

# *Exploitation and Utilization of Marine Resources under Numerical Analysis*

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**Abstract:** Marine resources are important strategic resources to support human economic and social development. Under the premise of maintaining the marine ecological environment, how to realize the rational and orderly development of fishery resources has become a social hot issue. In order to realize the historical mission of becoming a maritime power, our province should play its important role. As one of the two important demonstration areas for marine economic development in our province, city a strives to build a marine city with coordinated development of land and sea, harmonious coexistence of people and sea, and striving to be strong toward the sea. This paper chooses the development and protection of marine resources in city a as the research content, and uses the numerical analysis theory, system theory, sustainable development theory and externality theory as the theoretical basis to emphatically analyze the current situation, problems and reasons of the development and protection of marine resources in city A. by using the experience of domestic and foreign marine resources development and protection for reference, it tries to put forward the overall idea of coordinated development of marine resources development and protection in city A.

## 1. Introduction

How to rationally develop and utilize marine resources has become a hot topic in today's society. City a actively responded to the call of the state, unswervingly maintained the fundamental rights and interests of the country's oceans, rationally and appropriately developed and utilized marine resources, supported the development of the marine economy, maintained the marine ecological environment, and gathered great strength for the strategic goal of becoming a powerful marine country [1]. At present, the state is vigorously supporting the high-quality development of the marine economy. From the central positioning, city a is positioned as a cooperation fulcrum city on

the sea along the national "the Belt and Road", an important node city for land and sea linkage development, and a national demonstration city for marine economic innovation and development [2].

For a long time, city a has placed the development and protection of marine fishery resources in an important position in the development of marine industry. However, as a large marine economic city in Guangdong Province, under the development requirements of the new era, the original marine fishery resources development model can no longer meet the development needs of modern marine fishery. Therefore, it is of great practical significance to explore how to realize the rational and efficient development and utilization of marine fishery resources in city a and at the same time strengthen the protection of marine ecological environment [3]. Marine resources carrying capacity. Scholars believe that the North Atlantic oscillation has a positive correlation with the marine production and marine ecosystem, and will affect the local species richness, aggregation, and catchability; Spanish scholars in Galicia, northern Spain, through the research on the social and ecological vulnerability of small-scale fisheries to climate change, put forward that the seabed resources are highly exposed to climate hazards, highly sensitive to dependent populations, and low in adaptability. On the basis of analyzing the current situation of China's offshore fishery development, Chinese scholars put forward measures such as optimizing fishery development, perfecting fishery legal construction and protection system, strengthening fishing gear and fishing vessel management, and realizing multi-level utilization of ecosystem energy and recycling of marine resources; Other scholars have proposed that in order to ensure the quality and safety of aquaculture products, the ecological principle system development, dissolved waste removal technology and other treatment measures can be adopted to promote the green development of aquaculture [4].

Based on numerical simulation and analysis theory, sustainable development theory, externality theory and system theory, this paper analyzes the current situation, problems and reasons of marine resources development and protection in a city by using field investigation and case analysis, and combines the typical case experience of coordinated development of marine resources development and protection at home and abroad for reference, This paper tries to put forward the general idea and practical countermeasures for the development and protection of marine resources in a city.

## **2. Overview of Related Concepts**

### **2.1. Marine Fishery Resources**

Marine fishery resources refer to the economic aquatic animal and plant resources such as fish, crustaceans, shellfish and algae with development value in the fishery waters, and also include the marine ecological environment on which aquatic animals and plants live [5]. Marine fishery resources have special characteristics such as mobility, regeneration, sharing and integrity. Marine fishery resources belong to renewable resources and can be developed in a reasonable and orderly manner. However, over exploitation and exploitation will lead to the decline and depletion of fishery resources. Combined with the relevant concepts and characteristics of fishery resources, this paper defines marine fishery resources as the general name of natural or artificially cultured animal and plant resources with development and utilization value in the marine waters or with seawater as the living water body [6].

According to the characteristics of marine fishery resources, as a kind of public resources, it is difficult for the non exclusive public resources to have clear property rights, which will inevitably lead to excessive exploitation and free riding of marine fishery resources, and the trend of vicious competition among fishery practitioners. The fishery resources are facing the risk of serious depletion. When the capacity of marine fishery resources and the marine ecological environment are

unable to bear the human fishery production activities, which is far beyond the mediation capacity of its resources and the marine environment, it will cause the non renewable development of fishery resources and even damage the marine ecological environment system [7].

