UNEP/GEF YSLME II

Consultant Report

Interim review report on progress of implementation of NSAP related with SAP targets 1-2

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Contents

Background

The Large Marine Ecosystems (LMEs) are regions of the coastal areas of world's oceans, which were defined by ecological criteria including bathymetry, hydrography, productivity, and trophically linked populations (Sherman and Alexander, 1986; Sherman et al, 1993; Sherman, 2014a). The LMEs play important roles in the world food supply, which provide an estimated 80% of world fisheries catches every year (Pauly and Lam, 2016). The LMEs approach to ecosystem-based assessment and management has been broadly accepted around the globe by over 100 countries (Sherman et al., 2005; Sherman, 2014b).

The Yellow Sea is a semi-enclosed large marine ecosystem, with shallow and nutrient rich water (Tang et al., 2016). Both human activities and environment changes threated the Yellow Sea large marine ecosystem (YSLME). Under these multiple stresses, the YSLME changed greatly over the past half century which was reported by many researches, and the management of YSLME faces many challenges (Tang, 1989; Tang, 1993; Tang and Jin, 1999; Zhang and Kim, 1999; Tang, 2009; Tang and Fang, 2012; Tang, 2014; Tang et al., 2016).

The UNDP/GEF project entitled "Reducing environmental stress in the Yellow Sea Large Marine Ecosystem" or YSLME project started January 2005 to address some of the trans-boundary problems in the Yellow Sea and preserve these precious resources. This first phase of the project followed the GEF supported use of the Transboundary Diagnostic Analysis (TDA) where priority transboundary problems are identified and the causes analyzed by technical teams established by the participating countries. The problems identified in the TDA are then addressed in the Strategic Action Programme (SAP), which outlines the management actions required to overcome these problems.

The TDA identified four major problems: unsustainable mariculture; pollution; changes in ecosystem structure; and habitat modification. The SAP is a document that provides solutions for the transboundary problems identified in the TDA. It sets concrete targets to be reached by the year 2020, suggests ecosystem based management actions to achieve these targets, and identifies a co-operation & co-ordination mechanism to help oversee the implementation of the YSLME SAP in the form of the YSLME Commission. The objective of the SAP is to improve the Yellow Sea's capacity to provide ecosystem services. These are the supporting, regulating, provisioning and cultural services that are crucial for the economic, health and spiritual wellbeing of the population surrounding the Yellow Sea. The ability to provide these services, called "Ecosystem Carrying Capacity" in the SAP, is being impacted by the drivers of ecosystem change: unsustainable mariculture; pollution; changes in ecosystem structure; and habitat modification. To address the transboundary problems affecting supporting services a number of management actions are outlined in the SAP including: The establishment and implementation of a regional conservation plan to preserve biodiversity; the control of further reclamation; the development of regional guidelines for coastal habitat management; the establishment of a network of MPAs; the promotion of public awareness of the benefits of biodiversity conservation; the introduction of the precautionary approach

and strict control of introductions of non-native species and the control and monitoring of ballast water discharges. Country specific actions are further detailed in the National Strategic Action Plans (NSAP), drafted by the individual countries.

The YSLME SAP proposes eleven regional management targets to sustain the Ecological Carrying Capacity (Box 1). These targets primarily address an ecosystem service, with the understanding that achievement of a target will also benefit other ecosystem services. These targets are set using current scientific understanding and most are quantitatively measurable. Under ecosystem-based management, scientific monitoring is essential to assess the impact of the management actions and management must be adaptive to respond to new knowledge.

