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Current Status of China's Marine Resources and Development Trend of Marine Industry Considering Gray System Method

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Abstract: This paper mainly analyses the development trend of China's marine resources. First, it gives an overview of the water resources system. Second, it introduces the related concepts of China's territorial sea sovereignty, continental shelf and exclusive economic zone, and their proportion in the distribution of resources. Next, the quantity and quality of land available in China's sea areas are discussed from two perspectives: hydrological conditions and water area changes. Finally, the database is built by grey correlation degree model. The analysis results show that the weight distribution array obtained by normalizing the decision rows is highly consistent with the results of classical grey statistics, and the results are reasonable and reliable.

1. Introduction

With the development of China's economy, China is rich in marine resources, especially in water resources. However, due to the large population, low level of development and scientific and technological backwardness, China's sea areas continue to expand [1-2]. A large number of rivers are seriously polluted, leading to soil erosion and soil salinization. Part of it is the destruction caused by man-made activities that results in the reversal of seawater and causes eutrophication. In addition, the unbalanced economic development level and distribution of marine resources in China's coastal areas will also bring a series of negative effects such as water shortage, ecological deterioration and environmental change to the country [3-4].

Many scholars have done some research on marine resources. Domestic scholars'research on marine resources of the Ministry of Land and Resources mainly focuses on: (1) Using the fuzzy hierarchy evaluation method, establish a comprehensive index system, and apply it to regional coastline planning and management. (2) Prediction using multivariable grey correlation model. Some scholars think that the combination of overall planning and fishery economic development is

a typical practice [5-6] in the water resources development strategy of coastal provinces in China. On the basis of sustainable development theory, other scholars have made analysis on the evolution law and influencing factors of marine resources system. Other scholars calculated the correlation between the total sediment content of each river and the per capita GDP by using the gray correlation degree method through analyzing the hydrogeologic characteristics of the sea-land area and the distribution of freshwater resources in different provinces and cities along the coast of China. Some scholars have established an evaluation index system of sea area and water resources status in China [7-8] by using multistage fuzzy mathematical model. Therefore, considering the gray system method, this paper studies the current situation and industrial development trend of China's marine resources.

By analyzing and summarizing the two main indexes of total water resources and per capita share, this paper reflects the area and per capita share of China's sea areas, predicts and studies the development trend of China's marine industry in the future according to the relevant recommendations put forward by the United Nations in the sustainable development, and strengthens the development intensity of China's coastal areas in the light of national policies and the international situation. In order to promote the overall planning and construction of land and sea and make reasonable arrangements for the research, development and application of clean energy technology on the sea.

2. Discussion on the Current Situation of China's Marine Resources and the Trend of Marine Industry Development Considering the Gray System Method

2.1. Status of China's Marine Resources

China is rich in marine resources and has a high quality of marine environment. China has the world's largest coastline, land network and sea salt center. Among China's sea areas, 8692,000 square kilometers of vast waters are the national key protected objects, of which 95.12 square kilometers are the most serious lake-type soil erosion in the Yangtze River Delta. The total coastal area of the mainland accounts for about 1.3% of the total land area, while the abundance of marine resources is low and unevenly distributed [9-10]. Figure 1 shows the area of China's ocean distribution.

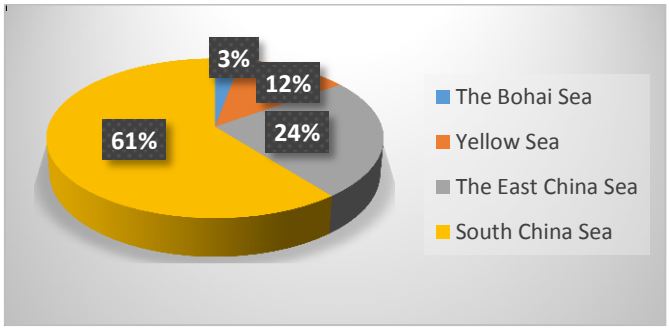

Figure 1. The proportion of all the waters in China

China's marine resources are rich, widely distributed and diverse, with freshwater, seawater and beaches accounting for more than half of the total land water resources reserves in the country. The sea area in China is about 12628,000 hectares. Among them, there are three types: fresh water, sea water and seafloor resources. The offshore waters include the coasts of the middle and lower reaches of the Yangtze River, some coasts of the East China Sea and inland areas of the South China Sea. Shallow water, underwater water, swamps and other forms of natural existence. In terms

of hydrogeology, China has a large number and excellent quality. The Bohai Strait and the Pearl River Delta are the eastern coastlines of the mainland of China, which are the most dense and dense. At the same time, the largest area of the sea is the Yellow Sea, but the per capita occupancy is very low. Due to the imbalance of economic and social development, the price of aquatic products varies greatly from region to region due to the different production scale and output demand. At the same time, the high efficiency of water resources utilization in coastal areas but poor development conditions make China's marine resources in an overall disadvantage position, with scattered distribution [11-12].