## 2.2. Marine Ecological Carrying Capacity

The marine ecological carrying capacity is mainly supported by the resources and environment system of the sea area and the pressure of the population, society and economic system around the sea area. The marine resources and environment system includes biological resources, marine water resources and various calcium, nitrogen and phosphorus nutrients needed in the marine environment [8]. The pressure on the marine resources and environment mainly comes from the huge resident population, the pollution of land and sea production and domestic wastes, the reclamation of land from the sea and other human practices. Once human activities exceed the ecological carrying capacity of the ocean, the ocean will give us corresponding warning. For example, overexploitation of marine fishery resources will cause non renewable fishery resources, and land and Sea economic development activities exceeding the environmental carrying capacity of the sea area will also cause irreversible damage to the marine ecosystem [9].

## 2.3. Numerical Mining

### (1) Data mining

From the technical level, data mining is a process of scientific processing of data with the goal of finding valuable knowledge in a large number of data; The process of combining traditional data processing methods with big data algorithms to mine knowledge is data mining. From the commercial level, data mining is to extract information from commercial databases and transform it into business information to support decision-making. Its essence is a means of business information processing. In general, data mining is to analyze large and complex data in a scientific and efficient way to find the underlying laws or knowledge [10].

### (2) Original data mining

Before data mining, it is first necessary to obtain the corresponding data, and make clear which data to select and why to select them based on specific business problems. In this paper, it is believed that in the numerical analysis of marine resources, it is also necessary to analyze the disordered and irregular original data based on specific problems to determine which data are obtained into the database and the data mining process described later. In this paper, the process of obtaining data is called original mining [11].

### (3) Descriptive data mining

The main objective of the descriptive mining task is to use classification methods, association rule analysis, clustering analysis, anomaly detection technology, etc. to describe the association and similar characteristics, trends, trajectories, anomalies and other properties of the information in the database [12].

### (4) Predictive data mining

The main goal of the predictive data mining task is to find out the relationship between the target attribute and other characteristic attributes through the analysis of the data in the database, so as to predict new items [13].

## 2.4. Data Processing and Analysis

### (1) Data preprocessing

Data preprocessing is the pre link of data mining stage, the basis for obtaining high standard data,

and the precondition for ensuring the efficiency of mining process and the accuracy of mining results. After three stages of data selection, data cleaning and data transformation, the cost data is preprocessed [14].

### (2) Data mining

The data mining stage is the second and core link of the whole data mining operation. The main task of this stage is to select a suitable data mining algorithm according to the task objective to be achieved, which can be a single algorithm or a combination of multiple algorithms, so as to obtain accurate analysis results [15].

### (3) Analysis end stage

The process of data mining is very flexible. If a problem is found, it can be adjusted by jumping to the previous step. If the final analysis result does not meet the requirements, the problem should be found step by step and the details should be modified accordingly until the mining goal is finally achieved [16].

The total ranking of the levels is to calculate the weight value of the scheme level to the factors of the target level from high to low. For example, there are  $m$  elements in the criterion layer that rank the target  $Z$  as  $A_1, A_2, \dots, A_m$ , and the  $n$  elements in the scheme layer that rank the factor  $A_j$  in the criterion layer as  $b_{1j}, b_{2j}, \dots, b_{nj}$  ( $j = 1, 2, \dots, m$ ), then the weight of the  $i$ th factor in the scheme layer relative to the target is:

$$b_i = \sum_{j=1}^m a_j b_{ij} \quad (1)$$

The calculation formula of hierarchical total ranking CR is:

$$CR = \frac{a_1 CI_1 + a_2 CI_2 + \dots + a_m CI_m}{a_1 RI_1 + a_2 RI_2 + \dots + a_m RI_m} \quad (2)$$

If the consistency tests of single ranking pass, the consistency of hierarchical total ranking must also be satisfactory.

## 3. Current Situation and Problems of Marine Resources Development and Protection in City A

### 3.1. Current Situation of Marine Resources

City a is located in the tropical monsoon area. It is affected by the marine climate all the year round. There are many harbors, wide beaches, many islands, abundant sunshine resources and rich marine resources. The mainland coastline of city a is 1243.7 kilometers long, with a total sea area of about 2 million hectares, a sea beach area of about 49 hectares, and a mariculture area of 81000 hectares. There are 101 harbors in the city. Most of the harbors here have obvious advantages such as low wind and waves and moderate salinity, which provide excellent natural "shelters" for the reproduction of many marine organisms [17].

