China Sustainable Seafood Assessment (CSSA)

Fishery

Japanese Spanish mackerel (*Scomberomorus niphonius*)
Offshore Fishery

CSSA Team

December 2023

Statement

In the assessment of all species, the China Sustainable Seafood Assessment (CSSA) team will strictly follow the assessment criteria and refer to the latest, impartial and objective scientific data. Common sources of reference for evaluation data include literature review, official materials, objective and unbiased media reports, data obtained from field research, and expert interviews. Inevitably, many fisheries face the problem of lacking robust data, and some data are not publicly available, which may affect the assessment results to some extent. The CSSA team is committed to carrying out the assessment and evaluation of the species objectively and impartially, basing on respecting objective facts, making maximum use of open data, and relying on rigorous scrutiny of experts. The results of the species assessment do not represent the opinion of any particular expert, scholar, etc.. The CSSA team has the right to the final interpretation of the assessment results.

Content

Introduction

China is the world's largest fishing country, and also has a large consumer market for aquatic products. The food choices we make determine the present and future of our marine and freshwater ecosystems. In order to cultivate a new generation of responsible seafood foodies, Qingdao Marine Conservation Society (QMCS) has launched the China Sustainable Seafood Assessment (CSSA) project to customize scientific and interesting sustainable seafood consumption guides for domestic consumers. We hope that by raising public awareness and promoting changes in consumer behavior, we can use the power of the market to force industrial transformation and make a lasting contribution to the continuous improvement of the health of China's marine and freshwater ecosystem.

Executive Summary

The Japanese Spanish mackerel (*Scomberomorus niphonius*) is a warm-temperate pelagic fish species widely distributed in the Northwest Pacific, ranging from the Japanese archipelago to the southern tip of the Korean Peninsula, and in the waters of the Bohai Sea, Yellow Sea, and East China Sea in China. The exploitation of Japanese Spanish mackerel resources in China began in the 1960s, mainly through gillnet fishing targeting the spring spawning population, with yields below 3,000 tons. Since the promotion of paired trawling in the 1990s, the catch of Japanese Spanish mackerel in China has sharply increased, with the national annual production currently maintained at around 350,000 tons. With the increasing fishing intensity, the Japanese Spanish mackerel resources in the Yellow and Bohai Seas are showing signs of overexploitation, with accelerated growth and early maturation, and more than 90% of the fish caught are mature at age 1, indicating a decline in fishery resources.

The main methods of Japanese Spanish mackerel fishing are gillnet and paired trawl fishing, both of which have low selectivity and involve multi-species, including hairtail (*Trichiurus japonicus*), small yellow croaker (*Larimichthys polyactis*), silver pomfret (*Pampus argenteus*), and Japanese jack mackerel (*Trachurus japonicus*). The threats to juveniles of economically important species also exist in the fisheries. Additionally, gillnet fishing poses a risk of bycatch to the East Asian finless porpoise, while trawling in the East China Sea has recorded incidents of bycatch of sharks and sea turtles.

The operation of trawl fisheries can have a significant negative impact on the seabed substrate, but due to the fact that Japanese Spanish mackerel are pelagic species, the paired trawling has limited interactions with the substrates. Gillnet fishing does not contact with the seabed substrate. Therefore the Japanese Spanish mackerel fisheries has limited impact on habitat.

The management of Japanese Spanish mackerel fisheries follows the provisions of the Fisheries Law of the People's Republic of China and other relevant laws and regulations. China has established aquatic germplasm reserve for Japanese Spanish mackerel and issued several regulations for their protection, such as *Notice on Strengthening the Protection of Japanese Spanish Mackerel Juvenile Resources*, and *Notice on Strengthening the Protection of Japanese Spanish Mackerel Resources in*

the Yellow and Bohai Seas. Additionally, decisions to prohibit trawling in the Bohai Sea, as well as *Regulations on the Protection of Spawning Fisheries Resources in the Bohai Sea* and *Conservation of Biological Resources in the Bohai Sea*, along with the seasonal fishing ban system, are all of significant importance for the conservation of Japanese Spanish mackerel fisheries resources. However, the current management plans primarily focus on the protection of Japanese Spanish mackerel as a single species, with a lack of comprehensive management measures for other economically important species and endangered species involved in the fisheries industry. There is also a lack of practical efforts to carry out fisheries resource conservation and management at the ecosystem level.

