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# *Spatial Heterogeneity Measurement of Marine Resources and its Relationship with Marine Economic Development*

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***Keywords:*** Marine Resources, Spatial Heterogeneity, Marine Economic Development, Coupling Model

***Abstract:*** With the development of economy, the world's population, resources and environment are under increasing pressure. The ocean can provide abundant energy resources for human society and expand people's living space. The purpose of this article is to study the spatial heterogeneity measurement and its relationship with the development. Taking each city in my country as the basic research unit, rough set theory is used to screen and construct a method that includes innovation-driven, coordinated There are five quasi-level layers of stability, green ecology, open cooperation and people's livelihood sharing. Using the coupling degree, the spatial heterogeneity measurement of marine resources in my country and the coupling and coordination relationship between marine resources and the environment are analyzed, which is expected to provide a useful reference for sustainable development. Develop the marine economy of my country's coastal areas. The results show that from the total effect, the spatial heterogeneity of marine resources effectively drives the growth of marine economy (0.827), eases the pressure on marine ecology (-0.682), promotes the progress of marine society (0.734), and improves the state of marine economy (0.736), and then promote the development of marine economy (0.789).

## 1. Introduction

The exploitation of marine resources not only promotes the development and prosperity of coastal society and economy, but inevitably affects the marine environment and marine ecosystem. At present, there is no effective comprehensive benefit assessment for water resources development projects in my country [1]. How to change the free use of water resources in the past, incorporate social benefits and environmental costs into the analysis and decision-making of marine economic development, and achieve rapid, sustainable and high-quality development of marine economy while maintaining sustainable development. The International Labour Organization, and has become a modern country. important in the process of economic and social development [2].

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Domestic and foreign students have achieved a number of research results in measuring the spatial distribution of water resources and their relationship with marine economic development. Mathew J provides an overview of what blue bonds are, the changing impact of blue bonds on the ocean economy, and where the ocean economy should focus in attracting investors and promoting investment. The investment community can actively integrate blue bonds into a variety of sustainable financial products, increasing investment in the water economy and supporting the health of our oceans[3] Novyanti Y To analyzes the Indonesian government's strategy to implement the blue economy in the Philippines from 2014 to 2017. Indonesia's geographic location is the largest archipelago in the world, and its location in the Coral Triangle underpins Indonesia's great potential and high value. Under the leadership of President Joko Widodo, Indonesia decided to develop its economy from the ocean using a blue economy strategy. Using empirical research methods, this paper finds that Indonesia's diplomatic strategy is to implement the blue economy through multilateral diplomacy through the signing of the Joint Maritime Declaration, and through the creation of the Coral Triangle with the participation of Indonesian NGOs (track 1) [4]. Nga HT aims to provide the water economy of countries such as the US, Australia, UK and Japan, as well as perspectives from leading academics. Therefore, this study defines the water economy as the economic activities that take place in the ocean or ocean, the economic activities that use water resources to produce goods and services, and the economic activities that provide goods and services for economic activities that take place in the ocean or ocean. Activity [5]. This paper mainly studies the spatial heterogeneity measurement of marine resources and its relationship.

Based on the importance and great prospects of marine resources for social and economic development, in order to achieve sustainable development, this paper examines the contribution of marine resources to marine economy based on systematic economic analysis—seawater problems and evaluation research. , and analyze the intervention. The economic impact of seawater. And then study the correlation and connection between marine economy and marine resources, combine the overall benefit evaluation of marine resource development with economic development evaluation, and propose development and suggestions for sustainable development of marine and marine resources. Study the connection and coordination of marine water resources and marine economy, and promote the rational development and sustainable utilization of marine resources while ensuring the sustainable development of marine economy. In the process of marine economic development, being able to adjust the water resources development process correctly and timely marine water resources and the environment.

## 2. The Measurement of the Spatial Heterogeneity of Marine Resources and its Relationship

### 2.1. The Formation and Connotation of the Spatial Heterogeneity of Marine Resources

The reasons for the spatial integration of water resources are complex in many aspects, which can be summarized into two parts: First, due to the influence of natural factors, the spatial homogeneity itself is far from homogeneity, which is reflected in the spatial integration. Due to the influence of factors, there are differences in the spatial dimensions of the sea area where people engage in marine economic activities, resulting in differences and utilization of water resources in coastal areas. Therefore, from the perspective of resource characteristics, the spatial classification of water resources is an important manifestation of the spatial classification of water resources such as quantity, quality, structure, and location [6-7].

