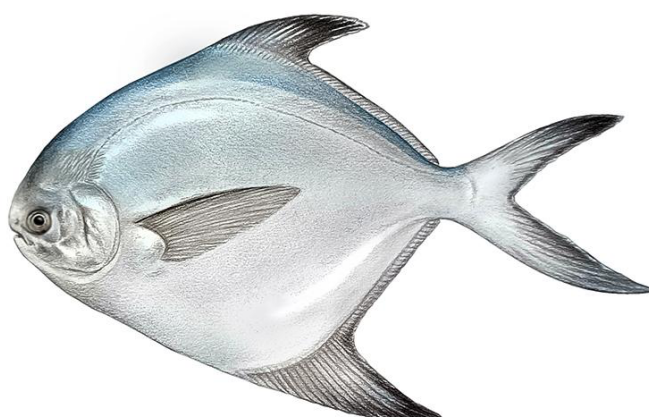




China Sustainable Seafood Assessment (CSSA)

Fishery



Silver pomfret (*Pampus argenteus*)
Offshore Fisheries

CASS 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.

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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

Silver pomfret belongs to warm-water pelagic fish, widely distributed in China's waters, is an important economic species in China, and its resources are highest offshore in the northern East China Sea.

China's research on the silver pomfret's resources was concentrated before 2015. Relevant research results show that China's offshore silver pomfret population resources generally show the phenomenon of resource decline, such as limit fork length reduction, accelerated growth rate, population miniaturization, and serious under ageing. To look at the fishing pressure, the excessive fishing mortality coefficient and exploitation rate have caused over-utilization of resources. At present, the annual catch of pomfret in China is maintained at more than 300,000 tons, and Zhoushan fishery along the coast of Zhejiang Province is the central fishing ground with highest yield.

Silver pomfret is the main target species of gillnet fishery, but also bycatch species of set net, stow net, trawl and purse seine. In addition to silver pomfret, the main species of gillnet catches in the East Yellow Sea may include economic species such as small yellow croaker, miiuy croaker, yellow drum, hairtail, grey pomfret, Japanese Spanish mackerel, chub mackerel, elongate ilisha, hairfin anchovy, pike conger, swimming crab, Asian paddle crab, golden cuttlefish and so on. In addition, sharks such as the hammerhead shark (*Sphyrna lewini*) are occasionally caught in offshore fisheries, with a low frequency, and the impact on related species is relatively small.

The gillnet fishery does not damage the substrate significantly, but the small mesh of multiple-layer gillnets are prone to overfishing of the juveniles of economic species, which has a certain impact on the recovery of fishery resources. The study showed that the main prey species of silver pomfret includes benthic shrimps, Northern mauxia shrimp, Japanese loligo squid, phytoplankton and zooplankton (including jellyfish) and other species in lower trophic levels, so the lower trophic level species resources also affects the population of silver pomfret and other economic species. Therefore,

CSSA team believes that when designing a fishery resource management plan for silver pomfret, the interspecies relationship should be included in the assessment, in order to achieve a more comprehensive and effective fishery management.

At present, China has set up input control methods based on fishing moratoriums, non-trawling zones and so on. China also established aquatic germplasm reserve for the silver pomfret, and formulated regulations such as the minimum catch size. These protection and management regulations, to a certain extent, have had a positive impact, but there are still some improvement needs in the implementation.

To summarize, according to the research and assessment of CSSA team, it is believed that China's silver pomfret resources show a declining trend generally, and its fisheries also have problems such as fishing intensity is too high, fishing gear selectivity needs to be improved, and the implementation of protection and management measures needs to be strengthened. Therefore, the silver pomfret fished offshore in China is rated as Yellow - a category that has good overall sustainability but still has room for improvement.



Silver Pomfret

Pampus argenteus

Think Twice

Species Profile

Silver pomfret is a warm-water pelagic species. Silver pomfret is found in the Indian Ocean, the Indo-Pacific Ocean, China, Korea and Japan. ^[6] In China, silver pomfret is mainly distributed in Lvsi of Jiangsu Province, Dai-qu and Da-mu of Zhejiang Province, offshore waters of Wenzhou and Taizhou, and Fujian's Min-dong fishing ground. China's silver pomfret population can be divided into two stocks, that is the Yellow -Bohai Sea stock and the East China Sea stock, while some scholars believe that the silver pomfret in the Bohai, Yellow and East China Sea can be divided into the Yellow and Bohai Sea stock, the northern East China Sea stock and the southern East China Sea stock. ^{[15][16]} Silver pomfret resources are highest in the northern East China Sea offshore. In natural environment, the silver pomfret usually spawns near the mouth of rivers and brackish waters. Due to the different water conditions in different areas, the spawning season of silver pomfret will also be different, varying from January to September worldwide, with April to July or August being the peak spawning season. In China, the spawning depth is around 10 to 20 meters, salinity around 26 ‰ ~ 31 ‰, and the substrate is mud and sand-based. The fecundity of silver pomfret is different among individuals, up to more than 10 times, with the absolute fecundity is around 3 ~ 24 million.