The sea area of city a belongs to the fishing area of the northern continental shelf of the South China Sea. The dominant species of coastal fish are mainly sardine, large yellow croaker, white croaker, barracuda, etc. the crustaceans are mainly shrimp such as shrimp and shrimp, and crabs such as Portunus and green crab. The Cephalopods are mainly squid, octopus, squid, etc., as well as shellfish, algae and jellyfish in other species [18].

### 3.2. Current Situation of Marine Development

Marine fishing industry is the traditional basic industry of marine fishery in city A. City a has

two fishing grounds with an area of 150000 square kilometers in Beibu Gulf and western Guangdong, which can be used for perennial fishing. It is an important part of marine fishing in the South China Sea. According to relevant surveys, the fishing catch of the continental shelf fishing ground in the north of the South China Sea (477600 km<sup>2</sup>) is as high as 1.21 million tons, of which nearly 80% comes from the offshore waters along the north coast of the South China Sea. The Beibu Gulf fishing ground (164000 km<sup>2</sup>) has about 600000-700000 tons of fishing catch, and the whole fishery resources have about 2.46-2.81 million tons of potential catch. According to the proportion of fishing output of city a accounting for 5.05% of the South China Sea area, the potential catch of fishery resources in city a is 142000 tons. In 2019, the marine fishing output of city a was 224200 tons, far exceeding the potential catch of fishery resources. There is still overfishing of marine resources.

According to the statistics of marine fishing output and output value, in 2019, the output of marine fishing (including offshore) in city a was 224250 tons, accounting for 18.3% of the total output of marine fishing, including 159053 tons of fish, 38026 tons of crustaceans, 12177 tons of shellfish, and 641 tons and 9033 tons of algae and cephalopods, respectively. According to the statistical report, the total economic output value of marine fishing in city a accounts for 19.3% of the total output value of Guangdong Province, and the economic output value reaches 5.081 billion yuan.

## 4. Numerical Analysis Results

### 4.1. Numerical Analysis of Marine Products Processing

The total output of aquatic products in city a has exceeded 1 million tons for 10 consecutive years, not only reaching about 2% of the annual output of aquatic products in China, but also accounting for about 14% of the annual output of aquatic products in Guangdong Province. The processing output of aquatic products has long been in the forefront of the province.

*Table 1. Output of aquatic products in city a from 2018 to 2020*

Particular year	National annual output	Annual output of the province	Annual output of city a	Proportion in the province	Proportion in the whole country
2018	6457.3	821.51	125.51	14.12	1.81
2019	6442.4	823.23	124.42	13.98	1.91
2020	6321.5	854.8	123.34	14.23	1.96

The processing capacity and industrial scale of sea water products in city a are in the forefront of the province. However, according to the field survey, the development status quo of sea water

products processing in city a is mainly based on primary processing, and the raw materials for processing are mainly frozen aquatic products such as shrimp, tilapia and mackerel. The processing varieties are single, the intensive processing products are few, and the recycling rate of sea water products processing is low, The unused wastes and waste water generated in the processing process cannot be recycled and reused, and it is easy to cause external environmental pollution.

