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# Current Situation and Problems of Marine Fishery in China

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**Abstract** Marine fishery plays an essential role in promoting the employment of labor force, ensuring food safety, promoting the construction of ecological civilization and safeguarding the maritime rights and interests. The development of marine fishery is of great significance. This paper analyzed the current situation and existing problems of marine fishery in China and came up with some pertinent recommendations and measures. The area of marine fishery with authentic right is increasing year by year, and pelagic fishery constantly grows and the industrial structure is becoming more and more reasonable. However, there are still problems such as serious pollution of marine environment, frequent occurrence of marine disasters, shrinking space of fishery development, which seriously affect healthy development of the marine fishery. In this situation, it came up with recommendations including strengthening monitoring of marine fishery resources and protection of marine environment, optimizing the industrial structure, and raising the scientific and technological level of marine fisheries, to protect the sustainable development of marine fishery. It is expected to provide references for the development of marine fishery in China.

**Key words** Marine fishery, Marine fishing, Seawater aquaculture, Current situation

## 1 The concept of marine fishery and overview of the development of marine fishery in China

**1.1 The concept of the marine fishery** Marine fishery is an essential part of modern agriculture and marine economy. In a broad sense, it refers to the marine aquaculture. Marine fishery is the material production activity of obtaining products through making full use of a series of physiological activities such as the growth and development of marine living resources, and other related production activities. In China, there is more than 300 million km<sup>2</sup> of marine land, more than 18000 km of the mainland coastline, about 2.17 million km<sup>2</sup> beach area, about 157000 km<sup>2</sup> shallow beach (within 20 m) and about 413000 km<sup>2</sup> shallow beach surrounded by 40 m isobath, thus the marine aquaculture has huge development potential<sup>[1]</sup>.

**1.2 Overview of the development of marine fishery in China** The marine fishery is developing rapidly. It has gradually developed from the single marine fishing and marine aquaculture in the past to a new industry covering the marine aquaculture, processing and circulation industry, recreational fishery and marine bio-pharmaceutical industry. China is a large marine country. Promoting the sustainable and healthy development of marine fishery is of great significance for ensuring the supply of aquatic products, increasing the income of farmers, boosting the employment of labor force, promoting the economic development of coastal areas and safeguarding the maritime rights and interests of China. The marine fishery of China is basically developed after the founding of New China. At the early stage of the founding of New China, marine fishery has been dominated by marine fishing (offshore fishing), and marine aquaculture was basically in a standstill state, the proportion has been less than 10%; till 1977, the pro-

portion of marine aquaculture production to seawater production started exceeding 10%<sup>[2]</sup>. In 1979 (the second year of the reform and opening up), China held the National Aquatic Conference and determined the policy of "vigorously protecting resources, actively developing aquaculture, adjusting offshore operation, and opening up offshore fishing grounds". The No. 5 document of central government in 1985 and the first *Fishery Law* issued in 1986 established the development policy of "focusing on aquaculture, and combining aquaculture, fishing, and processing together, and suiting measures to local conditions", the marine culture was valued and supported by the state, the pelagic fishery started to go abroad, and marine fishery entered the rapid development stage. In the Tenth Five-Year Plan period and Eleventh Five-Year Plan period, the marine fishery steadily developed through sticking to the policy of focusing on aquaculture. In this period, fundamental changes occurred in structure of marine fishery. According to the statistics, the proportion of marine aquaculture and marine fishing in 2001 exceeded 5:4; it reached 19:20 in 2005; by 2006, the marine aquaculture production exceeded that of marine fishing for the first time (as shown in Fig. 1). After entry into the 21st century, with policy support, recreational fishery realized vigorous development.

Through the development in recent years, China's marine fishery has gradually realized the transformation from traditional fishing industry-oriented model to the model with aquaculture and processing as major part combined with marine recreational fishery. Marine fishery is one of the earliest traditional industries in China's marine economy. It is also the most traditional basic industry and plays an essential role. Taking the year 2011 as an example<sup>[3,4]</sup>, the annual output of seawater aquatic products reached 29.08 million tons, accounting for 51.90% of the total aquatic products, 3.95% higher compared with the same period of last year, of which 15.513 million tons were marine aquaculture and 13.567 million tons were marine fishing (including 1.148 million

tons of pelagic fishing); the marine fishery production value reached 341.982 billion yuan, ranked the third place following the coastal tourism and transportation industry in the marine industry, of which the output value of marine aquaculture was 193.136 billion yuan, the output value of marine fishing was 148.845 billion yuan; marine fishery provided a large number of jobs, according to statistics, in 2011 the workers of marine fishery and related industries reached 587.9 million<sup>[3,4]</sup>. Marine fishery also plays a great role in safeguarding national food security and promoting increase of fishermen's income and steady development of rural economy.