Silver pomfret wintering grounds located in the convergence area of coastal currents and warm

currents in China and North Korea mainland. The wintering ground of silver pomfret located in Jeju Island, Tsushima Island and Wudao Island is the wintering ground of the Yellow and Bohai Sea stock. And the wintering ground in the East China Sea is for the East China Sea stock.

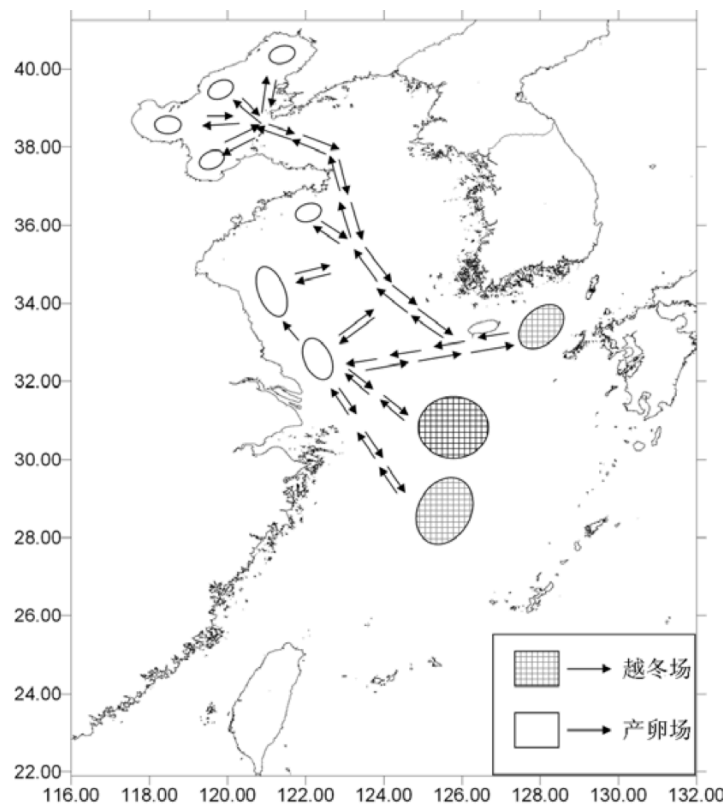


Figure 1. The distribution map of migratory route of silver pomfret in the Eastern Yellow and Bohai Seas^[15]

FULL ASSESSMENT

Criterion 1: Impact on Target Species

Status of resources

China's research on pomfret resources was concentrated before 2015. In 2008, Li Fan et al. published research results showing that the biomass of silver pomfret in the Yellow Sea area was 4,194 tons in 2000, which was mainly distributed in the western and northern inshore shallow waters of the Yellow Sea.^[5] Zhou (2013) et al. estimated the pomfret resource in the East China Sea by using the length-based cohort analysis and Schaefer and Fox model, and concluded that the average resource of silver pomfret in the East China Sea area in 2005-2006 was 19.38×10^4 tons, and the maximum sustainable yield was 14.4×10^4 tons.^[21] The minimum fork length of sexual mature silver pomfret in the southern Yellow Sea decreased from 129mm in 1985 to 104mm in 2004.^[1] The fishing mortality coefficient of silver pomfret in the Pearl River Estuary waters was 0.944 in the 1990s, which was nearly two times

higher than that in the 1980s. ^[13] By analyzing the fishery resources monitoring data in the East China Sea area from 2001 to 2010, Jiansheng Li (2014) et al. found that the asymptotic fork length of the East China Sea silvery pomfret gradually decreased from 360mm to 267.75mm from the 1980s to nowadays, whereas the growth parameter K increased from 0.205 to 0.46, and the inflection point age decreased from 4.1 to 2.21. All the indications showed that the East China Sea silver pomfret already had the phenomenon of resource decline such as reduction in asymptotic fork length, accelerated growth rate, population miniaturization, and serious under-ageing. ^[6]