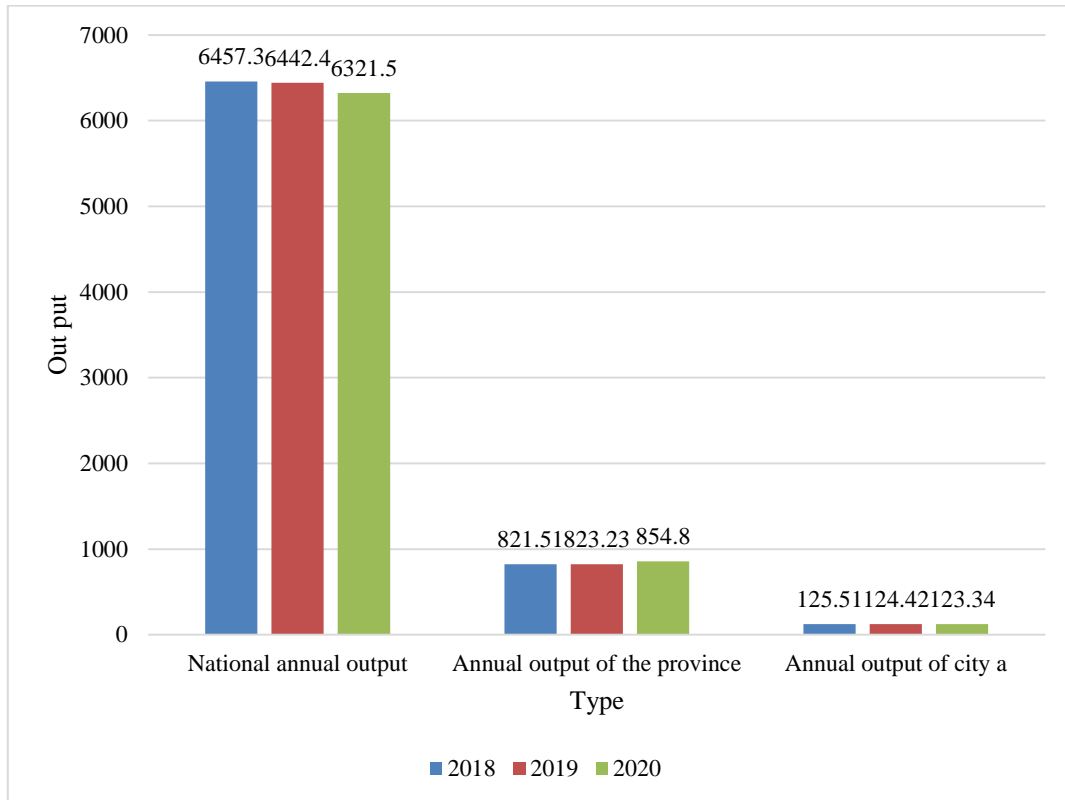


Figure 1. Output of aquatic products in city a from 2018 to 2020

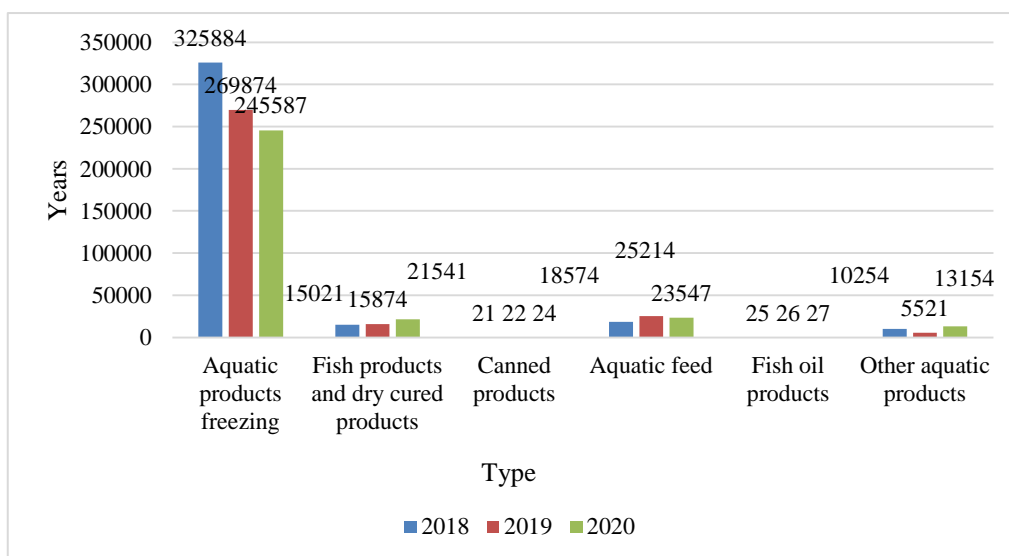


Figure 2. Aquatic products processing in a city

#### 4.2. Development Status of Marine Fishery Service Industry

It can be seen from the statistical data that the marine fishery service industry in city a is basically driven by the circulation of aquatic products. The aquatic product circulation channels in city a are mainly small-scale aquaculture households, and the aquatic product circulation dominated by aquaculture bases or enterprises is insufficient. The aquatic product market in city a has initially formed a main aquatic product circulation center relying on the southern international aquatic product trading center and other aquatic product wholesale markets in city a, and a aquatic product circulation system based on urban and rural farmers' markets, fresh supermarkets and other retail enterprises. The emerging aquatic product circulation mode led by the aquatic product circulation enterprises in city a has gradually developed.