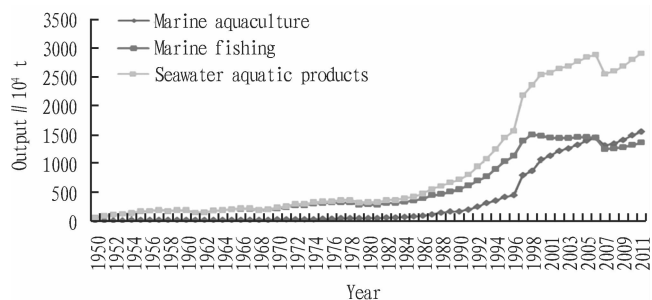


Fig. 1 Output of China's marine aquatic products in recent 6 decades (1950–2011)<sup>[2–4]</sup>

## 2 Analysis on current situation of development of the marine fishery in China

### 2.1 Analysis on current situation of development space of the marine fishery

**2.1.1** The area of marine fishery with authentic right is increasing year by year. The marine area for fishery is the maritime area for developing and using fishery resources and undertaking fishery production. The marine area for fishery is a fundamental condition for development of the marine fishery (especially marine aquaculture). According to statistical data of use of maritime area in recent years<sup>[5]</sup>, the area of marine fishery with authentic right was the largest in 2005, up to 272555.32 hm<sup>2</sup>; in 2009, it was the smallest, only 147817 hm<sup>2</sup>; from 2002 to 2004, it took on gradual decline trend; in 2005, the area of marine fishery with authentic right increased sharply, and later it gradually declined; after 2009, it became steady; in 2012, it sharply increased again, as shown in Fig. 2.

From Fig. 2, we can see the trend in a short term, but on the whole, the area of marine fishery with authentic right was not equal, in other words, it took on a discrete state, and the overall trend was still not clear. In view of the above-mentioned situation, we applied the area accumulation method to signify the demand trend of area of marine fishery with authentic right. Through the regression analysis of the total area change in certain time series, we obtained the trend prediction formula, so as to achieve the purpose of demand forecast. From the distribution of annual cumulative area, it can be seen that the linear correlation is very good. Through the current trend analysis, the correlation coefficient was up to 0.996 ( $R^2 = 0.996$ ), and we obtained following regression equation:

$$y = 184451x - 70907$$

From the results of the trend line analysis in Fig. 3, it can be seen that the total area of marine fishery with authentic right in China was increasing year by year despite the slight increase in some years (through comparison between the area of marine fishery with authentic right and the area cancelled). However, with the increase in offshore development, especially the reclamation leading to permanent disappearance of large area of beach wetlands, the offshore environment gets seriously polluted, space resources available for development will gradually shrink, and the increase in the area of marine fishery with authentic right will become slower.

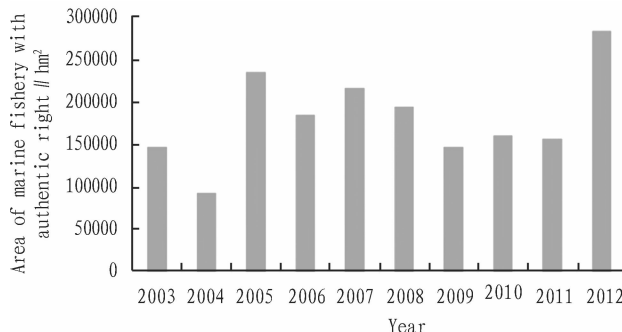


Fig. 2 Area of marine fishery with authentic right in 2003–2012

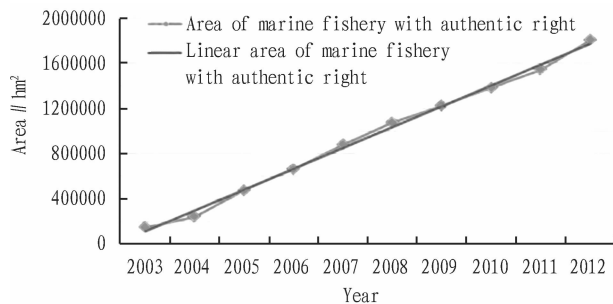


Fig. 3 Total area of marine fishery with authentic right and variation trend in 2003–2012