Fishing level

Since 1999, the production of pomfret (including silver pomfret and grey pomfret *Pampus cinereus*) in the East China Sea area has been maintained at more than 20×10^4 tons, which is basically dominated by silver pomfret. ^[6] Yongdong Zhou (2013) et al. estimated the maximum sustainable yield of silver pomfret in the East China Sea to be about 140,000 tons in 2005-2006, and the silver pomfret catch in the three provinces and one city in the East China Sea area far exceeded this level. ^[21] Jiansheng Li (2014) and others showed that the fishing mortality coefficient and exploitation rate of silver pomfret in the East China Sea in 2001-2010 increased significantly compared with those from 1997-2000, and the exploitation ratio E was as high as 0.71, which indicating that the silver pomfret in the East China Sea is in a state of overexploitation under high-intensity fishing. ^[6] From the above fishery resources assessment and monitoring results, the biological indicators such as age structure, length composition, age at sexual maturity and biomass index in the silver pomfret populations are gradually decreasing, which on the one hand, indicates that the catch of its recruitment population is obviously excessive, and on the other hand, indicates that the silver pomfret is in the state of overexploitation. ^[6]

The annual production of only pomfret species in China's marine capture production statistics has basically remained around 300,000 tons in the last decade, which is relatively stable, with the highest production in 2016 at 366,500 tons. In 2021, production is 330,000 tons. Silver pomfret has the highest proportion of all pomfret catches.

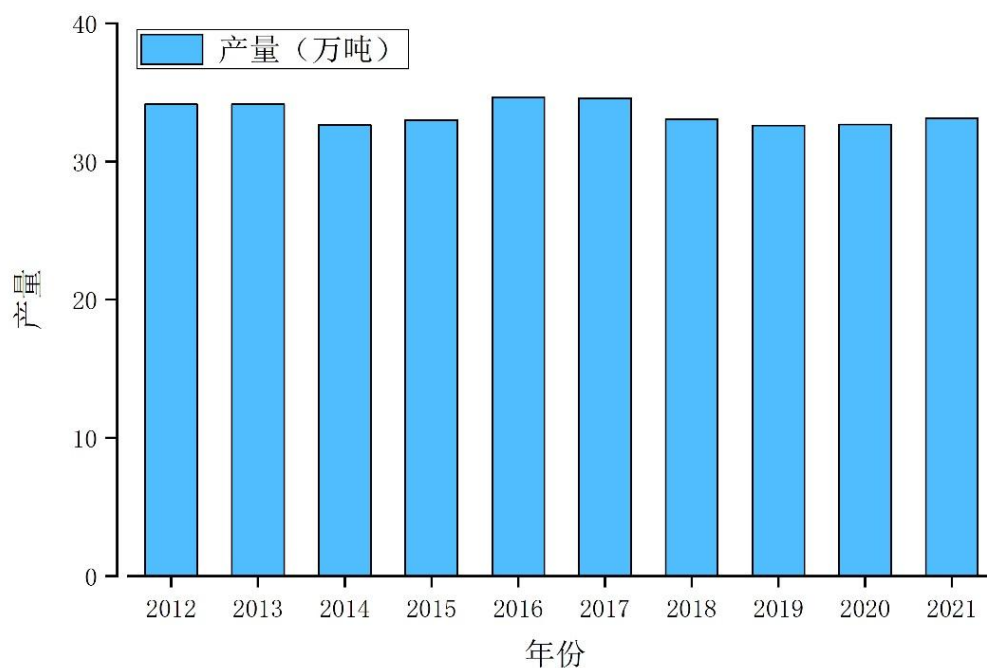


Figure 2. Inter-annual variation in marine catches of pomfret in China ^[11]

Pomfret production is relatively unevenly distributed in coastal provinces and cities, and the annual production of silver pomfret in the East China Sea area accounts for about 85%-90% of all pomfret species, especially in Zhoushan fishing ground along the coast of Zhejiang Province.^[20]As shown in the figure below, Zhejiang has the highest silver pomfret production in 2021, reaching 100,000 tons, accounting for about one-third of the national total, followed by Guangdong, Fujian, Hainan and so on.

