practice of ecosystem-based management as through coordination and synergizing, the linkage among environmental factors within an ecosystem can be emphasized and the actions taken to solve one environmental problem can accelerate

the solution of other environmental problems. And by carrying out the mechanism, the obstacles under the former sector-based management and administrative jurisdiction can be appropriately mitigated.

Besides the establishment of the ad hoc committee, it is also suggested to enhance the law by requiring different administrative sectors to coordinate with each other both in information sharing and strategy development through regular or specific meeting mechanisms. The current laws are enacted based on sectors, hence, there is less obligation imposed on the sectors to work with each other. Therefore, the current law does not provide enough legal guarantee for a cross-sector implementation mechanism. To make a change in the law by asking sectors to collaborate on environmental problems is an important method to ensure the proper functioning of the cross-sector implementation mechanism.

Also, the law should promote the establishment of an information sharing platform by imposing the obligation of information disclosure and sharing to administrative departments to facilitate cross-sector implementation.

3.3.2 Enhance the Legal System on Risk Assessment

The evolutionary history of environmental law in developed countries shows that the focus of environmental law develops from pollution control to improvement of environmental quality and then to prevention of risk. The Environmental Law of China follows this path as well. From the 1970s to the beginning of the 21st century, the pollution control laws have been well developed by establishing a set of pollution discharge standards and prohibition provisions; in the last ten years, laws on the protection of natural resources, marine protection areas, islands, etc., have been issued implying that environmental law entered into a stage to raise environmental quality comprehensively. However, many international conventions have recognized the importance of precaution and assessment, and have put more emphasis on that in recent years. Many environmental problems turned out to be unsolved or unmitigated by end-of-pipe control, therefore, more countries agree that controlling the environmental risk from the source and reducing environmental damage using the precautionary principle is the future direction of the development of environmental law. Some international conventions took the lead in this process by encouraging the participating countries to carry out risk prediction and assessment, especially UNFCCC and CBD. But China's legal system does not provide enough methods to respond to this change. Possible suggestions may include: (1) expand the environmental impact assessment to cover the risk assessment for major environmental decisions; (2) strengthen the legal system on marine observation, disaster forecasting and risk assessment.

3.3.3 Improve the Cooperation in Developing Laws, Policies, Guidelines with Neighboring Countries

All the international conventions discussed above impose obligations to participating countries to collaborate with other countries to develop laws, policies, guidelines or projects in environmental protection. The YSLME project is a good attempt to show China's implementation of cooperation obligation. The Strategic Action Programme (SAP) of YSLME has suggested a series of governance actions, including "improve the effectiveness of legal instruments through regional agreements and guidelines". This action will fill up the legal gaps in regional governance and international cooperation. Considering the difficulty to reach a legally-binding agreement within the YSLME region, it is more practical to aim for some regional guidelines.

3.3.4 Establish Regulations on Prevention and Control of Marine Debris

Researchers classify debris as either land- or ocean-based, of which up to 80% was land-based such as sewage disposal, solid waste, discarded fishing gear and fishing net, etc., with the remaining 20% originating from catastrophic events or maritime sources such as domestic waste from shipping, offshore petroleum and natural gas platform.[66] Marine debris has caused severe harm to marine lives and ecosystem and has been regulated under both international and regional levels. Many international conventions and guidelines, including UNCLOS, 1972 London Convention, MARPOL 73/78, Washington Declaration, have imposed related regulations on the control of marine debris, and many regional programs have put a lot of emphasis on that as well.

The SAP of YSLME also touched upon this issue by generating some actions under Component 3, improving ecosystem carrying capacity with respect to regulating and cultural services. The actions are: (1) reducing marine litter through engagement of private sector and communities demonstrated; (2) advisory services in development and adoption of marine litter control policies and regulatory measures in coastal provinces; and (3) awareness and education programs in demonstration sites and the YSLME region on responsible disposal of wastes so they do not end up in the sea.

However, the international and regional regulation schemes have to be converted to domestic laws in order to get implemented. It is suggested to improve the laws on solid waste control and cleaner production by limiting the number of dumping and bury sites in nearshore area or bank area, developing garbage sorting, recycling, reusing regulation, collecting of discarded fishing gears and nets, etc. Further, the planning system in coastal zone management should be strengthened.

[66] Weiss, K.R. 2017. "The pileup of plastic debris is more than ugly ocean litter". Knowable Magazine. doi:10.1146/knowable-120717-211902.

3.3.5 Improve Laws on the Protection of Marine Biodiversity

The marine biodiversity is influenced by overfishing, pollution, ecosystem degradation, invasive species, etc. As China doesn't have an integrated biodiversity protection law, to improve the protection of marine biodiversity relies on making progress in individual laws regulating wildlife protection, fishery, pollution, marine protected areas (MPAs) and wetlands, etc. Under this sub-section, suggestions are given especially to laws on MPA, leaving the other issues to be discussed in other parts of Section 3.