Box 1: Regional targets and technical actions proposed by the YSLME SAP

Provisioning Services

Target 1: 25%-30% reduction in fishing effort
- Action 1-1: Control fishing boat numbers
- Action 1-2: Stop fishing in certain areas /seasons
- Action 1-3: Monitor and assess stock fluctuations

Target 2: Rebuilding of over-exploited marine living resource
- Action 2-1: Increase mesh size
- Action 2-2: Enhance stocks
- Action 2-3: Improve fisheries management

Target 3: Improvement of mariculture techniques to reduce environmental stress
- Action 3-1: Develop environment-friendly mariculture methods and technology
- Action 3-2: Reduce nutrient discharge
- Action 3-3: Control diseases effectively

Regulating Services

Target 4: Meeting international requirements on contaminants
- Action 4-1: Conduct intensive monitoring and assessment
- Action 4-2: Control contaminants discharge with reference to Codex alimentarius and Stockholm Convention
- Action 4-3: Implementing MARPOL 1973/78 effectively

Target 5: Reduction of total loading of nutrients from 2006 levels
- Action 5-1: Control total loading from point sources
- Action 5-2: Control total loading from non-point sources and sea-based sources
- Action 5-3: Apply new approaches for nutrient treatment

Cultural Services

Target 6: Reduced standing stock of marine litter from current level
- Action 6-1: Control source of litters and solid wastes
- Action 6-2: Improve removal of marine litter
- Action 6-3: Increase public awareness of marine litter

Target 7: Reduce contaminants, particularly in bathing beaches and other marine recreational waters, to nationally acceptable levels
- Action 7-1: Conduct regular monitoring, assessment and information dissemination particularly in bathing beaches and other recreational waters
- Action 7-2: Control pollution in bathing beaches and other marine recreational waters

Supporting Services

Target 8: Better understanding and prediction of ecosystem changes for adaptive management
- Action 8-1: Assess and monitor the impacts of N/P/Si ratio change
- Action 8-2: Assess and monitor the impacts of climate change
- Action 8-3: Forecast ecosystem changes in the long-term scale
- Action 8-4: Monitor the transboundary impact of jellyfish blooms
- Action 8-5: Monitor HAB occurrences

Target 9: Maintenance and improvement of current populations/distributions and genetic diversity of the living organisms including endangered and endemic species
- Action 9-1: Establish and implement regional conservation plan to preserve biodiversity

Target 10: Maintenance of habitats according to standards and regulations of 2007
- Action 10-1: Develop regional guidelines for coastal habitat management
- Action 10-2: Establish network of MPAs
- Action 10-3: Control new coastal reclamation
- Action 10-4: Promote public awareness of the benefits of biodiversity conservation

Target 11: Reduction of the risk of introduced species
- Action 11-1: Control and monitor ballast water discharge
- Action 11-2: Introduce precautionary approach and strict control of introduction of non-native species

1. Report Structure

Data/information of status related to target 1-2 were collected and reviewed. For each target, there are related actions and indicators, we compared the status with those indicators to summarize the implementation progress of NSAP in YSLME region.

2. Target 1

Target 1 is about the "25%-30% reduction in fishing effort". There are three actions, including control fishing boat numbers, stop fishing in certain areas /seasons, and monitor and assess stock fluctuations, the corresponding indicators are fishing vessel number, summer fishing ban and fish stock dynamics etc.

2.1 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 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 a total of 30, 000 fishing vessels was reduced in China, while strengthening alternative job markets, training, and financial support for retiring fishermen. In the 13th year plan in China, the fishing vessel buy-back programme is continued, 20, 000 fishing vessels will be reduced before 2020, as well as strengthen the fishery management. Based on the fishing vessels in 2015, marine motor fishing vessels will reduce 1500, 000 kW, the reducing fishing vessels in each province per year is not lower than 10% of total reducing fishing vessels. The large and middle size marine fishing vessels will reduce 8303 vessels with 1350829 kW, the small size fishing vessels will reduce 11697 vessels with 149171 kW, the fishing vessels is found in Table 2.1. The goal of control fishing vessels in provinces alone Yellow Sea 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 alone Yellow Sea*

Provinces	2015		2020	
	Fishing vessels (number)	Fishing vessels(kW)	Fishing vessels (number)	Fishing vessels(kW)
Liaoning	7084	703520	6177	614660
Shandong	10355	1292888	8976	1129267
Jiangsu	4274	550932	3644	480192
Zhejiang	13799	3270423	12082	2852613