Table 2. Fishery circulation and service industry in city a from 2018 to 2020

Years	Aquatic products circulation	Aquatic transportation	Leisure fishery	other
2018	1211587.32	3354	1254	820
2019	1256654.65	3587	1235	1257
2020	4255783.12	3684	32258	1322

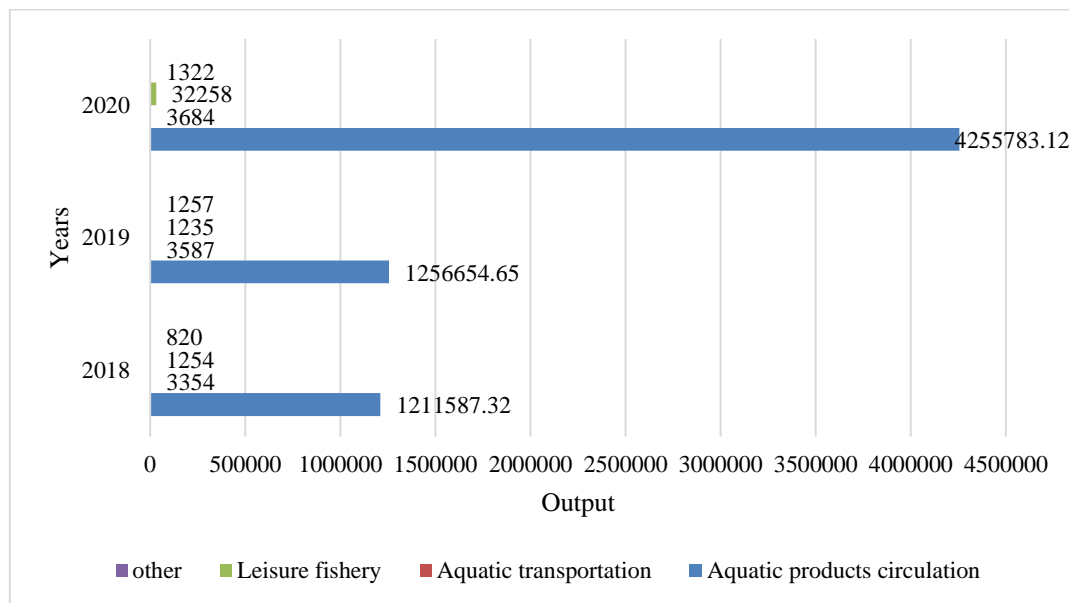


Figure 3. Fishery circulation and service industry in city a from 2018 to 2020

With the increase of the output of marine products and the rapid development of the processing industry, the export trade volume of aquatic products in city a has a large growth trend. According to statistics, the export volume of sea water products in city a accounts for about 3% of the total export volume of aquatic products in China and about 23% of the total export volume of our province. In 2019, the export volume of shrimp products in city a reached 460 million US dollars, accounting for nearly 30% of the total export volume of Chinese shrimp. The aquatic products export markets of city a are concentrated in the United States, Japan, South Korea and Southeast Asia, of which the trade volume with the United States is large. Shrimp culture in city a has formed an industrial chain integrating production and marketing. The development capacity in seven aspects, such as culture area, processing scale and product export, ranks first in the country, and has become a pillar industry for aquaculture, processing and export of marine products in city A.



## 5. Conclusion

Marine fishery resources not only provide human with abundant nutrition such as protein and calcium, but also become the basic strategic resources of medicine, industrial raw materials and energy. In order to realize the coordinated development of land and sea and the harmonious coexistence of people and sea in city a, combined with the current situation, problems and reasons of the development and protection of marine fishery resources in city a, and through the successful practical experience of the development and protection of marine fishery resources at home and abroad, The conclusions of this paper are as follows: the utilization of marine fishery resources has developed from primary products to high-tech industries such as high added value and high efficiency marine biological medicine. The industrial structure of marine fishery has been gradually adjusted from the traditional fishing and aquaculture fishery to the intensive processing of marine products and the comprehensive services of characteristic oceans. The supply of marine resources has always been based on the supply of domestic resources. Now, it is necessary to share foreign resources to the maximum extent, and vigorously develop offshore fishery and replenishment purchase fishery. The development and protection of marine fishery resources is a huge systematic project. China's research on the basic research and development of marine biological resources, the ecological carrying capacity of the sea area, and the property right of fishery are still in the primary stage. The development and protection of marine fishery resources and the healthy development of the marine ecological environment can not be separated from the participation of the whole society. How to achieve the coordinated development of marine fishery development and protection and achieve the harmonious coexistence of people and the sea, The common progress of marine ecological environment and human economic and social development is our eternal practical goal.

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## Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

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