



# Scarcity and Sustainable Development of Marine Living Resources in China

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**Abstract.** Marine living resources refer to the economic animal and plant resources in the ocean, which are characterized by life, self-proliferation and continuous renewal. China's marine living resources are rich in species and widely distributed, but they are facing an increasingly scarce situation. The author tried to summarize some reasons for the increasing scarcity of marine living resources in China: (1) Overfishing and poor management of aquaculture; (2) Marine pollution destroyed marine ecological environment; (3) Adverse effects of reclamation, water conservancy project and ocean engineering. On this basis, the author put forward some countermeasures to promote sustainable development of marine living resources in China: (1) Improve relevant laws and strengthen marine awareness; (2) Control fishing industry, develop healthy aquaculture and marine strategic emerging industries; (3) Establish marine reserve to protect ecological environment and living resources.

**Keywords:** Marine living resources · Scarcity · Sustainable Development · China

## 1 Introduction

Marine living resources refer to the economic animal and plant resources in the ocean, which are characterized by life, self-proliferation and continuous renewal. Through the reproduction, development, growth and new and old replacement of individual species and populations, marine living resources can continuously renew resources and supplement populations, and achieve relatively stable quantity through certain self-regulation ability.

China is a major maritime country. China's sea areas are located between the Eurasian continent and the Pacific Ocean, and are distributed in an arc from north to south. They span the temperate zone, subtropical zone and tropical zone. In addition, large-scale material and energy exchange brought about by monsoon circulation, runoff into the sea, ocean currents and other means make the sea areas a basic element that affects China's natural geographical environment and determines China's natural geographical characteristics [1]. In the 21st century, with the great development of marine industry, accelerating the development of marine resources and transforming marine advantages into economic advantages has become an important way of "Blue revolution" of China.

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**Table 1.** Main economic fishes in China's coastal waters

The Yellow Sea and Bohai Sea	The East China Sea	Northern continental shelf of the South China Sea
Larimichthys crocea	Larimichthys crocea	Dussumieria elopsoidea
Larimichthys polyactis	Larimichthys polyactis	Harengula zunasi
Pennahia argentata	Epinephelus akaara	Stolephorus chinensis
Tetraodon fluviatilis	Trichiurus lepturus	Decapterus maruadsi
Trichiurus lepturus	Stromateoides argenteus	Stromateoides argenteus
Stromateoides argenteus	Scomberomorus niphonius	Trichiurus lepturus
Lateolabrax maculatus	Sardinella aurita	Epinephelus akaara
Gadus macrocephalus		

China has a vast sea area and a wide variety of marine living resources. How to scientifically, reasonably and fully develop and utilize marine living resources and protect marine living resources and their diversity is an important strategic issue related to China's sustainable development [2].

## 2 Overview of Marine Living Resources in China

### 2.1 Resource Types

China is rich in marine living resources, including fish, shrimp, crab and a series of other animals and plants, of which the number of fish is the largest. The biomass of China's sea areas is  $2.7 \text{ t/km}^2$ , with a total biomass of  $1.3 \times 10^7 \text{ t}$ . In addition, there are vast living resources in the open sea, deep sea and other sea areas [3].

There are more than 4,600 species of fish in China's coastal waters, of which more than 300 are important economic fish. The main economic fishes are shown in Table 1.

The largest output of shrimp and crab resources in China's coastal waters are *Penaeus orientalis*, *Acetes chinensis*, *Trachypenaeus curvirostris*, *Exopalaemon carinicauda*, *Portunus trituberculatus*, *Scylla Paramamosain*, etc. *Penaeus orientalis* is a specialty of China's coastal waters, which winters in the south of the yellow sea and migrates northward in groups in early spring; the Bohai Sea is the main place to fish for it. *Portunus trituberculatus* is the largest food crab in China, which is distributed along the coast, with more in the Bohai Sea, the Yellow Sea and the East China Sea; *Scylla Paramamosain* are found along the coasts of Zhejiang, Fujian, Guangdong and Taiwan.