(* not include distant water fishing vessels)

2.2 Stop fishing in certain areas /seasons

Summer fishing bans are important measures to protect fishery resource. The individual size of catch and production both greatly increased because of the implementation of closed

season in the recent years. Evidence shows that the fishing bans are effective in protecting the fishery resource. Since 2017, the summer fishing ban is extended to 4-4.5 months, there is 4 months in the north of latitude 35 ° N, and 4.5 months in the south of latitude 35 ° N. During the closed season, strengthening of fishing vessels management, and monitoring by AIS and radar, it is basically guaranteed “fishing vessels to port, gears to bank, fishermen to shore, collection of license”. The closed season relieves the decline of fishery resource by reducing to fish spawning stock and recruitment stock, effectively protect the fishery resources and maintain the long-term interest of fishermen. This measure brings good ecological, economic and social benefits. As a result, we strongly encourage the strengthening of supervision, and the reduction of fishing intensity to more effectively protect the fishery resource.

Fisheries resources dynamics in the Yellow Sea obviously occurred, especially extended the closed season in 2017. For example, the average biomass indicator of fishery species in 2017 greatly increased than that in 2015, the $\overline{CPUE}$ of pelagic species, such as Japanese anchovy, chub mackerel, silver pomfret, half-fin anchovy, increased more than 94.3%; the demersal fishery species, such as small yellow croaker, Pacific cod, angler fish, their $\overline{CPUE}$ increased from 46.6% to 127.4% during 2015-2017. The commercial invertebrates swimming crab and edible mantis shrimp showed greatly increase in $\overline{CPUE}$. Based on survey data, the average body length of commercial species (small yellow croaker and largehead hairtail) increased (Fig 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 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 had never been found in recent surveys, such as silver pomfret, black sea bream and largehead hairtail, their larvae and juveniles had been found in survey of 2017. 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 than those in the past years, correspondingly, the biomass of recruitment stock was higher than that in the past years.

The fishing production in the Yellow Sea was better than that in the past years, the production of Yanwei fishing ground in northern Yellow Sea was higher than that in the Dandong waters, as well as the production increase from bottom trawl and set net in the southern Yellow Sea, however, the production from gill net decreased.