Given the issues of excessive fishing intensity and pressure on resources in the trawl and gillnet fisheries for Japanese Spanish mackerel in the Yellow and Bohai Seas, CSSA rates the sustainability of Chinese coastal fishing for Japanese Spanish mackerel as yellow—overall sustainability is good, but there is room for improvement.

Japanese Spanish Mackerel

Scomberomorus niphonius

Think Twice

Species Profile

The Japanese Spanish mackerel (*Scomberomorus niphonius*) belongs to the Perciformes order, Scombridae family, and *Scomberomorus* genus. It is a warm-temperate pelagic fish species widely distributed in the Northwest Pacific, ranging from the Japanese archipelago to the southern tip of the Korean Peninsula, and in the waters of the Bohai Sea, Yellow Sea, and East China Sea in China.[3]

The Japanese Spanish mackerel is agile in swimming and exhibits schooling behavior. It migrates long distances for spawning and overwintering, being sensitive to water temperature during migration.[3]

Males mature earlier than females. Most male fish reach sexual maturity at age 1, while only a few female fish reach maturity at this age. All male fish reach maturity at age 2, while most female fish reach maturity at this age, and all female fish reach maturity at age 3. The Japanese Spanish mackerel spawns in batches, with a reproductive capacity ranging from 4.80×10^4 to 11.00×10^4 eggs. The fecundity increases with age. Spawning occurs from May to July, delayed from south to north.[3][6]

It is generally believed that there are two overwintering grounds for Japanese Spanish mackerel, one near Jeju Island, South Korea (32°00′-33°40′N, 124°40′-127°15′E), and the other in the East China Sea (28°00′-31°20′N, 123°40′-125°30′E). As water temperatures decrease in September, the fish begin their migration to suitable temperature zones. In December, they stay at the Dasan fishing ground, and from January to February, they overwinter near Jeju Island. In March, the fish gradually leave the

overwintering grounds for spawning migration. One group migrates to the central and eastern Fujian coastal fishing grounds, then northward along the Taiwan Warm Current, while the other group migrates to the Yellow and Bohai Seas via the Dasan fishing ground.[10]

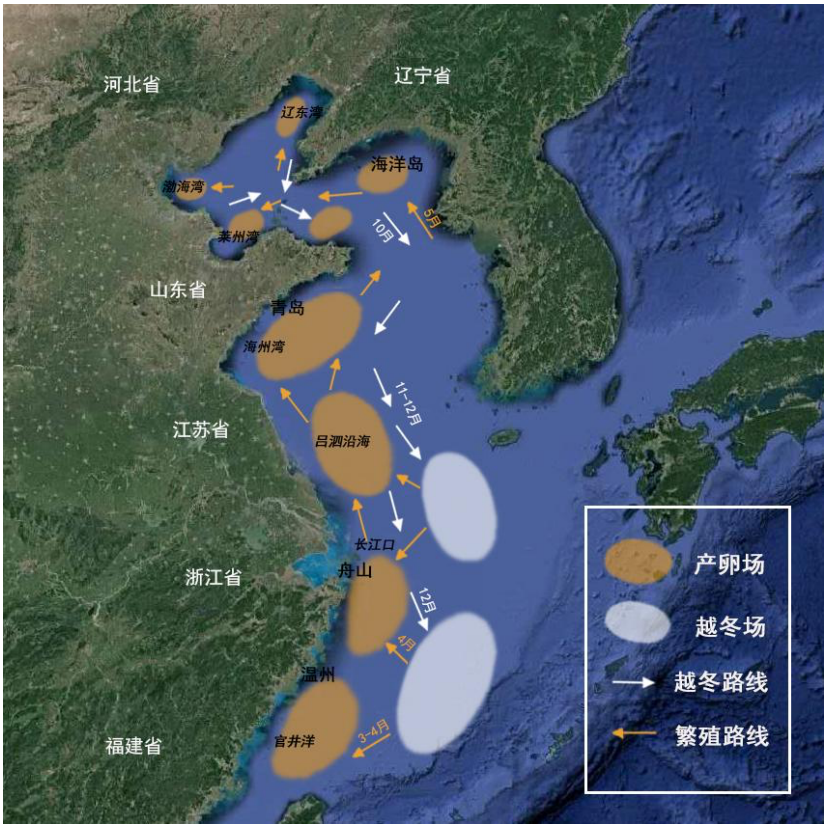

Figure 1. The wintering grounds of Japanese Spanish mackerel [7]