**2.1.2** Marine aquaculture develops towards deepwater area. With the constant development of marine economy, the demand of various industries for offshore area is gradually increasing; the development with inner bay and coastal area as major part is accelerating, such as tourism and recreation, port, and offshore industries are mainly concentrated in the coastal 0–5 m isobath area, and the shallow water area that can be developed is shrinking<sup>[6]</sup>; due to the discharge of land-based pollutants, offshore environment is seriously polluted, and some waters are not suitable for aquaculture. Due to the actual situation of marine resources and environment in offshore area, the offshore area fails to satisfy the rigid demand of marine aquaculture, the development of deepwater area is an inevitable trend, and the water environment of deepwater aquaculture is good, and there are few diseases detrimental to the aquaculture varieties, which is conducive to the rapid growth of fishes. In addition, the technology of deepwater cage culture has been improved, especially for cage culture of 20–40 m isobath, which provides technical support for aquaculture from shal-

low aquaculture to deepwater aquaculture.

**2.1.3** The pelagic fishery has been growing and its international competitiveness has been constantly enhanced. China's pelagic fishery started going abroad from 1985. By now, it has been growing year by year. With the support of state policies, the pelagic fishery has been constantly growing, and the international competitiveness is constantly enhancing. The amount of pelagic fishing rose from 1.075151 million tons in 2007 to 1.147809 million tons with annual growth rate of 1.7%, showing steady growth of pelagic fishing<sup>[3,4]</sup>. In the Eleventh Five-Year Plan period, it consolidated traditional fishing grounds of pelagic fishery, established new pelagic fishery bases, further strengthened development of open sea fishery, and raised the organizational level and modern equipment level of the pelagic fishery. The 12th Five-Year Plan for Fishery took the development of the pelagic fishery as a major task. It stated that China should actively participate in formulation of international fishery resource management system, expand development space for the pelagic fishery, and support and strengthen the pelagic fishery. With the support of state policies, China's pelagic fishing will continue to grow, and its international competitiveness will continue to strengthen.

## **2.2 Analysis on current situation of industrial structure of the marine fishery**

**2.2.1** Industrial structure becomes more and more reasonable. Aquaculture and fishing have been taking the dominant place in China's marine fishery. However, since the reform and opening-up, China's fishery structure has realized constant structural transformation and optimization and upgrade, the proportion of both aquaculture and fishing in the fishery economy has been reduced from 68.56% at the end of the Ninth Five-Year Plan to 52.54% in 2011, while the proportion of secondary industry (fishery industry and construction industry) and the tertiary industry (fishery circulation and service industry) increased rapidly from 19.32% and 12.12% at the end of the Ninth Five-Year Plan period to 23.50% and 23.95% respectively in 2011 (the data here included marine fishery and freshwater fishery). This indicates that through the adjustment and optimization of industrial structure, and actively exploring the potential, the fishery development space continues to expand. Through the national support for the secondary and tertiary industries, the proportion of output value of secondary and tertiary industries will further increase, China's fishery industrial structure will gradually change from the traditional model with the marine fishing and aquaculture occupying the dominate place to the model integrating the aquaculture, fishing, processing and distribution industry, and recreational fishery.