### 2.2. Demand Analysis of Marine Economic Development

(1) Innovation-driven development of marine economy

The innovation-driven development of the marine economy is the source of power for high-quality development. Development dynamics determine development speed, efficiency and sustainability. And the level of enterprise innovation ability and innovation level determines the competitiveness of enterprises. If there is no technological innovation as the driving force. Innovation not only refers to technology and product innovation, but also a comprehensive innovation system established with technology and product innovation as the core, combining science and technology, management concepts, institutional policies, and strategic directions. Therefore, it is necessary to encourage scientific research institutions and leading enterprises to strengthen the technological research and development and achievement transformation of new species of marine fishery, new equipment of marine enterprises, and new space of marine resources; promote the mode of production, study and research, strengthen the collaborative sharing of innovation platforms, and promote the achievements of marine science and technology. More and faster translate into actual productivity [8-9].

(2) Unified development

The integration and sustainable development of the marine economy are inherent characteristics of high-quality development. Only with stable economic development can the industrial system be further optimized and developed. In the process of marine economic development, if there is excessive reliance on the quantity of resource input, economic development with low efficiency and low potential will appear; if it is based on improving the efficiency of marine economic resource allocation, there will be a quality-based development method. On the other hand, realize the efficient allocation of resource elements through the conversion of old and new kinetic energy, and eliminate backward production energy [10-11].

(3) Green and ecological development

It is necessary to restore the status quo of marine ecosystem degradation in a timely manner, strengthen marine environment restoration and ecosystem restoration, and strengthen the management of water pollution resources. Develop and rationally utilize water resources, and replace the previous large-scale development model of fishing and development with distant-water fishing and offshore aquaculture; realize real-time monitoring of the marine environment, and prevent ecological damage and environmental pollution as soon as possible [12-13].

### 2.3. Design Principles of Evaluation Index System

(1) Specific

The description of the index system should fully reflect the important characteristics of the evaluation object. The sample selection should be carried out in a specific area, that is, 11 coastal areas (provinces and autonomous regions). Based on a comprehensive analysis of the importance and characteristics of the high-quality development of the marine economy, understand the most important and representative content, and describe the actual situation. Due to the differences in different coastal areas, in the process of establishing the index system, it is necessary to ensure its exclusivity and representativeness, as well as the direction and appropriateness. Reports may reflect regional differences [14-15].

(2) Measurement

At the same time, in the process of index data collection and calculation, the scale should be unified as much as possible to facilitate comparison. This requires: First, to avoid ambiguity in understanding. Secondly, the number of indicators should be appropriate, too few indicators, and the amount of information is small; conversely, the amount of information is large, but the degree of information overlap will also increase, resulting in unimportant indicators being included, and the accuracy of the evaluation system is reduced. The index system should be simple and complex, and

try to avoid the overlapping and repetition of the indicators. The calculation methods and data sources of each index should be standardized and easy to operate [16-17].

(3) Availability

In the design process of the indicator system, it is necessary to pay attention to whether the data can be obtained. Some indicators are very meaningful, but they are difficult to quantify or obtain in practice and should be discarded [18].

## 3. Model and Research on the Spatial Heterogeneity Measurement of Marine Resources and its Relationship with Marine Economic Development

### 3.1. Data Sources

This research is based on the marine economy-related data of China's provinces and cities in 2021, and the research theme is the development and evolution of the marine economy. The kernel density distribution was calculated using the logarithm of per capita water production/annual production in the area. The larger the data, the more normal the data distribution, unlike logarithmic.

### 3.2. Coupling Model

Coupling is a common method of describing the cooperative relationship between two or more systems of communication and influence. An introduction to the coefficient of variation method for measuring the synergistic relationship between water resources, environment and water economy development potential.

$$C = \frac{2S}{z(x)+h(y)} = 2\sqrt{1-\frac{z(x)\cdot h(y)}{[\frac{z(x)+h(y)}{2}]^2}} \tag{1}$$

In formula (1), C represents the coefficient of variation of marine resources and marine economic development, z(x) and h(y) represent the comprehensive evaluation results of resources and environment, respectively. On the contrary, the degree of coordination is lower. Therefore, the coupling function is constructed as follows:

$$c = \{\frac{z(x)\cdot h(y)}{[\frac{z(x)+h(y)}{2}]^2}\}^k \tag{2}$$

In formula (4.2), k is the adjustment coefficient.