Other marine animal resources in China include squid, octopus, jellyfish, scallops, oysters, abalone, sea cucumber, etc. There are more than 100 species of sea cucumbers in China's coastal waters, and more than 20 species in Xisha Islands in the South China Sea alone [3].

Marine plants are dominated by various types of algae, mainly including 11 phyla such as *Bacillariophyta*, *Phodophyta*, *Cyanophyta*, *Phaeophyta*, *Pyrrophyta* and *Chlorophyta*. Nearly 100 of them are edible, and many compounds such as phycocolloid can be extracted from them.



Fig. 1. Distribution of main fishing grounds in China Sea Area.

## 2.2 Main Fishing Ground

There are many fishing grounds in China's sea area. The Bohai Sea has fishing grounds such as Liaodong Bay, Luanhe Estuary, Bohai Bay and Laizhou Bay; known as a "fish basin", it is the most densely populated sea area in China [4]. The Yellow Sea has Yantai-Weihai, Shidao, Qingdao, Haizhou Bay, Lyusi, Dasha and other fishing grounds, and the shallow sea beach area ranks first in China. The East China Sea has the Yangtze Estuary, Zhoushan, Taizhou, Wenzhou, Eastern Fujian, Southern Fujian, Northern Taiwan, among which Zhoushan fishing ground is the largest fishing ground in China. The South China Sea has Shanwei, Jiazi, Shantou, Pearl River Estuary, Dianbai, Dongsha, Zhongsha, Xisha and Nansha, with the largest variety of biological resources (Fig. 1).

### 3 Reasons for the Increasing Scarcity of Marine Living Resources in China

#### 3.1 Overfishing and Poor Management of Aquaculture

The traditional fish resources in China's coastal waters are declining due to overfishing, and some high-quality economic fish such as *Larimichthys crocea*, *Larimichthys polyactis*, *Trichiurus lepturus* and *Pleuronichthys cornutus* have even experienced a serious decline. In recent years, the juveniles of these high-quality economic fish have also been caught in large quantities, making it more difficult to recover the nearly exhausted economic fish resources.

In recent years, aquaculture in China's coastal areas has developed rapidly. However, due to poor management, there has been a tendency to endanger the marine ecological environment and ecological balance [1]. Aquaculture wastewater causes organic pollution and eutrophication in seawater; a large number of bait organisms were collected, which greatly reduced the number of shellfish in some beaches and destroyed the normal food chain; large area mariculture has changed the biota structure of the sea area, and the biological species tend to be single, reducing the biodiversity [4].

#### 3.2 Marine Pollution Destroyed Marine Ecological Environment

Coastal waters such as estuaries, harbours and mariculture intensive areas in China have different degrees of marine pollution. The biological resources of Dalian Bay, Bohai Bay, Laizhou Bay, Jiaozhou Bay, Haizhou Bay, Zhoushan Islands, Meizhou Bay, Xiamen sea area and other places have been polluted. The development of marine oil and gas exploitation and shipping industry will lead to an upward trend of oil pollution. Every year, 15million tons of various pollutants enter the offshore waters through various ways, including waste water and gas discharge, engineering construction, ship navigation, oil exploration and development, etc. [5]. The degree of marine pollution and the ability of the ocean to accept pollution and self purification have exceeded the critical value of equilibrium, resulting in degradation of the ecological environment and frequent red tides and other disasters [6].

#### 3.3 Adverse Effects of Reclamation, Water Conservancy Project and Ocean Engineering

For decades, China's coastal beaches have been continuously reclaimed. In addition to natural siltation and artificial reclamation, the coastal areas are losing a large area of marine biological habitat, spawning grounds, fish fry grounds and feeding grounds, resulting in the reduction of species and a significant impact on marine living resources. In addition, reclamation has also caused serious damage to the mangrove coast. Dams and gates are built in many rivers in northern China, resulting in the reduction of river water into the sea, affecting the amount of normal nutrients into the sea, and deteriorating the living environment of some species. Some engineering projects have changed the hydrodynamic conditions in the sea area, causing siltation in the sea area and leading to the decline of marine living resources.