3.3.5.1 Establish Rules on How to Build and Manage the MPA Network

Creating a network of MPAs has been discussed worldwide among legislators and practitioners. Although over 240 MPAs of different categories have been established, the MPAs are rather independent from each other and are managed under different administrative departments at both national or provincial levels. Currently, the establishment and management of an MPA follows the Regulation on Nature Reserves issued by the State Council and the Rules on Marine Protected Areas issued by SOA. Both the laws do not mention an MPA network. Therefore, establishing rules on how to build and manage the MPA network is needed. First, a guiding principle should be established that the selection, demarcation, construction and management of an MPA should consider the interactions among separate MPAs to form a network of MPAs to operate cooperatively and synergistically from the ecosystem point of view. Some legal systems should be improved to respond to the principle, such as planning, assessment and monitoring systems. An integrated planning system is needed to build networks that can include several MPAs of different sizes, located in critical habitats, containing components of a particular habitat type or portions of different kinds of important habitats, and interconnected by the movement of animals and plant propagules. Long-term monitoring is needed for the biodiversity status and overall ecosystem status of the network in order to build an information network. In the assessment, it is suggested to add the evaluation criterion to show the integration, consistency and representativeness of the network. Then the effects of MPAs will be largely strengthened and can meet objectives that a single reserve cannot achieve.

3.3.5.2 Establish Rules on the Selection and Management of a Marine National Park

National parks have been a hot topic since 2013 and are always mentioned by documents related to the reform of ecological civilization. The establishment of a national park system has been raised in the CPC Central Committee Decisions on Key Issues to Comprehensively

Deepen the Reform in 2013. Then, a pilot program plan to establish national parks has been issued by 13 ministries and commissions in 2015 and has been carried out since then. Scientists have provided a list of 24 marine national parks that should be considered in priority, and 7 of them located in Bo Sea and the Yellow Sea region.[67] Most of them are current MPAs of different levels. As the law does not provide a clear definition for a national park and differences among the related definitions like nature reserve, protected area, national park, etc., the function and boundary of national parks are not clear, and how to select and manage national parks remained to be unregulated by law. So, improving the Regulation on Nature Reserves to define the concept of a national park and include it as one of the categories has been suggested. A departmental rule focusing on the detailed process and procedures of national park construction and management should be the second step to follow.

3.3.6 Upgrade Laws on the Protection of Wetlands

Compared to that of the 2003 first national wetland survey, the result of the 2013 second survey illustrated that China lost an estimated of 3,376,200 ha of natural wetlands over the past decade, representing an average annual 9.33 percent loss of its wetlands.[68]

The competent department taking charge of wetlands is the Bureau of Forestry and Grassland. But the health of wetlands is closely related to the use of water resources, water pollution control, etc. Therefore, the Department Rules on the Protection of Wetlands issued by the Bureau of Forestry and Grassland in 2013 (amended in 2017) has an innate defect in ranks of validity. Due to the significant roles that wetland plays in the protection of biodiversity and mitigation of climate change, as well as the need for cooperation between more governmental departments to promote ecosystem-based management, the importance of wetland protection should be addressed, especially through upgrading the Department Rules on Wetland Protection into a regulation.

3.3.7 Improve Fisheries Law

Amending the Fisheries Law has been hotly discussed in recent years due to the depletion of fishery resources and the recognition of its economic value. It has been put into the legislation

[67] Chen Shang. Recommendations on the Priority Construction Plan of 24 Marine Parks, Environmental Protection, Vol. 14: 35-38 (2017)

[68] China's National Report on the Implementation of the Ramsar Convention on Wetlands submitted to the COP 12.

plan of the State Council in 2016 and is now under the drafting process by the Ministry of Agriculture and Rural Affairs.[69] The areas that need improvement may include the following:

3.3.7.1 Establish Implementation Rules on TAC, Mesh Size and Fishing Methods

Article 22 and Article 25 of Fisheries Law give general descriptions on the legal system of total allowable catch and the regulation on mesh size and fishing methods. The law says that the State determines the total fishable amount of the fishery resources and implements a fishing quota system in accordance with the principle that the fishing amount shall be lower than the increasing amount of the fishery resources. The total amount of the fishing quota for inland seas, territorial seas, exclusive economic zones and other jurisdictional seas shall be determined by the department in charge of fishery administration of the State Council, and shall be distributed and reported to the governments level by level.[70] But there aren't any unified implementation rules in place, and its implementation depend much on the local policy and the effectiveness varies from place to place.