### 3.3. Coupling Coordination Degree Model

The degree of fusion is the further development and improvement of the degree of fusion. The suggested procedure for measuring the correlation coefficient is as follows:

$$R = \sqrt{c\cdot p} \qquad p = \alpha\cdot z(x)+\beta\cdot h(y) \tag{3}$$

In formula (3), R is the degree of integration, c is the degree of integration, and p is the total income of economic development and marine resources. α is the density of water resources and environmental carrying capacity, β is the density of marine economic development.

## 4. Analysis and Research on Spatial Heterogeneity Measurement of Marine Resources and Its Relationship with Marine Economic Development

### 4.1. Determination of Indicator Weights

Greenhouse gas emissions per unit of marine products, and total marine solid waste generation, other citations are negative. The indicators and statistical results of the indicator scale are known in Table 1.

*Table 1. Weights of the evaluation index system*

| Target layer | Criterion layer | Weights | Indicator layer | Weights |
|---|---|---|---|---|
| The level of marine economic development | Innovation driven | 0.2421 | Per capita marine patent ownership | 0.1178 |
| | | | Number of published scientific papers per capita | 0.0712 |
| | | | The number of scientific and technological personnel among 10,000 sea-related employees | 0.0531 |
| | Coordination and stability | 0.1613 | Number of sea-related employees | 0.0845 |
| | | | Urban-rural income ratio | 0.068 |
| | Green ecology | 0.2304 | Number of marine type nature reserves | 0.0987 |
| | | | Energy utilization | 0.0531 |
| | | | Number of pollution control projects in coastal areas | 0.0786 |
| | Open cooperation | 0.1897 | Total import and export | 0.0975 |
| | | | Actual use of foreign investment | 0.0922 |
| | People's livelihood sharing | 0.1765 | Per capita aquatic product supply | 0.0896 |
| | | | Per capita disposable income | 0.0869 |

The innovation driving weight is 0.2421, the coordination and stability weight is 0.1613, the green ecological weight is 0.2304, the open cooperation weight is 0.1897, and the people's livelihood sharing weight is 0.1765.

As shown in Figure 1, the weight of marine patents per capita in the index layer is 0.1178, The publication rate of scientific and technological papers per capita is 0.0712, and the number of professional scientific and technological workers wading in water is 0.0531, and the weight of the number of sea-related employees is 0.0845. , and the weight value of marine economic growth rate is 0.068.

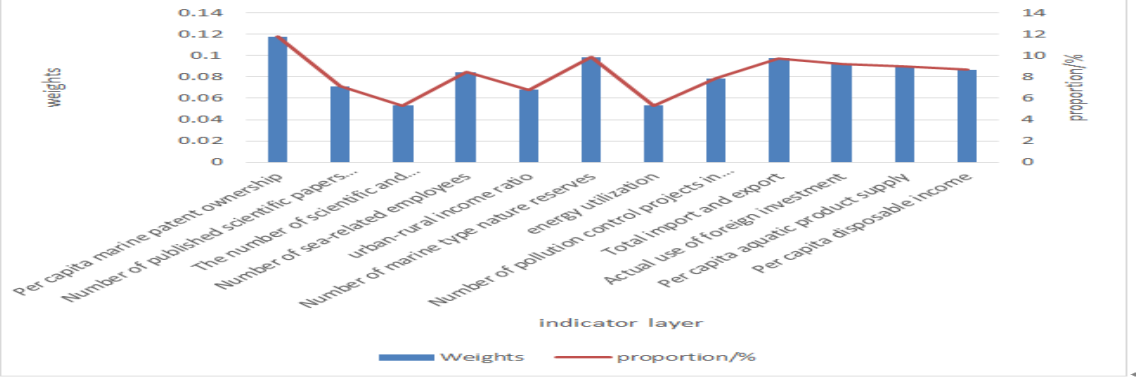


*Figure 1. The weight value of the marine economic development evaluation index layer*

## 4.2. Structural Model Estimation

The evaluation of structural models is generally carried out from three aspects: measurement parameters of endogenous variables, estimation of path coefficients, path correction and multicollinearity. The results obtained by running the "PLS algorithm" using SmartPLS software are shown in Table 2. The PLS method was divided into: better (0.65), moderate (0.34) and poor (0.18), the results are known in Table 2.