In the Yellow and Bohai Seas, during the spawning season each year, the spawning population mainly feeds on adult fish with a body length of 85-120 millimeters, followed by Japanese flying squid, sand lance, Indian perch, and *Trachypenaeus curvirostris*. During the summer and autumn fishing seasons, juvenile Japanese Spanish mackerel primarily feed on anchovies. In winter, the overwintering population mainly feeds on juvenile Japanese anchovy, juvenile red seabream, Chinese tapertail anchovy, common hairfin anchovy, goby fish, *Metapenaeopsis dalei* and *Metapenaeus joyneri*.[3]

As fishing efforts in the Japanese Spanish mackerel fisheries continue to increase, the population composition and biological characteristics of the species undergo continuous changes. This is evident in the accelerated growth rate, earlier age of sexual maturity, lower aged and miniaturization. However, despite fluctuations, the population size has been consistently increasing.

FULL ASSESSMENT

Criterion 1: Impact on Target Species

Status of resources

The exploitation of Japanese Spanish mackerel resources can be divided into five stages: the primitive stage before 1962, the development stage from 1962 to 1976, the full utilization stage from 1977 to 1989, the decline stage from 1990 to 1997, and the management stage after 1997. The composition of spawning populations also varies significantly across these five stages. With the rapid increase in fishing intensity, the composition of spawning populations in the Yellow and Bohai Seas tends to become smaller and younger.

From the primitive stage to the full utilization stage, the dominant age classes shifted from ages 3 and 2 to ages 1 and 2, with average fork lengths and weights decreasing from 583 mm and 1507 g to 521 mm and 1091 g, respectively. After 1990, due to the use of larger mesh sizes in gillnet and the introduction of trawling, there was an increase in the capture of older fish, leading to increases in the average age, fork length, and weight. However, the population still consists mainly of age 1 and 2 fish. Moreover, since the late 1970s, after the exploitation of recruitment population by using trawling, the autumn fishery in the Yellow and Bohai Seas has primarily targeted juvenile fish, accounting for over 90% of the Japanese Spanish mackerel catch, with this proportion gradually increasing from 90.25% in the full utilization stage to 92.76%.[6] In recent years, there have been continuous changes in the composition and biological characteristics of Japanese Spanish mackerel populations, notably characterized by accelerated growth rates, earlier sexual maturity, extended spawning periods, and increasingly unstable compositions of spawning population.[3]