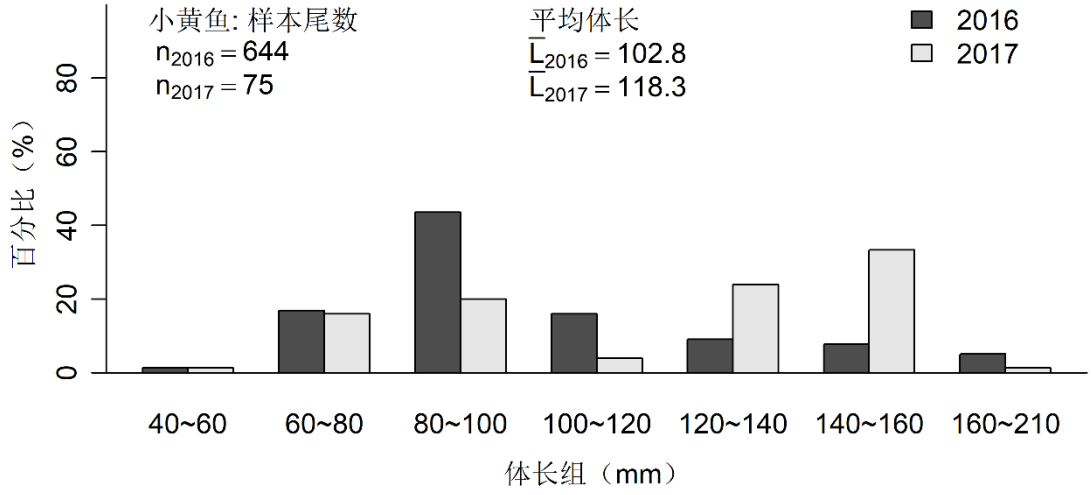

Fig 2.1. Body length distribution of small yellow croaker in the Yellow Sea

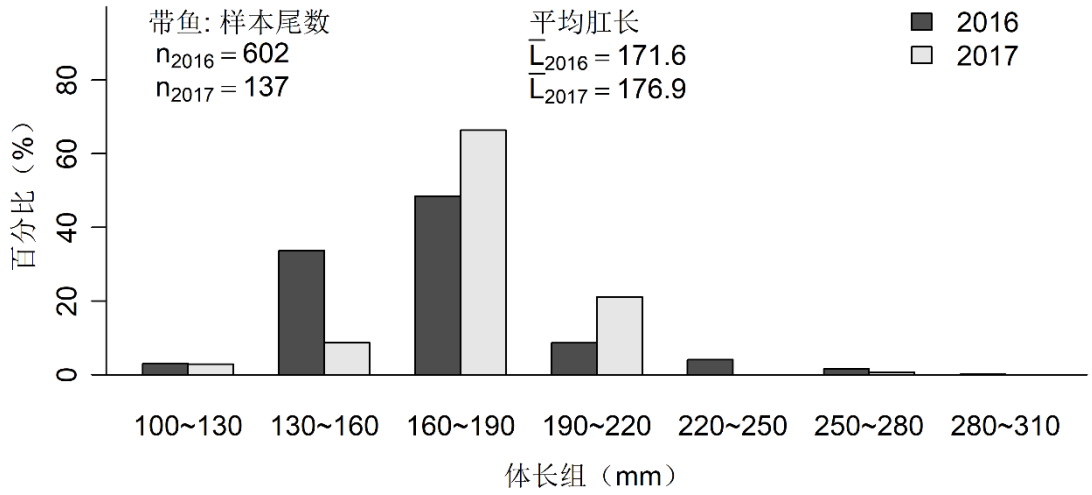

Fig 2.2. Body length distribution of largehead hairtail in the Yellow Sea

The closed season/area played an important role in conservation of fishery stock, especially extended 4-4.5 months since 2017. The results based on survey data and production data showed the increase of fish stock biomass and production. However, the effects evaluation system of the closed season needs to be improved, the evaluation system of closed season/area is not just included the 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.

2.3 Monitor and assess stock fluctuations

2.3.1 Changes in biomass yields

The long-term CPUE changes of fishery resources in the Yellow Sea were found in Fig 2.3. CPUE in the spring and autumn during 1958 to 1959 was higher than those 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.

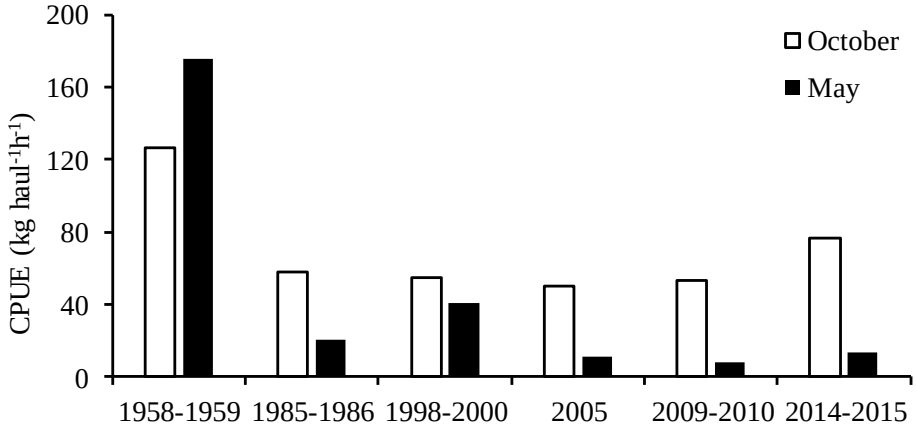

Fig 2.3. Long-term CPUE changes of fishery resources in the Yellow Sea. The CPUE data was collected by Yellow Sea Fisheries Research Institute, Chinese Academy of Fishery Science, based on scientific surveys. The data in the 1950s were collected by fishing vessels, and in other years, the data was based on research vessels.