2.2. Characteristics of China's Marine Resources

(1) The distribution of China's marine resources is formed by the combined action of coastal areas and inland sea areas, in which land area accounts for 60% of the total land area and water area for 70%. Therefore, in the development and utilization of the ocean, we should focus on how to rationally and effectively use the natural resources such as sea and water. Since the coastal areas of our country are mostly distributed in the Yangtze River Delta and the Yangtze River Basin and other economically developed areas, there are a large number of sea-land-air junction zones, coastal economic zones and some special waters. Therefore, we can use these unique geographic environmental advantages to develop fisheries, aquaculture, salt washing industry, etc. At the same time, we should pay attention to the protection of marine biodiversity and marine resources and ecological environment from damage and pollution [13-14].

(2) Our country has a vast territory and a large population, but a low per capita possession and a vast territory. In the coastal areas of China, there are a large number of large-scale projects or industrial zones with dense population, rapid economic development and great investment value. At the same time, with the increase of the state's overseas construction efforts and the introduction of related policies and measures, a series of industrial upgrades and transformation opportunities have brought about a diversified trend in the utilization of China's marine resources, such as: seawater cleaning projects, seawater purification projects, seawater purification projects, and so on. There is a new round of intensity increase [15-16] in the exploration, exploitation and processing of submarine oil fields.

(3) The hydrologic advantage is obvious. China's sea area is wide, the water volume is large and the distribution is scattered, the water area is vast and there are many lakes. The close relationship between land and sea provides convenience and broad market prospects for the maritime transportation network, and also becomes one of the important components in the development and utilization of seawater resources.

2.3. Grey System Method

The gray system is a complex mixture of many factors, including many uncertainties, such as the level of economic development, the availability of resources and so on. Based on known information, these unknown data are quantified and divided into quantitative indicators to a certain extent. These uncertainties are also known as incomplete and unreliable [17-18]. The so-called "bounded rationality" means that all kinds of information that have a decisive role in the change of things must fully understand and accept the reasons and environmental conditions that are reflected in the decision-making process. Otherwise, there will be phenomena that contradict the original target or deviate too far or mistaken understanding, resulting in inaccurate predictions or even deviations. Indicators or variables of certain regularity and imprecision are expressed in terms of probability. In practice, we call these factors "observable". The higher the level of economic and social development, the greater the demand for resources when the gross national economy

increases steadily. Figure 2 shows the gray system process.

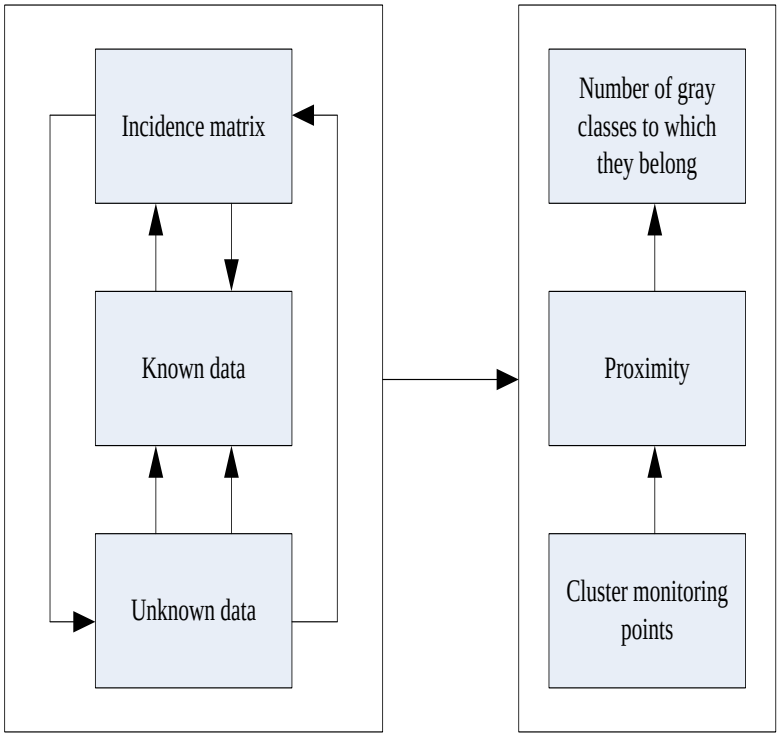

Figure 2. Basic process of gray system method

After determining the relationship between the factors, a mathematical model is established to quantitatively explain the range and size of some variables in each subsystem. Gray correlation degree refers to the relative change produced by two or more related coefficient values when there is a definite relationship between them (that is, within a period of time) and the node set, which reflects the trend and degree of the system development trend. The core of gray system comprehensive evaluation method is to evaluate the health status of target ecosystem by calculating the clustering coefficient of each gray class and comparing the number of gray classes belonging to different objects. The clustering coefficient reflects the degree of affinity of the cluster monitoring points to the gray classes. If there are m monitoring points, the clustering coefficient of the first monitoring point for J grey classes is expressed by the following formula:

$$\varepsilon_{ij} = \sum_{i=1}^{n} f_{ij}\left(d_{ij}\right) w_{ij} \tag{1}$$

In the formula, e is the clustering coefficient of the jth grey class of the kth monitoring point, FIJ (dij) is the whitening coefficient of the jth grey class of the ith index of the kth monitoring point, and WJ is the weight value of the jth grey class of the ith index.

$$f_{ij}(x) = \begin{cases} 1, x \geq x_m \\ \dfrac{x - x_0}{x_m - x_0}, x_0 < x < x_m \\ 0, x \leq x_0 \end{cases} \tag{2}$$

That is, a correlation matrix is established between known and unknown data, each part of the characteristic quantity is normalized according to some rules to form a new set of system indexes,

and then the subsystem is evaluated by calculating the new combination coefficient to provide basis and reference information for decision-making and other functions.

3. The Experimental Process of China's marine resources status and the development trend of marine industry considering the gray system method

3.1. Marine Industry Development Structure Considering Gray System Method

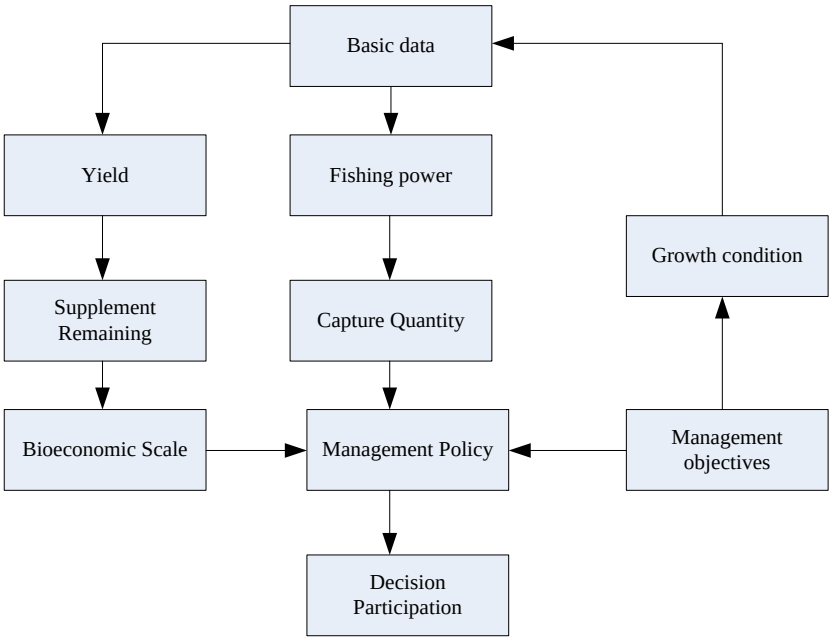

Figure 3. The marine resources industry based on the gray system method

Gray correlation analysis quantifies the uncertain factors, establishes a mathematical model, and quantitatively describes the role and degree of each index in the system. Figure 3 illustrates the interdependence of subsystems as a quantitative relationship. This method is mainly used when dealing with multi-level, small-scale or large amount of deep information. It can also be used to deal with comprehensive evaluation methods which can neither reflect a whole nor solve complex problems. It can also deal with some relatively independent but differently related and incomplete deterministic factors in the system. Gray correlation degree refers to a system formed by the interaction of different factors. It has multi-level, multi-faceted and complex degree, which is the most common when determining the weight of each index to the evaluation object. It consists of subsystems. There are mainly abundant resources and exploitation and utilization. Among them, rich resources need to be processed to meet certain requirements, and mining must be through technological transformation to meet the demand and economic development level and other factors before deciding whether it should be put into development or use or assign the tasks of means of production.