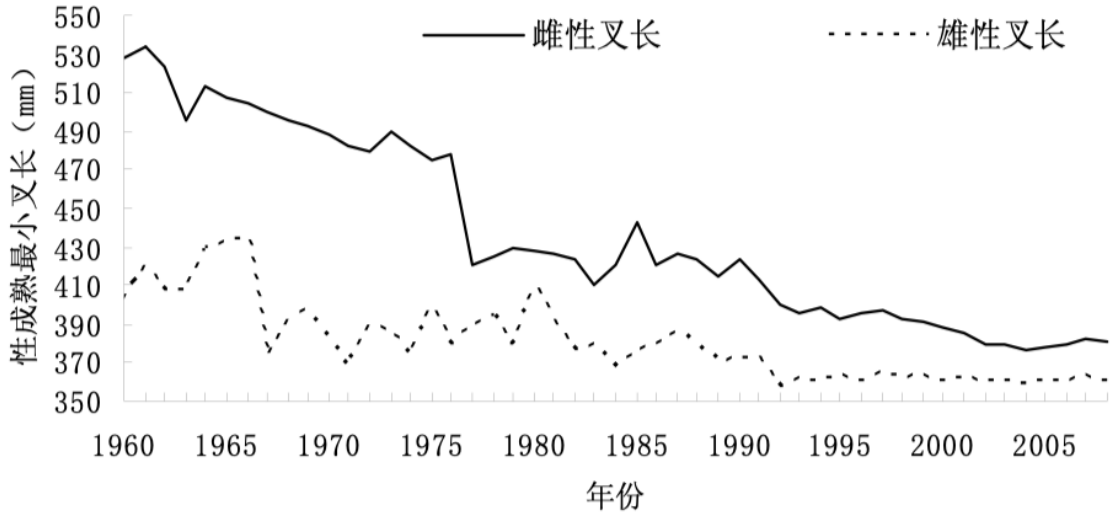

Figure 2. The minimum fork length of Japanese Spanish mackerel during 1960-2008 [6]

Fishing level

Before 1962, cotton-thread gillnets were used to catch spawning populations with relatively low fishing capacity, resulting in annual catches ranging from 0.14×10^4 to 0.48×10^4 tons.

After 1963, with the motorization of fishing vessels and the use of nylon thread gillnets, the fishing capacity increased rapidly. Although the focus remained on catching spawning populations, the annual catch increased year by year, ranging from 0.86×10^4 to 4.30×10^4 tons. After 1977, bottom trawlers in autumn joined the fishing and gradually became the main method for the harvest of Japanese Spanish mackerel resources. The Japanese Spanish mackerel fishery is conducted in two seasons, spring and autumn. The spring catch has remained around 20,000 tons, but the annual catch has increased year by year, reaching 2.98×10^4 to 6.95×10^4 tons. After 1990, due to the use of paired trawlers, the catch increased rapidly to 6.26×10^4 to 16.99×10^4 tons. After experiencing the primitive stage, development stage, full utilization stage, and overutilization stage, in the beginning of the 21st century, fishing management measures such as the summer fishing moratorium system began to be implemented. The spawning population and supplementary population resources received certain protection, and the catch of Japanese Spanish mackerel in the Yellow and Bohai Seas increased to over 200,000 tons, ranging from 21.40×10^4 to 29.72×10^4 tons.[6]

Currently, due to the severe decline of other economically important fisheries resources in the Yellow and Bohai Seas, Japanese Spanish mackerel has become one of the most important large-scale economic fish species in the Bohai and Yellow Sea. Since the 21st century, annual catches in the Yellow and Bohai Seas have exceeded 10×10^4 tons, with a total annual catch ranging from 21.40×10^4 to 29.72×10^4 tons. The main fishing areas in the Yellow and Bohai Seas are concentrated near Jeju Island and the Dasan fishing ground, while the East China Sea has a wider operating area, with higher CPUE in the Yushan fishing ground and Yuwai fishing ground.[11]