2.3.2 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 (Figs 2.4 and 2.5). There was no significant changes in trophic level from 1985 to 2015, which implied 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.

In 1958-59, the dominant species were demersal, benthophagic, ichthyophagic, highly commercial valued species, including pointhead flounder (*Cleisthenes herzensteini*), bluefin searobin (*Chelidonichthys kumu*) , small yellow croaker (*Pseudosciaena polyatis*), hairtail (*Trichiurus haumela*), red seabream (*Pagrosomus major*), and the trophic level (TL) was 4.05-4.07; In 1985-86, the dominant species were pelagic, demersal, planktophagic, ichthyophagic, lower value species, including anchovy (*Engraulis japonicus*), horse mackerel (*Trachurus japonicus*), snailfish (*Liparis tanakai*), scaled sardine (*Sardinlla zunasi*), 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 (*Setipinna tenuifilis*), sand lance (*Ammodytes personatus*), and TL was 3.46-3.48; In 2014-15, the dominant species were demersal, benthophagic, ichthyophagic, low valued species, including crangonid shrimp (*Crangon affinis*), snailfish, yellow goosefish (*Lophius litulon*), 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 1958-59 to 1998-2000, and the other is from pelagic, low valued species to demersal, low valued species during 1998-2000 to 2014-15.

2.3.3 Changes in biodiversity

In 1958-59, the biodiversity of fishery resources in the Yellow Sea was relatively low, which might be related to the difference of the survey vessels and nets between 1958-59 and other years. The biodiversity fluctuated from 1985 to 2015, but it 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 (Fig 2.6).