Same problems exist in the management of fishing operations. The law says that the unit or individual engaged in fishing operations must operate in accordance with the provisions in the fishing license on type of operation, location, time limit, quantity of fishing facilities and fishing quota.[71] The varieties of fishery resources under key protection as well as their fishable standards, the banned fishing areas and the banned fishing periods, fishing facilities and fishing methods prohibited to be used, the smallest size of mesh, and other measures to protect fishery resources shall be stipulated by the department in charge of fishery administration of the State Council or of the provincial, autonomous regional, municipal people's governments.[72] These rules need to be further strengthened, especially on how to carry out implementation.

3.3.7.2 Amend the Implementation Rules on Fisheries Law

The Implementation Rules on Fisheries Law was issued in 1987, while the new amendment on Fisheries Law was issued in 2013. Some articles in the implementation rules have been absorbed into the amendment, some are in conflict with the new amendment. Therefore, it is suggested to update the implementation rules on Fisheries Law or include the implementation rules into the Fisheries Law.

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69 National People's Progress in the People's Report from China. http://www.npc.gov.cn/npc/xinwen/2016-11/07/content_2001567.htm

70 Fisheries Law, Art. 22

71 *Ibid.* Art. 25

72 *Ibid.* Art. 30

3.3.7.3 Enhance the Regulations on Mariculture

The number of laws on mariculture is very limited and most of them are department rules issued by the Ministry of Agriculture and Rural Affairs. Many legal systems should be enhanced, for example, the environment impact assessment system, pollution control system for mariculture waters, the control of invasive species in mariculture process, the issuance and implementation of a mariculture permit system.

An EIA prior to the application of mariculture permits should be required to analyze, predict and assess the environmental impact of mariculture activities, alternative plans, methods to prevent and mitigate these environmental impacts and post-assessment monitoring.

The system to prevent invasive species should include the risk assessment of imported species, import permit and register system, inspection and quarantine system, monitoring system and emergency response system. Suggestions to fill the loopholes in these systems are as follows:

(1) Carrying out a compulsory risk assessment before the issuance of permits. Article 25 of the Marine Environment Protection Law requires that any introduction of marine animal or plant species shall be subjected to scientific assessment so as to avoid damage to marine ecosystems. But the Management Rules on Aquatic Seeds does not list the risk assessment on ecosystem safety as a compulsory material during the application of import permits. Considering the irreversible impact that the imported species might cause to marine lives and the environment, the law should require that a compulsory risk assessment be carried out from an authoritative institute before the application for permits.

(2) Improving the inspection and quarantine system by enlarging the testing items to include the transportation medium and sharing and updating the information on invasive species both domestic and abroad.

(3) Making sure the importer has built systems in their facilities to prevent escaping and to raise the alarm.

The pollution control system should be enhanced by incorporating the total quantity control on nutrients and other key pollutants and undertaking treatment in a prescribed limit of time if the seawater quality goes below the national or local standards that could not support the function of mariculture.

Standards for regulating a mariculture facility and methods should also be improved or developed.

3.3.8 Strengthen Laws to Address Climate Change Adaptation

Combating climate change is a hard case for all countries. No matter if seeing from the causes of climate change or the damages caused by the changed climate, the laws fighting against climate change should be composed of a set of laws from the areas of environmental protection, energy management, industry development, meteorological hazard mitigation. China has a lengthy coastline. Under the context of climate change, coastal erosion, improper use of coastal resources and lack of effective management, all could influence the ecological safety of coastal zones. The call for enacting a coastal zone management law has been raised for many years, however, no major progress has been achieved. Considering the urgency and severity of climate change, having a coastal zone management act to strengthen the planning and management of the coastal zone is of great importance. Under that, monitoring, forecasting and disaster response system for typhoon and storm surge disaster in coastal areas should be developed to resist the negative effect of sea level rise and to mitigate the damages of climate change.

Annex Level of Compliance of National Laws and Policies to International Agreements

The Compliance to UNCLOS

UNCLOS				National Law	Local Law	Policy Plan and project
Section	**Content of the Article**	**Article**	**Responsibility**			
Sovereign right of States to exploit their natural resources	Conservation of the living resources	A 61.1	Determine the allowable catch	The Fisheries Law of People's Republic of China, Art.21-22, Art.28-37	Ordinance on the Administration of the Marine Fishery in Qingdao City, Art.16, Art.23-27 Ordinances on the Administration of the Fishery in Jiangsu Province (2012 Amendment), Art.16-17, Art.20-21 Ordinances on the Administration of the Fishery in Liaoning Province, Art.13, Art.20-25	The 13th Five-year Plan for Marine and Fisheries Development of Liaoning Province, Plan on Marine Functional Zoning of Liaoning province, The 13th Five-year Plan for Fishery Development of Jiangsu Province, Plan on Marine Functional Zoning of Shandong Province
		A 61.2	Take proper conservation and management measures to maintain the living resources			
		A 61.5	Contribute and exchange available scientific information, catch and fishing effort statistics, and other data relevant to the conservation of fish stocks			

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