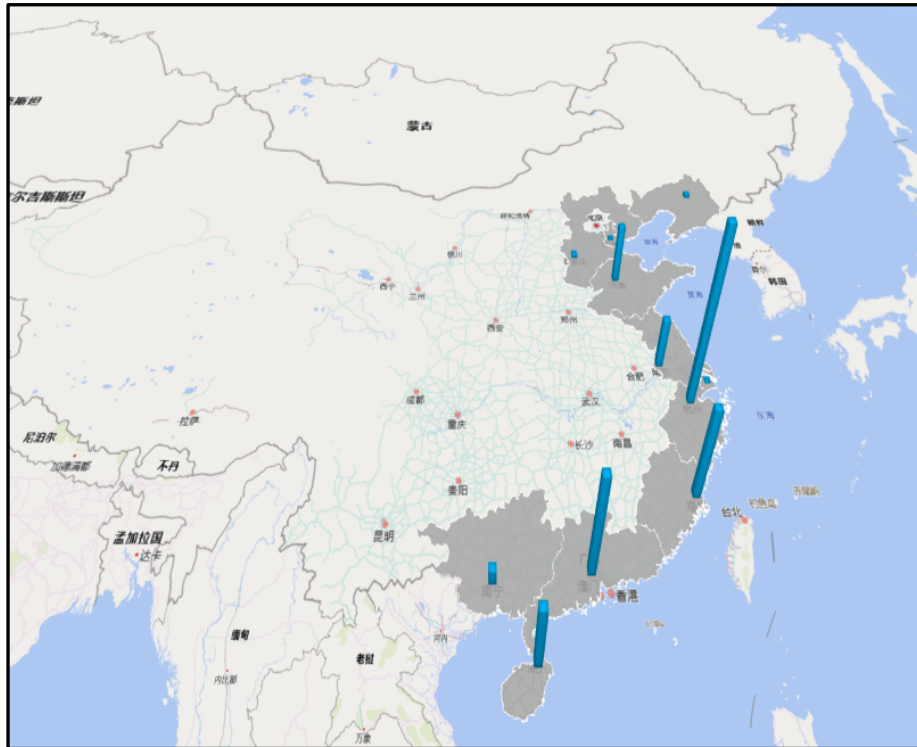


Figure 3. Distribution of pomfret production by provinces and cities along China's offshore coast in 2021^[11]

Criterion 2: Impact on Non-target Species

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

Silver pomfret is the main target species of gillnet fishery, but also bycatch species of set net, stow net, trawl and purse seine. In addition to silver pomfret, the main species of gillnet catches in the East Yellow Sea may include economic species such as small yellow croaker, miiuy croaker, yellow drum, hairtail, grey pomfret, Japanese Spanish mackerel, chub mackerel, elongate ilisha, hairfin anchovy, pike conger, swimming crab, Asian paddle crab, golden cuttlefish and so on. ^[7] Some articles mention that silver pomfret adults often swim with golden threadfin bream, ponyfish or shrimps. ^[15] In the Yellow Sea paired trawling fisheries, the main catch species include Japanese Spanish mackerel, silver pomfret, hairtail, small yellow croaker, anchovy, etc. ^[3]

Bycatch of ETP species in the silver pomfret fishery is relatively rare, some sharks are occasionally caught, but the amount is very small. For example, when Lingzhi Li (2010) et al. carried out a study of gear selectivity of silver pomfret gillnets in the Eastern Yellow Sea, there was a presence of the scalloped hammerhead shark (*Sphyrna lewini*) in the silver pomfret gillnets. ^[7] The scalloped hammerhead shark is rated as Critically Endangered (CR) by the IUCN Red List of Threatened Species,

and is distributed in China in the South China Sea, East China Sea, and Yellow Sea.^[2] The bycatch of scalloped hammerhead shark in gillnet fisheries should be an incidental event and only have small impact on their populations. In addition, there may also be the occurrence of large yellow croaker (*Larimichthys crocea*) (IUCN - Critically Endangered CR) in gillnet fisheries, although it is not listed as an endangered protected species in our country, its wild population has never been truly recovered, and the status of the resource is under greater threat. Additionally, in the East China Sea, a common economic species, the Bombay duck (*Harpadon nehereus*) (IUCN-Near Threatened NT), although it is a species with a higher IUCN endangered level, has a larger production in China. There may also be species such as the spadenose shark (*Scoliodon laticaudus*) (IUCN-Near Threatened NT) that are occasionally observed in the offshore fisheries. In the future, measures should be taken to record and report the release of these occasionally caught threatened, endangered or protected species in the fisheries practices, or to improve the selectivity of fishing gear to mitigate the risk of bycatch.