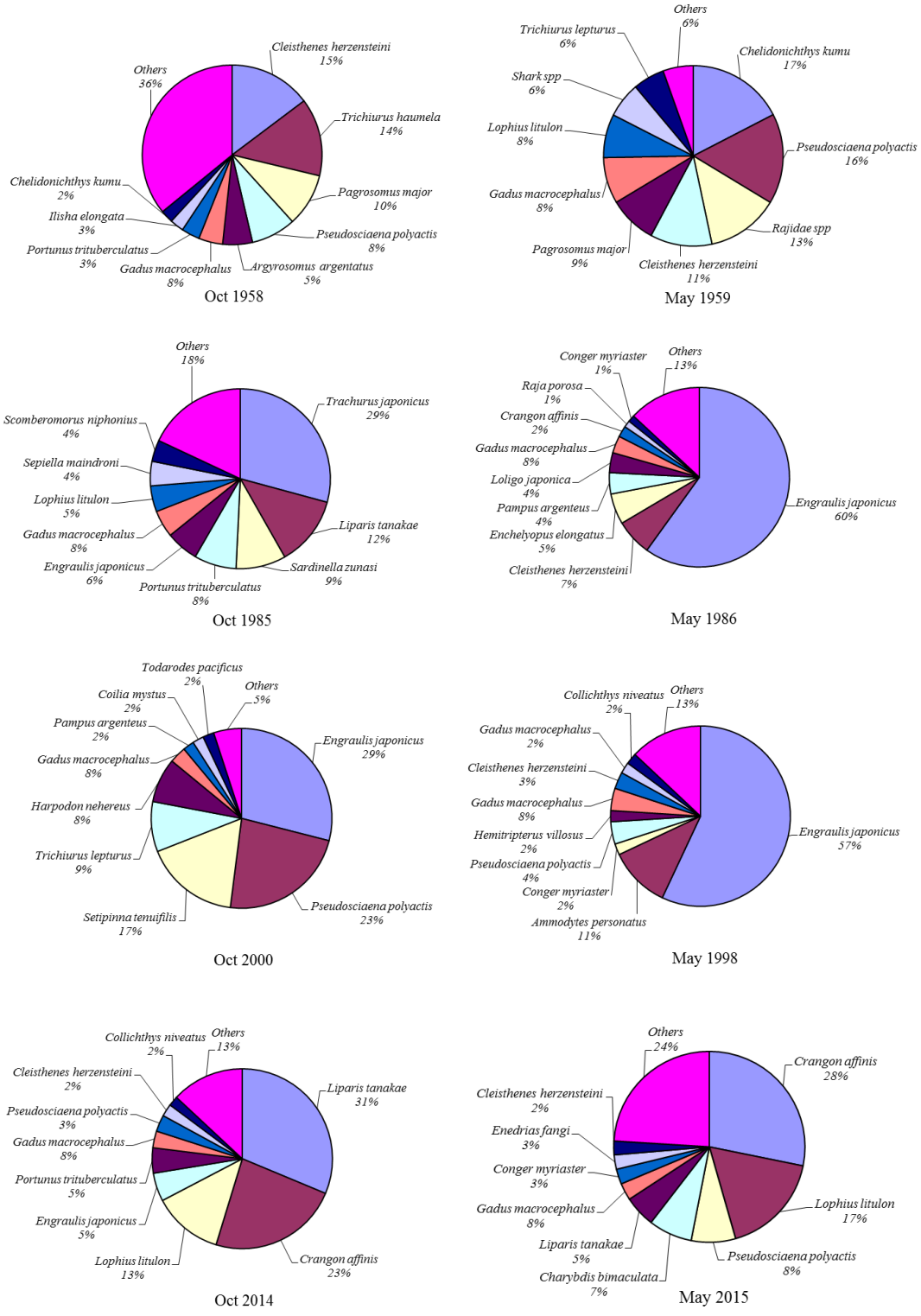

Fig 2.4 Long-term changes of fishery species composition in the Yellow Sea LME. The data source was the same as Fig 2.3

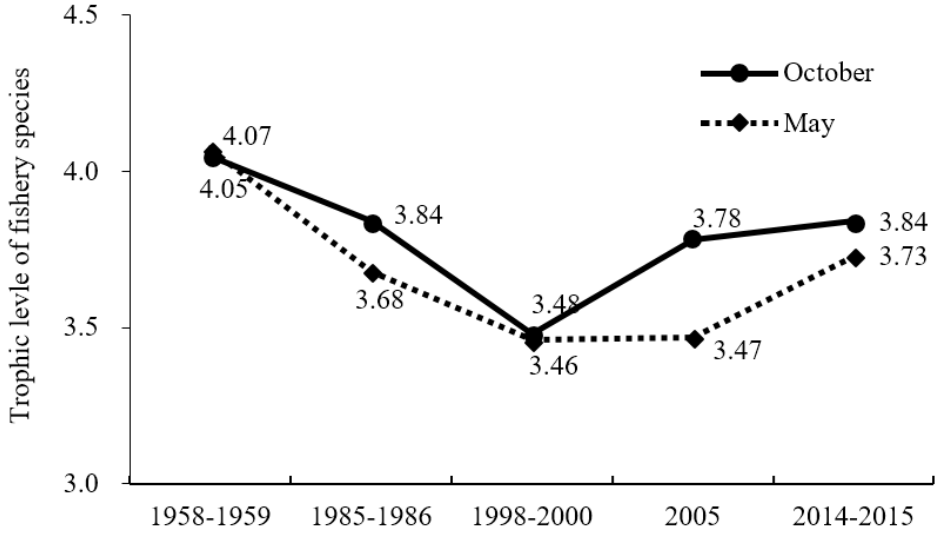

Fig 2.5 Long-term changes of trophic levels of fishery species in the Yellow Sea. The trophic levels cited from Zhang & Tang (2004). The data source was the same as Fig 2.3