**2.2.2** The seawater aquatic product processing industry steadily grows, and the deep fine processing industry has broad prospects. The development of seawater aquatic product processing industry plays a bridge role in the development of marine fishery. It great promotes the optimization of the structure of marine fishery and the realization of the growth of industry. In recent years, China's seawater aquatic product processing industry keeps a steady growth. According to statistics, China's processing capacity of seawater aquatic products grew from 1314.0840 million t in 2008 to 1523.7683 million t in 2011; the proportion to the total seawater aquatic

products increased from 50.58% in 2008 to 52.4% in 2011, but it was still lower than the developed countries (70% processing rate of aquatic products)<sup>[3,4]</sup>. The processed products were mainly low-end products with low technological content, and relatively low proportion of deep processing of marine products such as marine drugs, health care products, marine chemicals and new-type aquatic beverage and food products. These products with high added value and high scientific and technological content, high market share, high export rate are the development trend of international aquatic products, and also an effective approach for increasing China's marine fishery efficiency, increasing fishermen's income, and the development direction of consolidating and enhancing the international competitiveness of China's marine fishery, thus they will have broad development prospects.

## **2.3 Main problems of the development of marine fishery**

**2.3.1** Offshore ecological environment is seriously polluted and fishery resources are greatly damaged. The offshore ecological environment is serious polluted, and ecosystem health is harmed. According to the statistics<sup>[7]</sup>, the sea area of the coastal areas of China with quality inferior to the category IV water quality standard in 2012 was 6.8 million km<sup>2</sup>; the eutrophic sea area was about 98000 km<sup>2</sup>, among which the heavy, medium and light eutrophic waters were 19000 km<sup>2</sup>, 40000 km<sup>2</sup> and 39000 km<sup>2</sup> respectively. About 81% typical marine ecosystem health status of estuaries, bays, beach wetlands, coral reefs, mangroves and seagrass beds in the key national monitoring areas remained in the sub-healthy and unhealthy state. Marine environmental pollution leads to imbalance in marine ecosystem structure, degradation of service functions, decline of marine biodiversity, reduction of rare and endangered species, and frequent occurrence of marine ecological disasters, accordingly resulting in a serious decline in fishery resources, depletion of traditional economic fishery resources, low value, low age and miniaturization of catches<sup>[8]</sup>.

**2.3.2** Fishery development space is constantly shrinking. Reclamation, as an important means of expanding the space for survival and development of the sea, is mainly concentrated in the bay and estuary, and the area is constantly expanding. According to statistics<sup>[5]</sup>, since the implementation of *Law of the People's Republic of China on the Administration of the Use of Sea Areas*, the cumulative area of marine reclamation land with authentic right was 1921.64 km<sup>2</sup>; in 2008, the area of 22 key gulfs shrank about 19.1% in 2008 compared with the year 1990, Jiaozhou Bay and other key gulf area reduced nearly 50%; according to statistics, since the founding of new China, the coastal wetland area annually reduced 200 km<sup>2</sup>, and intertidal wetland lost 57%. Loss of marine and coastal habitats changed the natural environment and natural conditions on which marine organisms depend, and permanent loss of coastal wetland habitat and ecological function reduced the development space of marine fishery.

**2.3.3** Marine disasters frequently occur and fisheries economic losses are huge. China is a country with frequent occurrence of marine disasters, often hit by red tide, storm surge, sea wave, sea ice, and oil spill. Taking red tide disaster as an example<sup>[9]</sup>, From 2008 to 2012, the average annual occurrence of red tide disaster was 66.6 times, red tide disaster area was about 10556 km<sup>2</sup>, and

the average annual economic loss was 131.3 billion, of which the coastal fishery resources and marine aquaculture industry caused the greatest losses; with the increase in China's dependence on oil, the oil import volume constantly rose. According to statistics, during the 11th Five-Year Plan period, 41 oil spill accidents occurred in China, resulting in hundreds of thousands of hectare of oil spills. As a result, the number of oil spills in the sea has increased, which brings huge losses to the marine fishery.

**2.3.4** The fishery development in the world and surrounding areas is complex. With the decline in global fishery resources and the increase in internationalization, China's fishery development faces increasingly complex international and surrounding environment. The competition of international fishery resources is intense and conflicts of fishery interests emerge in an endless stream. The implementation of the new system through market measures against illegal fishing and the stricter management system of ocean fishery quota have put forward higher requirements for fishery production, management and management. In addition, including frequent occurrence of disputes in the South China Sea and the East China Sea, fishery disputes will exist for a long time, and the task for keeping the fishery production order in surrounding marine area is arduous.