Criterion 3: Control Impact on Ecosystem

The effect of fishing gear

Silver pomfret is the main target species of gillnet fishery, but also bycatch species of set net, stow net, trawl and purse seine. Trawl is a mobile filtering fishing gear that uses the movement of the vessel to drive the fishing gear forward on the seabed or in the seawater, and uses the water pressure to push the fish, shrimp, and crabs to enter the codend to fish. Trawling not only causes great damage to the fishery resources, but also to the marine ecosystems, especially bottom trawling. In the last decade, the technical innovation has allowed the development of the bottom trawlers, which improves the strength of the nets and makes it easier to operate in complex substrate with a wider range of impacts on the benthic habitats. Trawl codend meshes are generally in diamond shape, which are easily closed when moving in the water, making it difficult for juvenile fish to escape.

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. This type of gear does not require towing but rather relies on the fish swimming into the net and becoming trapped. 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.^[10]

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. ^[4] 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 a national aquatic germplasm reserve for small yellow croaker and grey pomfret has been established to safeguard 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.

Xiujin Wei (2019) et al. analyzed the bait composition of Bohai silver pomfret by isotope technique, and the results showed that the main food of Bohai silver pomfret was benthic shrimps (average contribution rate of 35.03%), such as Chinese ditch prawn, Japanese sand shrimp, and snapping shrimp, followed by Northern mauxia shrimp (average contribution rate of 27.87%), as well as Japanese loligo squid, phytoplankton, and zooplankton. ^[14] Shiming Peng (2011) et al. found through their study that the East China Sea silver pomfret mainly feeds on *Sagitta sp.*, demersal shrimps, jellyfish, cephalopods, juvenile fish and zooplankton. ^[12] The bait composition of silver pomfret in the Yellow Sea and East China Sea are both dominated by zooplankton, but the species composition are different, which may be related to the difference in the composition of zooplankton species in the two sea areas. ^[20] Therefore, while fishery management is carried out for the purpose of protecting and restoring the resources of a single species of silver pomfret, more attention should be paid to the ecosystem as a whole, and the relationship between its bait and predator species and their resource changes should be included in the scope of management design.

Criterion 4: Management and Implementation

Fishery management plans for target species

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.

In 2011, the Ministry of Agriculture merged the nationally designated aquatic germplasm reserve established on the inner side of the non-trawling zone line in the Lvsi Sea area of Jiangsu Province with the Lvsi Fishing Ground Small Yellow Croaker and Silver Pomfret National Aquatic Germplasm Reserve designated by the Ministry of Agriculture. This Reserve, located in the southern Yellow Sea Lvsi Fishing Ground, primarily protects spawning individuals and juveniles of small yellow croakers and silver pomfrets, as well as other economically important fish species. The total area of the protection zone is 1.66 million hectares, with a core area of 0.87 million hectares and an experimental area of 0.78 million hectares. The special protection period is from May 1st to July 1st.^[8]

Regarding to the minimum allowable catch specification of silver pomfret, relevant management regulations already exist. 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 silver pomfret at a weight of 90 grams or a fork length of 140 mm.^[17] In 2016, according to the *Decision of the Standing Committee of the Zhejiang Provincial People's Congress on Strengthening the Protection of Marine Juvenile Resources to Promote the Restoration and Revitalization of Zhejiang Fishing Ground*, Zhejiang Province began implementing a transitional minimum catch size management system for six key marine fishery species, including hairtail, large yellow croaker, small yellow croaker, silver pomfret, chub mackerel, and gazami swimming crab.^[19] In February 2017, the Zhejiang Provincial Bureau of Ocean and Fisheries issued a *Notice on the Transitional Minimum Catch Size of Key Marine Fishery Species*, setting the minimum catch size of silver pomfret at a weight of 60 grams, effective from March 24, 2017.^[18] 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 silver pomfret is set at a fork length of ≥ 150 mm across China's seas.^[9]

However, it should not be overlooked that, even though various management measures for silver pomfret already exist, their actual implementation has yet to be evaluated and verified. In our field research, we found that the implementation of the minimum catch size of silver pomfret was insufficient, and individuals below the allowable size appeared in large numbers in the landings.

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 plans 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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<p>[9] 农业部,农业部关于实施带鱼等 15 种重要经济鱼类最小可捕标准及幼鱼比例管理规定的通告,2018 <a href=). Ministry of Agriculture. (2018). Circular of the Ministry of Agriculture and Rural Affairs on the Implementation of the Minimum Allowable Catch Standard for Fifteen Important Economically Important Fish Species and Provisions on Management of the Proportion of Juvenile Fish in the Catch.
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