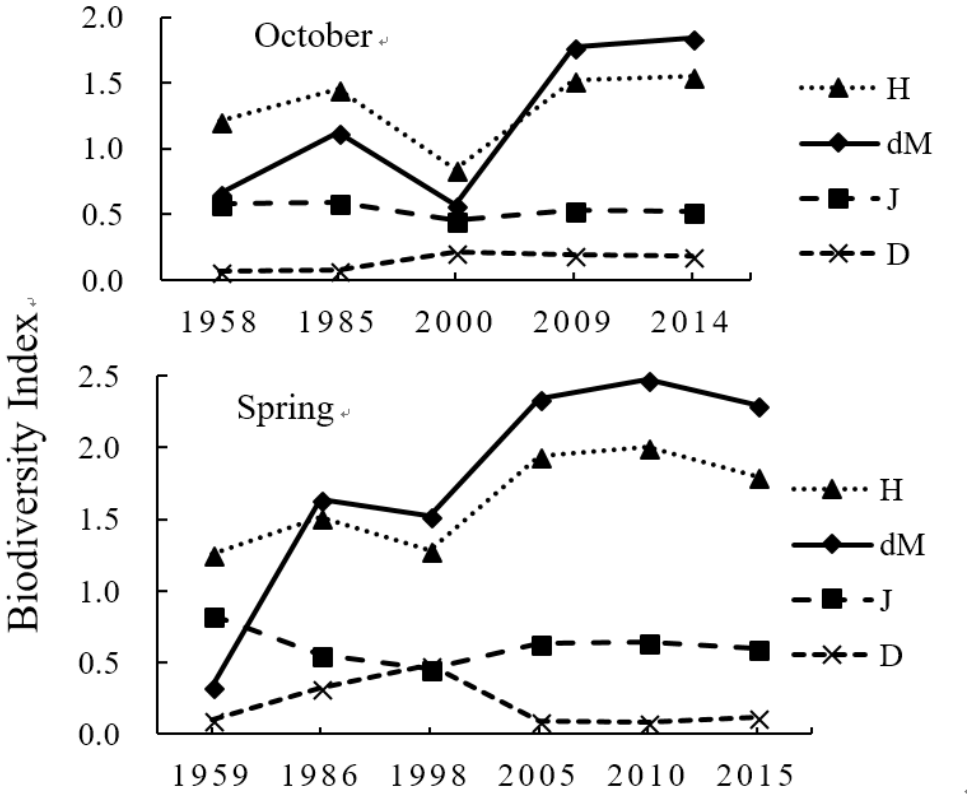

Fig 2.6 Long-term changes of biodiversity index (H: Shannon-Weiner Index, dM: Species richness Index, J: Pielou's evenness Index, D: Simpson dominance Index) of fishery species in the Yellow Sea LME. The data source was the same as Fig 2.3

Although there was no significant decline in biomass, trophic level and biodiversity of fishery resources in the Yellow Sea since the 1980s, the dominant species changed from demersal, higher value species to pelagic, lower value species during 1958-59 to 1998-2000, and then from pelagic, lower value species to demersal, lower value species during 1998-2000 to 2014-15. 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 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.

2.4 Summary

To recover YSLME 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, which is called "the strictest in history", and the fishing moratorium in all sea areas has been extended to 4-4.5 months. Facing the actual situation of YSLME, it is obviously necessary to carry out these new and strict management measures.

According to the analysis in the previous context, the assessment of target 1 was listed below (Table 2.2).

Table 2.2 The assessment of Target 1

Target 1	Indicators	Progress
25%-30% reduction in fishing effort	control fishing boat numbers	✧ A total of 30,000 fishing vessels was reduced during 2003-2010; ✧ There will reduce 20, 000 fishing vessels during the 13th year plan of China; ✧ Greatly reduced the fuel subsidies since 2015, there will be just 40% of 2014 in 2019, which indirectly reduce the fishing vessels; ✧ Strengthening alternative job markets, training, and financial support

		for retiring fishermen;
	stop fishing in certain areas/seasons	✧ The summer fishing ban is extended to 4-4.5 months; ✧ There is 4 months in the north of latitude 35 ° N, and 4.5 months in the south of latitude 35 ° N; ✧ Strengthening of fishing vessels management, and monitoring by AIS and radar;
	monitor and assess stock fluctuations	✧ Kickoff the regular survey of fishery resources in China coastal waters during 2014-2019, as well as the survey of spawning ground distribution; ✧ Make the plan on regular survey of fish stock;

3. Target 2

Target 2 is about “Rebuilding of over-exploited 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.