## 4 Countermeasures for Sustainable Development

### 4.1 Improve Relevant Laws and Strengthen Marine Awareness

China has promulgated and implemented such laws and regulations as *the marine environment protection law of the people's Republic of China*, *the Fisheries Law of the people's Republic of China*, and *the regulations of the people's Republic of China for the implementation of the protection of aquatic wildlife*, laying a foundation for promoting the sustainable utilization of marine living resources. However, China's current industry management system cannot fully adapt to the effective management of marine living resources and marine ecological environment. Therefore, national laws such as the law on marine nature reserves and the law on the protection of marine biodiversity should be formulated as soon as possible according to the needs of development and protection, and the supporting laws and Implementation Regulations for the protection and management of marine living resources should be further improved [3]. At the same time, China should attach great importance to new situations and problems under the new situation, conduct in-depth investigation and research, revise the existing laws and regulations that do not adapt to the new situation, and improve the relevant supporting technical regulations.

As a land power with a long history, China still needs to improve its understanding and attention to the ocean from the official to the private. Governments at all levels, from the central government to coastal areas, should carry out education on the protection of marine living resources and marine publicity activities to improve the marine awareness of the whole nation [7].

### 4.2 Control Fishing Industry, Develop Healthy Aquaculture and Marine Strategic Emerging Industries

Controlling fishing and developing healthy aquaculture are important ways to realize the sustainable development of marine living resources. It is necessary to seriously rectify the fishing order, control the number of fishing vessels, reduce trawling operations, limit the minimum size of the net mouth, strictly implement the approval and inspection system for the renewal and transformation of fishing vessels, and strengthen the management of fishing licenses [4]. At present, China has implemented the summer fishing moratorium system, which provides time and space for the spawning of major economic fish and the growth of young fish, promotes the recuperation and recovery of marine living resources to a certain extent, and maintains the natural balance of the marine ecosystem. In addition, there are artificial reefs and the release of fishery resources, which have played a significant positive role in the protection of marine living resources.

Marine strategic emerging industry is an important part of national strategic emerging industry. China is implementing the strategy of "invigorating the sea through science and technology", using modern high and new technologies to establish and improve a unified monitoring and early warning network for the protection of marine living resources, and carry out long-term dynamic monitoring and early warning of biodiversity status and ecological environment of important targets [4]. In order to highlight the marine characteristics, the government should carry out in-depth development of marine

living resources, develop modern biotechnology such as cell engineering, enzyme engineering and fermentation engineering, and fully transform them into strategic emerging industries such as marine biomedical industry, so as to enhance the international competitiveness of China's marine industry [7].

### 4.3 Establish Marine Reserve to Protect Ecological Environment and Living Resources

Many coastal countries and regions in the world have established a large number of marine protected areas, which can be divided into marine ecosystem protected areas, endangered and precious species protected areas, natural and historical sites protected areas, special natural landscape protected areas and marine environment protected areas according to different protected objects [4]. Through establishing marine protected areas, the natural environment and natural resources can be completely preserved, biodiversity can be protected, and the adverse effects of human activities can be reduced or even eliminated. The total area of China's marine nature reserves is less than 200,000 km<sup>2</sup>, which is still very small compared with its total sea area of 3 million km<sup>2</sup>. Therefore, it is necessary to strengthen the construction of marine living resources reserves, and build a number of marine living resources reserves on the basis of the existing marine natural reserves, such as mangrove, coral, beach and coastal natural reserves, so as to open up new ways to protect the marine ecological environment and marine living resources.

## 5 Conclusion

Due to the lack of protection awareness, the protection of China's marine living resources was once faced with a severe situation. In recent years, with the implementation of various protection measures, the decline of marine living resources has gradually improved, but the scarcity of resources is still its essential attribute. In the future, we need to continue to carry out protection work on the current basis to better promote the sustainable use of the blue land.

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