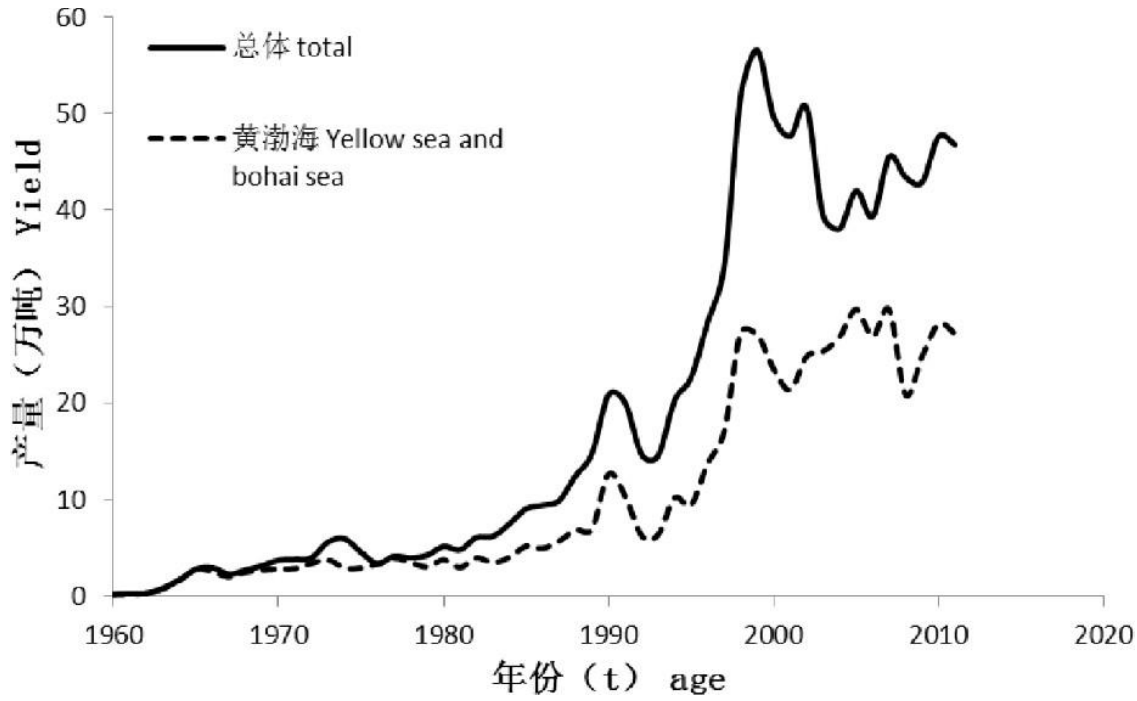

Figure 3. Historical catch data of Japanese Spanish mackerel

Criterion 2: Impact on Non-target Species

Bycatch of other concurrently harvested species and Threatened, Endangered, Protected (ETP) species

In addition to Japanese Spanish mackerel, the catch in gillnet also fishery includes Korean rockfish, grey pomfret, and hairtail, etc. Japanese Spanish mackerel accounts for 80% of the catch, while Korean rockfish constitutes the main component of the bycatch, accounting for 18% of the total catch. Other bycatch species make up only 2% of the total catch.[9] Although gillnets has relatively high selectivity in catch Japanese Spanish mackerel, it poses a potential threat to the East Asian finless porpoise due to the overlap with their habitats of the fishing grounds.

The mesh size of trawl nets is small, generally around 20mm, resulting in low selectivity in catches. In addition to catching Japanese Spanish mackerel and anchovies, trawl nets also bycatch various fish species, including the juveniles of economically important species, including Japanese Spanish mackerel juveniles. The bycatch harms fishery resources and undermines their sustainable utilization. Japanese anchovy is an important forage fish species in the Yellow, Bohai Seas and the northern East China Sea and serves as a major food source for many marine species. Due to the combined effects of climate change and long-term intensive fishing, Japanese anchovy resources in China have been declining, influencing the abundance of Japanese Spanish mackerel. Since the 1990s, to meet the demands of aquaculture and livestock farming for feed, Japanese anchovy has transitioned from being a low-value bycatch to a key target for fishing, with an average annual catch of millions of tons.

As the resources of Japanese anchovy and other forage fish decline, including Japanese Spanish mackerel, many medium to large carnivorous species will face threats of population reduction due to food shortages.

Figure 4. A large quantity of bait species and juveniles of economically important species are found in the catch of paired trawlers.

In addition to affecting other economically important species, the low selectivity of trawl nets may also result in the bycatch of endangered or threatened species. Records of shark bycatch in trawl fisheries in China's coastal waters are not uncommon. A study conducted through interviews with fishers and fisheries departments, combined with field surveys, have found that trawl nets may be the primary gear type responsible for shark bycatch, as the vast majority of shark species surveyed (25 out of 28) have records of being bycaught in trawl nets.[8] Sharks grow slowly, take a long time to reach sexual maturity, and have low reproductive rates, making them typical K-strategists. Currently, several shark-related species are experiencing declining populations, especially species such as the scalloped hammerhead shark (IUCN Red List status: Endangered). In addition, species such as the olive ridley sea turtle and green sea turtle have been incidentally caught in Fujian and Zhejiang provinces, while hawksbill turtle have been bycaught in Fujian. Leatherback turtles have also been incidentally caught by trawl vessels in Zhejiang.

Criterion 3: Control Impact on Ecosystem

The effect of fishing gear

In China, the harvest of mackerel has evolved from the initial cotton thread gillnet fishing to the use of paired pelagic trawls, which are more flexible and significantly improve the efficiency of catching economically important species. The operation method of paired trawling can change the operating water layers according to the different target species, but it has low selectivity. While ensuring high

yields, it causes significant harm to multiple fishery resources and increases the risk of damage to the seabed substrate to some extent due to contact.