3.1 Increase mesh size

To conserve fishery resources, improve the sustainable fisheries in China, China government improved “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 3.1). If their body length of these 15-fishery species would not reach to the catchable size, they all 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 someone violated this rule, who will be penalized according to the No.38 items of Fisheries Law. The announcement pointed out that there should have more strict 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 3.1 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

*data source from Ministry of Agriculture and Rural Affairs, China, 2018

3.2 Enhance stocks

The 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 organization gradually increased, so was the releasing scale increased. For example, the stock enhancement in Shandong province, including 19 marine species and 6 freshwater species, the releasing time is from April to end of November. The conservation measures, such as artificial reef and marine ranching, have been developed, a total of 62 national level marine ranching have been built until 2017, and will reach to 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, China-Korea joint stock enhancement will firstly be conducted in the Yellow Sea on July, 2018. In the coming years, more cooperation on conservation and management of fishery resources in the Yellow Sea will be launched between China and Korea.

3.3 Improve fisheries management

3.3.1 The main fishery management measures in China

The main fishery management can be found in Table 3.2, the input control and output control are the main part of China 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 (start in 2017).

Table 3.2 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 BS, YS and ECS; and from 1998 in SCS; 4-4.5 months since 2017	Since 1950's 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

3.3.2 TAC management

Combined with fishing vessel buy-back program, total allowable catch (TAC) management conducted since 2017 (Table 3.3), 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 3.3 Control fishing production in 2020 in provinces alone Yellow Sea waters* (tons)

Provinces	2015	2020
Liaoning	1107857	846514
Shandong	2282340	1743937
Jiangsu	554314	423552
Zhejiang	3366966	2572700

3.3.3 Quota management

In 2017, quota management was conducted in China, and swimming crab in Zhejiang Province and jellyfish in Shandong Province were as the cases. The swimming crab showed excited results, the biomass and the catch increased in 2017, as well as the individual size. The income of fishermen 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, as we all know, jellyfish biomass is closely related to environment, especially temperature, so the quota and the catchable time of jellyfish should be determined by the concrete condition.

3.4 Summary

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 environmentally friendly aquaculture should be encouraged, some of them have been proved to have both ecological benefits and socioeconomic requirements (Tang et al., 2012, 2016).

According to the analysis in the previous context, the assessment of target 2 was listed below (Table 3.4).

Table 3.4 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	✧ The releasing aquatic species 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 on July, 2018;
	Improve fisheries management	➢ Reducing the fuel subsides since 2015; ➢ Reducing the total catch since 2017; ➢ Conduct the quota management of swimming crab and jellyfish since 2017, and expand to 5 species in 2018; ➢ Extend the summer fishing ban since 2017; ➢ Strengthening fishery law enforcement during summer fishing ban, combined with China Coast Guard;

4 Prospects

The 13th Five-Year Plan period is crucial for China to accelerate eco-civilization construction and to complete the construction of the moderately prosperous society. Fisheries can support the food security, increase the income of fishermen, 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, more fisheries conservation items have been introduced. Ministry of Agriculture and Rural Affairs launched the regular monitor survey on fisheries in coastal waters and inland waters since 2014, as well as the main spawning ground monitoring. These results will provide the important base for adaptive management. And since 2017, the TAC and Quota management have been introduced in China fishery management, and the closed season extended to 4-4.5 months. The control fishing vessels was conducted in 2003, and reduced 30000 fishing vessels to 2010, and there will reduce 20000 fishing vessels in 2020. The fuel subsidies greatly reduced since 2015, and will reach to 40% of that in 2014. The guideline of stock enhancement and marine ranching were issued by Ministry of Agriculture and Rural affairs in recent years, which will guide them to scientific development. Particularly, China-Korea joint stock enhancement will conduct in 2018, which is a good beginning to the conservation of fishery resources in the Yellow Sea. In the future, China will continue cooperate with the other countries to develop the responsible fisheries.

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