*Table 2. Endogenous latent variables R2 and* $R^2_{adj}$

| Endogenous variables | R2 | $R^2_{adj}$ |
|---|---|---|
| Mgd | 0.696 | 0.689 |
| Mes | 0.712 | 0.702 |
| Me | 0.456 | 0.504 |
| Ms | 0.548 | 0.541 |
| Med | 0.954 | 0.956 |

According to Figure 2, the coefficient of determination of "marine economic development" in the model has reached a good level, indicating that the five components. The low coefficient of determination for ocean-driven variables suggests that there are factors other than ocean economic policy that influence the components of ocean economic development.

As shown in Table 3, from the overall effect, the spatial heterogeneity of marine resources effectively drives the development (0.827), eases the pressure on the marine ecology (-0.682), promotes the progress of the marine society (0.734), and improves the state of the marine economy (0.736).

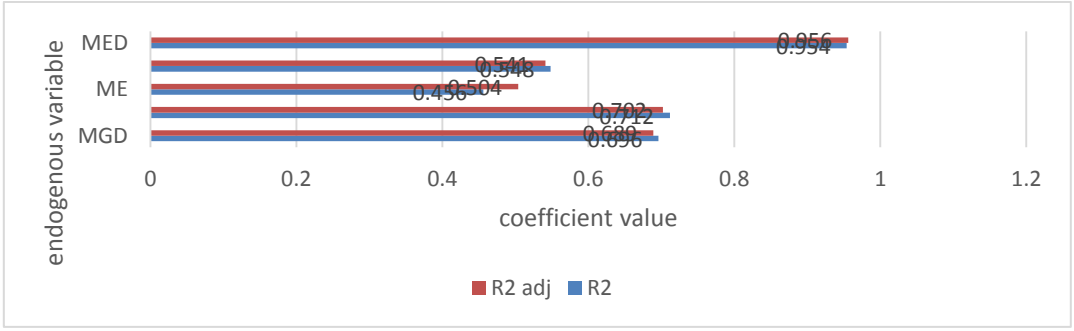


*Figure 2. Comparison of endogenous latent variables R2 and* $R^2_{adj}$

*Table 3. Direct and total effects of ocean economic policies*

| Effect | Path | Coefficient | $F^2$ |
|---|---|---|---|
| Direct effect | Mep--mgd | 0.827 | 2.369 |
| | Mep--me | -0.682 | 0.864 |
| | Mep--ms | 0.734 | 1.224 |
| Total effect | Mep--mes | 0.736 | 1.235 |
| | Mep--med | 0.789 | 1.364 |

## 5. Conclusion

By studying the relationship between water resources and environmental carrying capacity, this paper measures my country's marine economic development potential and water resources and environmental carrying capacity, judges whether they are consistent, and conducts a qualitative analysis. Under the conditions of sustainable development, economic development capacity is to use quantitative and qualitative methods to measure and analyze the relationship between these two systems, and to study the relationship between marine resources. Transport capacity and economic development potential. economic sea. strength. The relationship is the interaction of water resources and environmental transport systems. The energy transfer of water resources to adapt to the region and the environment. In addition, some problems that may exist in the development of marine economy in my country's coastal areas are analyzed to provide effective policy ideas for sustainable economic development.

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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.