Currently, a considerable proportion of Japanese Spanish mackerel is also caught using gillnets. Gillnetting is a traditional and efficient fishing method primarily used to catch migratory fish species. It involves suspending vertical nets in the water, where passing fish become entangled in the mesh. Gillnets come in various forms. Single-layer gillnets offer a relatively high degree of selectivity. However, in recent years, the length of gillnets has increased significantly, with some extending for tens or even hundreds of kilometers. Developments have progressed from using single layer net panels to employing double or triple-layered ones, with mesh sizes generally small and some even featuring codends. Many gillnets are placed across the migratory routes of marine species, causing significant harm to the fishery resources while obstructing their migration to spawning grounds for reproduction. As a result, the fishing intensity for adults and juveniles is high. Therefore, multi-layer gillnets have become a highly destructive fishing gear for fisheries resources. Currently, the use of gillnets has been prohibited in key areas of the Yangtze River Basin in China.[5]

Ecosystem-based fisheries management

Based on the principles of ecosystem-based fisheries management, it is imperative to not only focus on the target species but also consider the broader components and functions of the ecosystem in fisheries management practices.[1] Ecosystem-based fisheries management represents a more comprehensive approach to resource management. However, in China, fisheries management predominantly relies on total catch and input controls, with limited implementation of measures for conserving and managing fisheries resources at the ecosystem level. While aquatic germplasm reserve has been established for Japanese Spanish mackerel to conserve and replenish fishery resources, the planning and design of these protected areas have yet to fully integrate their ecological roles and impacts on the ecosystem into the fisheries management framework.

The Japanese Spanish mackerel belongs to the group of fish with a longer life cycle and higher trophic level in the ecosystem. A decrease in its population may lead to an increase in the proportion of lower trophic level species in the ecosystem, causing changes in population structure and a decrease in the stability of marine ecosystems. Therefore, in managing fisheries for such species, it is crucial to adopt a holistic perspective and incorporate the dynamics of species interactions into management frameworks. Consequently, CSSA advocates for the comprehensive consideration of various factors, including the management of prey resources, when developing management plans for Japanese Spanish mackerel fisheries. This approach facilitates the maintenance of marine ecosystem balance and the achievement of management objectives aimed at restoring fishery resources.

Criterion 4: Management and Implementation

Fishery management plans for target species

As a major economic fishery resource in the Yellow and Bohai Seas, the management of Japanese Spanish mackerel resources has always been a focus of China's marine fisheries management, with multiple measures and regulations applied to its resource management.

In 1955, the State Council issued the "Order on the Prohibition of Trawling in the Bohai Sea, Yellow Sea, and East China Sea by Motorized Trawlers," which established a non-trawling zone line consisting of 17 reference points. It stipulated that motorized trawlers equipped with propellers and fishing gear intended for bottom-dwelling aquatic animals (excluding sailboat fishing vessels) were not allowed to operate within the non-trawling zone line. The zone line was extended in 1957 and 1980, resulting in the national non-trawling zone line for motorized trawling fishing vessels comprising 40 reference points. Starting in 1981, all motorized bottom trawling fishing vessels were prohibited from operating within the aforementioned non-trawling zone line.

Since 1995, to conserve the spawning fisheries resources in summer, the East China Sea region has implemented a comprehensive fishing ban on trawling and canvas stow nets in July and August, gradually extending to the entire Chinese coastline. Currently, the summer fishing ban has become one of the fundamental fisheries management measures in China, covering major fishing operations and adjusting the timing, types, and scope of fishing bans according to the actual situation each year.