### 3 Recommendations for ensuring the development of marine fishery

**3.1 Strengthening the monitoring of marine fishery resources, and undertaking protection and recovery of fishery resources** It is recommended to establish and improve the environmental monitoring network, carry out regular monitoring of important fishery waters, especially for aquaculture waters, important spawning grounds and migratory passages of fishes, and promptly grasp and regularly announce the marine fishery environmental conditions; fully consider the reclamation of marine fisheries systems, the gulfs, estuaries, islands and shallow beaches and other sea areas, to strictly control the reclamation scale and establish the reclamation red line system; carry out improved seed production, enhancement releasing, and construction of artificial reefs. It is expected to ensure the sustainable use of resources and the restoration of fishery resources, and stabilize the fishery production.

**3.2 Strengthening marine environmental protection, and improving the ability of early warning and forecasting of marine disasters** It is recommended to establish a coordination mechanism for land and sea and combine land and sea, improve the coordination and cooperation mechanism for marine environmental protection, strengthen the monitoring and assessment of the marine environmental capacity and the total discharge of pollutants, and the comprehensive treatment of key coastal waters, such as the Bohai Sea, Yangtze River Estuary and Pearl River Estuary, implement total discharge control of pollutants, to reverse the status of marine pollution; enhance the fishery ecological environmental protection and emergency response capability, expand the forecast scope, strengthen emergency preplan and mechanism for major pollution accidents in marine fishery and aquaculture ar-

ea, and improve the ability of early warning, emergency response, prevention and control, and treatment of major marine pollution accidents.

**3.3 Optimizing the industrial structure and vigorously developing the secondary and tertiary industries** In the primary industry of marine fishery, it is recommended to stabilize the development of traditional aquaculture, and develop towards green aquaculture, raise benefits through the quality and brand, to realize increase of fishery efficiency and fishermen's income. The secondary industry should increase the technological content and improve the product quality, and actively develop deep and fine processing, strengthen high value development and use of low-value aquatic products and processed by-products, and increase the added value of fishery products. It is recommended to encourage the extension of processing industry to marine drugs, functional foods, marine chemicals and other fields. The tertiary industry is the industry with the highest development potential, and it is also the sunrise industry in marine fishery. Therefore, it is recommended to energetically develop recreational fishery, make full use of marine resources, enrich the content and development pattern of recreational fishery, expand the scale of recreational fishery, raise its industrialization level and increase its proportion in marine fishery<sup>[10,11]</sup>.

**3.4 Enhancing the government support and raising the scientific and technological level of fishery** It is recommended to formulate and improve the fishery policies, fiscal and taxation policies, credit policies, enhance financial support and research investment, and accelerate scientific and technological innovation. It is recommended to improve marine aquaculture technology, increase beach and deep and shallow sea breeding benefits, promote development of marine aquaculture technologies, especially the deep-sea cage culture technology, to ensure the safety of deep-sea aquaculture, and promote the sustainable development of marine fishery. Besides, it is recommended to strengthen the overall planning for the development of offshore fishery, to promote the development of pelagic fishery. Also, it is recommended to improve the policy support for the development of offshore fishing industry and enhance the technical support for the modernization of pelagic fishery. Finally, it is recommended to improve the level of deep processing of aquatic products, reduce the loss of catches, improve the product quality and increase the added value of aquatic products.

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### 4.3 Bringing into play the authoritative effect of scientific research experts

Negative information dissemination is the third important factor influencing consumers' trust after the harm crisis of agricultural products. It shows that the greater the dissemination of crisis information of agricultural products, the lower the trust may the consumers have. Rumor brings the public only one-sided information. If scientific research experts and the authority of knowledge disclose scientific knowledge to the public promptly, it is able to inform the public about the crisis, which is an important measure to promote the scientific spirit. The power of knowledge depends not only on the value of its size, but also depends on whether it is spread and the depth and breadth of spreading<sup>[11]</sup>. The information dissemination of scientific research experts is a long-term responsibility. It focuses on the long-term effects of communication and the popularization and promotion of scientific quality of the masses. The correct dissemination of knowledge not only can prevent the occurrence of crisis, but also can mitigate the harm caused by the negative information transmission in the crisis, so that scientific researches can realize the purpose of serving the people's livelihood. In addition, correct information dissemination can improve the impact of science on the public and help researchers to obtain the public support. Scientific research institutions and other professional authoritative organizations in crisis disclosing the authoritative information will realize win-win of three parties, the

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