## References

*[1] F Bray. The Making of an Indian Ocean World-Economy, 1250–1650: Princes, Paddy Fields, and Bazaars. By Ravi Palat. New York: Palgrave Macmillan, 2015. xii, 305 pp. The Journal of Asian Studies, 2019, 78(2):474-476. https://doi.org/10.1017/S0021911819000433*

*[2] Lubchenco J , Haugan P M , Pangestu M E . Five priorities for a sustainable ocean economy. Nature, 2020, 588(7836):30-32. https://doi.org/10.1038/d41586-020-03303-3*

*[3] Mathew J , Robertson C . Shades of blue in financing: transforming the ocean economy with blue bonds. Journal of Investment Compliance, 2021, 22(3):243-247. https://doi.org/10.1108/JOIC-04-2021-0020*

*[4] Novyanti Y , Raharyo A . Actualizing Blue Economy: Multi-Track Diplomacy in Supporting Indonesia–Philippines Ocean Economy Cooperation (2014-2017). AEGIS Journal of International Relations, 2019, 3(2):169-188. https://doi.org/10.33021/aegis.v3i2.710*

*[5] Nga H T . Approaches in the world and in Vietnam Ocean Economy - Definition and*

*classification. Science & Technology Development Journal - Economics - Law and Management, 2018, 2(1):49-57. https://doi.org/10.32508/stdjelm.v2i1.501*

*[6] Patil P G , Virdin J , Colgan C S , et al. Initial Measures of the Bangladesh Blue Economy. Journal of Ocean and Coastal Economics, 2019, 6(2):1-19. https://doi.org/10.15351/2373-8456.1118*

*[7] .Susandi A , Wijaya A , Kuntoro W S , et al. Analysis of human activities and socioeconomic development on the marine ecological carrying capacity (mecc) evaluation index to climate change adaptation in Nunukan Regency, North Kalimantan, Indonesia. IOP Conference Series: Earth and Environmental Science, 2021, 824(1):012074 (8pp). https://doi.org/10.1088/1755-1315/824/1/012074*

*[8] Raspotnik A , Rottem S V , Sthagen A . The Blue Economy in the Arctic Ocean: Governing Aquaculture in Alaska and North Norway. Arctic and North, 2021(42):122-144. https://doi.org/10.37482/issn2221-2698.2021.42.122*

*[9] Andriamahefazafy M , Kull C A . Materializing the blue economy: tuna fisheries and the theory of access in the Western Indian Ocean. Journal of Political Ecology, 2019, 26(1):403-424. https://doi.org/10.2458/v26i1.23040*

*[10] Haq M , Suraiya S . A review on the bio-functional roles of phospholipids from marine resources. Food Research, 2021, 5(5):1-16. https://doi.org/10.26656/fr.2017.5(5).677*

*[11] Tammela P , Kapp K , T Püssa, et al. Bioactive Natural Products from Terrestrial and Marine Resources, Especially Terpenes, but not limited to…-Original Article. Natural Product Communications, 2020, 15(12):1-14.*

*[12] Masimen M , Harun N A , Misbah S , et al. Marine Resources: Potential Of Polychaete Application In Combating Covid-19 Infection. Journal of Sustainability Science and Management, 2020, 15(7):1-9.*

*[13] Touwe S . Local Wisdom Values of Maritime Community in Preserving Marine Resources in Indonesia. Journal of Maritime Studies and National Integration, 2020, 4(2):84-94. https://doi.org/10.14710/jmsni.v4i2.4812*

*[14] Tsiouvalas A . Mare Nullius or Mare Suum? Using Ethnography to Debate Rights to Marine Resources in Coastal Sámi Communities of Troms. The Yearbook of Polar Law Online, 2020, 11(1):245-272. https://doi.org/10.1163/22116427_011010013*

*[15] Narwastuty D S . The Equation On The Justice For Fisherman: The Urgency To Protect Fishermen And Marine Resources In Indonesia. Dialogia Iuridica Jurnal Hukum Bisnis dan Investasi, 2020, 12(1):081-096. https://doi.org/10.28932/di.v12i1.2959*

*[16] Tampus A , Torino B . Marine Resources and Utilization in Buug, Dumanquillas Bay, Philippines. International Journal of Biosciences (IJB), 2020, 17(3):124-133.*

*[17] Said A , Macmillan D . 'Re-grabbing' marine resources: a blue degrowth agenda for the resurgence of small-scale fisheries in Malta. Sustainability science, 2020, 15(1):91-102. https://doi.org/10.1007/s11625-019-00769-7*

*[18] Salleh H S , Wan N M , Hazimah N , et al. Traditional medicines from marine resources: Understanding the consumer's knowledge and perceptions. International Journal of ADVANCED AND APPLIED SCIENCES, 2020, 7(11):110-118. https://doi.org/10.21833/ijaas.2020.11.012*