3.2. Procedures to Test the Performance of A Model for Ocean Industry Development Trend Based on Grey System Method

Gray correlation analysis is a new multi-factor decision making problem based on gray system theory and method. It quantifies and evaluates many kinds of non-quantitative information, such as complex uncertainty and fuzziness. This method can use multiple indicators to describe the

relationship between different variables at the same time. Therefore, this method can be used when there is less data for each subsample or subsystem, and gray correlation analysis (AHP) is used when there are more observations for each subsample. If the minimum value is selected as the weight vector, it will be used instead of the original value to indicate the relative importance between systems. According to the requirements of fuzziness, the weights of the corresponding indicators at each level in the whole evaluation system should be determined first, then the degree of association between each factor and the decision unit should be determined by fuzzy comprehensive evaluation. Finally, the evaluation set is transformed into a matrix to form a unified standard format.

4. Experimental Analysis of the Current Status of China's Marine Resources and Development Trend of Marine Industry Considering Gray System Method

4.1. Performance Test Analysis of the Development Trend Model of China's Marine Industry Based on Gray System Method

Table 1 shows the performance test data of this gray system method.

Table 1. Performance testing

Test times	Decision line	Weight	Influence degree
1	0.34	0.12	Large
2	0.13	0.32	Large
3	0.43	0.34	Moderate
4	0.31	0.23	Large
5	0.45	0.38	Large

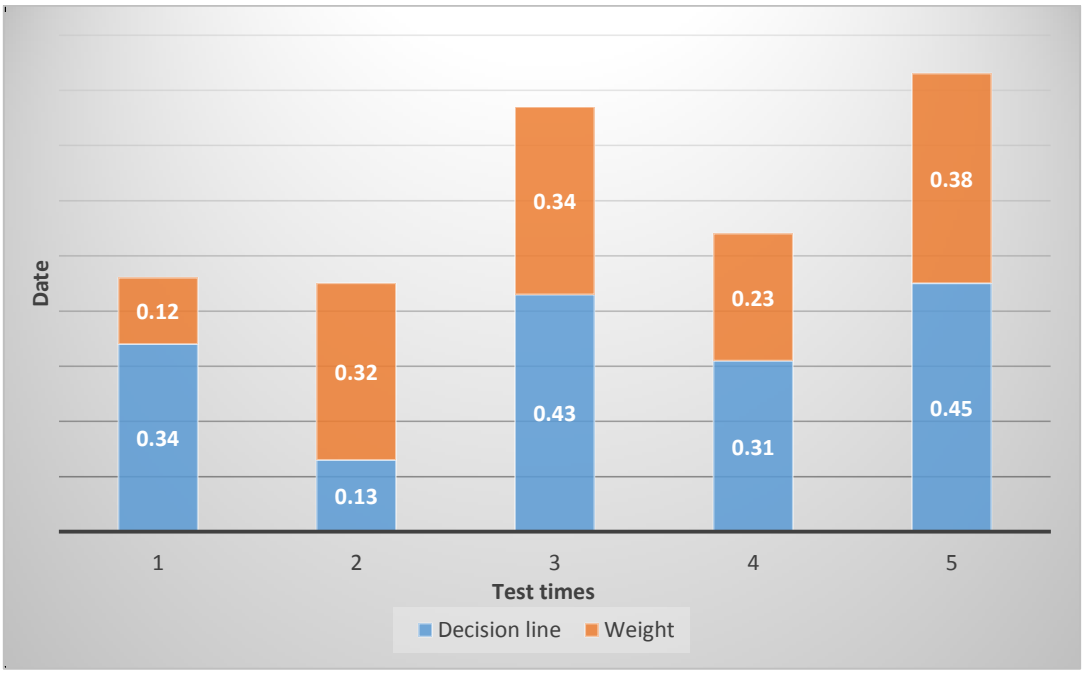

Figure 4. Gray system method weights

The analysis method of grey correlation degree is the deterministic relationship among the factors in the system, and the dependence degree of the relationship in quantity and space. The

fuzzy comprehensive evaluation matrix is obtained by building a model, and the grey correlation degree analysis method can be used to compare and evaluate multiple decision plans and determine the best plan or optimal plan. Figure 4 shows that the weight allocation array obtained from the normalization of decision rows is highly consistent with the results of classical gray statistics, and the results are reasonable and reliable.

5. Conclusion

China is rich in marine resources, but due to the low level of economic development and the fragile marine environment, there are blindness and unreasonable phenomena in the development and utilization. Among them, water pollution, soil degradation and other problems caused a serious shortage of water resources and land salinization, but also caused a large number of problems such as the reduction of cultivated land area, the deposition of sea water and so on. Therefore, this paper conducts pollution capacity analysis for countries along China's Marine Silk Road and some coastal provinces and regions, and combines with grey system theory to provide guidance and decision-making basis for sustainable development of China's marine resources.

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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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