The Xiangshan Port Japanese Spanish Mackerel National Aquatic Germplasm Reserve has been included in the fourth batch of aquatic germplasm reserves in China, with a special protection period from March 1st to July 31st each year. The reserve focuses on the protection of Japanese Spanish mackerel as the main protection target, protecting its spawning grounds, feeding grounds, and migration routes.[6]

In 1986, the Yellow and Bohai Sea Fisheries Administration implemented No. 63 (1986) *Notice on Strengthening the Protection of Japanese Spanish Mackerel Juvenile Resources*, protecting the juvenile resources of Japanese Spanish mackerel in the northern Yellow and Bohai Seas by establishing spring Japanese Spanish mackerel protection zones and fishing moratoriums. Measures such as prohibiting various types of trawling, gillnets, and purse seines from fishing for Japanese Spanish mackerel spawning populations have effectively protected recruitment population. To strengthen the protection and management of Japanese Spanish mackerel resources, the Ministry of Agriculture issued No. 17 (1996) *Notice on Strengthening the Protection of Japanese Spanish Mackerel Resources in the Yellow and Bohai Seas*, which stipulated the minimum catch size and mesh size standards for gillnets for Japanese Spanish mackerel fisheries. Since 1991, the *Regulations on the Protection of Spawning Fisheries Resources in the Bohai Sea* stipulated that the minimum catch size for Japanese Spanish mackerel is a fork length of 45 cm or more. Nets with a mesh size of less than 90 millimeters and a straightened height of netting not exceeding 9 meters are prohibited for fishing

Japanese Spanish mackerel.

In 2003, the *Conservation of Biological Resources in the Bohai Sea* strengthened the protection of important spawning grounds, feeding grounds, overwintering grounds, feeding grounds, overwintering grounds, and migration routes for biological resources in the Bohai Sea, playing an important guiding role in the conservation of Japanese Spanish mackerel resources.

In 2015, Zhejiang Province issued a Notice on the Implementation of the Minimum Catch Size and Juvenile Proportion Management System for Key Marine Fishery Species, setting the minimum catch size of Japanese Spanish mackerel at a weight of 430 grams or a fork length of 380 mm. [10] To effectively protect juvenile fish resources and promote the recovery and sustainable utilization of marine fishery resources, starting in 2018, the minimum catch size standards and juvenile catch proportion management regulations for 15 important economic fish species were implemented in accordance with the requirements of the Ministry of Agriculture and Rural Affairs. The minimum catch size for Japanese Spanish mackerel is a fork length ≥380 mm.[4]

However, it is worth noting that although there are relatively rich management measures for Japanese Spanish mackerel, the actual implementation effect needs to be evaluated and verified. Through field investigations, it was found that the implementation of the minimum catch size for Japanese Spanish mackerel is not implemented well, and a large number of individuals below the minimum size appear in the catch. Additionally, the length of gillnets deployed by some fishing vessels during actual production far exceeds the prescribed length.

Fisheries management system

China's current fisheries management primarily relies on measures such as summer fishing moratorium, non-trawling zone lines, and aquatic germplasm reserves to control fishing intensity and alleviate fishing pressure. While these initiatives have yielded some initial outcomes, they have not effectively addressed the overarching goal of resource recovery. China's fisheries management system faces several key deficiencies:

1. Inadequate data reporting and monitoring of fishery catches, leading to a lack of fishery-dependent species biomass assessment and monitoring.
2. Low gear selectivity resulting in a high proportion of non-target species and economically valuable species' juveniles in the catch, with limited information available to evaluate associated impacts.
3. The substantial catch of low trophic level species may have significant ecosystem impacts, but relevant information for assessing these impacts is lacking.
4. Absence of specific management plans tailored to individual species, beyond general measures like summer fishing moratorium and non-trawling zones.

Moreover, China's nearshore areas typically feature mixed fisheries involving multiple species. Challenges in designing and implementing quota-based fishing management systems arise due to incomplete regulations, lack of vessel and catch volume data, and the absence of an effective fisheries monitoring system.

To address these challenges, it is imperative to not only reinforce enforcement of existing management measures but also to:

- Strictly limit the use of destructive fishing gear and practices.
- Crack down on three-no fishing vessels (fishing vessels without licenses, vessel names or proof of being on a port registry).
- Improve gear selectivity to reduce bycatch.
- Strictly implement minimum mesh sizes and minimum catch sizes to protect juveniles.

Additionally, there is a pressing need to develop comprehensive fish catch monitoring systems, design and implement ecosystem-based management approaches, and integrate species-specific fishing management plannings into the existing management framework. These efforts are crucial for establishing a robust and effective fisheries management system in China.

Acknowledgement

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