

# Evolution Path and Development Trend of Domestic Marine City Research --- A Visual Analysis Based on CiteSpace

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## Abstract

This paper uses the information visualization software CiteSpace, through the main research methods of spatiotemporal knowledge atlas and content knowledge atlas analysis, to search the CNKI with "marine city" as the key word or title. The publication time is selected from 2012 to 2022. A total of 146 effective documents are retrieved for analysis, revealing the current research hotspots and development frontier of marine cities in China. The analysis results show that the development of the research field of marine cities presents three stages: the first stage is from 2012 to 2016, and the publication volume of the documents related to marine cities is relatively flat; the second stage is from 2017 to 2020, showing a trend of steady growth year by year; the third stage is from 2021 to 2022, when the number of marine cities shows a "blowout" surge. The authors and institutions of the papers present scattered distribution, and the parts are slightly tight. The research focuses on three aspects: Marine center city, Marine industry and Marine power, and the research context is easily affected by the policy effect, showing a dynamic development trend. At present, academic research on marine cities is relatively scarce. Therefore, this paper gives a further summary and reflection, with a view to providing a reference for further research, exploration and promotion of marine undertakings in China's marine cities.

**Keywords:** marine city, CiteSpace, global ocean center city

## 1. Introduction

The sea of people coexists with the city and the sea. They live by the sea, thrive towards the sea, and prosper by exploring the sea. The coastal countries and cities in the world are also often economically developed areas. Because these areas have a large number of human and various resources, through this agglomeration effect, the coastal areas have achieved rapid development. Since the Eighth National Congress of the Communist Party of China put forward the concept of "building a maritime power", many cities have extended the concept of "coastal city", "coastal city" and "marine city". For the concept of "marine city", its related themes are mostly resource economy, marine economy, port city, sustainable development, cultural tourism, etc. (Yang et al., 2020). This paper quotes the concept of marine city summarized by Lu et al. (2020). In terms of academic content, this study combed the literature research of marine cities from 2012 to 2022 and found that most of the relevant topics were marine industry, marine power, marine culture, sustainable development, and marine central cities. In the past two years, the academic community has not only explored the experience of building marine central cities, but also conducted empirical research on the implementation path of marine central cities. Few scholars have conducted a hot research on documentary metrology of marine cities. In view of this, this paper uses CiteSpace software to clarify the research content of marine cities, analyze the research context of marine cities, and explain the research hotspots of marine cities, with a view to providing theoretical reference and data support for subsequent research.

## 2. Method and Data

### 2.1 Research Method

This study uses CiteSpace software developed by Chaomei Chen. In this software the "keyword" was used to analyze the subject areas, research hotspots and research frontiers; "Author" and "institution" were used to analyze the author and the institution respectively. The time slice is set to 1 year, and other parameters are set to

default reference values. The software can observe the research trend or trend of a certain research field and present it in a visual way, which can overcome the subjectivity of traditional literature review and make the research results more objective and scientific. Through the quantitative and scientific knowledge atlas visual analysis of the marine city research literature in the CNKI database, the author co-citation analyses, the document co-citation analyses, the keyword co-occurrence analysis, the research content process analysis are drawn respectively, and the relevant marine city literature is analyzed and sorted accordingly.

## *2.2 Data Source*

This paper mainly focuses on the analysis of word frequency, clustering, hotspot and frontier of the key words of the domestic marine city literature. Based on the research method of metrology, through the China National Knowledge Network (CNKI) retrieval platform, with the title or keyword of "Marine City", the publication time was selected from 2012 to 2022, and the time slice was set to 1 year. A total of 176 documents related to "Marine City" were retrieved, and 146 effective documents were finally obtained after removing the conference abstract, news reports and other non-research documents as well as the documents that were obviously inconsistent with this research.

## **3. Quantitative Results and Analysis**

### *3.1 Number of Annual Articles Published*

The annual number of documents issued reflects the activity and change rules of a certain field. Through CiteSpace to draw the annual publication trend chart of marine cities (Figure 1), it was found that the number of documents issued by marine cities in the CNKI database showed an overall upward trend. From 2012 to 2022, the time sequence of the published documents of the relevant research on marine cities presents three development stages. The first stage is from 2012 to 2016, and the publication volume of the documents related to marine cities in this stage is relatively flat, and even decreased in 2017. The second stage is from 2017 to 2020, showing a trend of steady growth year by year. The third stage is from 2021 to 2022, when the number of marine cities shows a "blowout" surge, and the research of marine cities has been paid attention and importance by scholars.

The above changes in the number of publications are related to the orientation of China's marine economic development and reform. Based on the report of the Eighteenth National Congress of the CPC in 2012, "Building a Strong Ocean State" was proposed for the first time, and in 2013, General Secretary Xi Jinping proposed the initiative of establishing the "21st Century Maritime Silk Road". Most of the research in this period focused on the formation logic and strategy of the maritime power and the coastal port trade, indicating that the establishment of a maritime city in the initial stage of building a maritime power is not the main idea. During the 13th Five-Year Plan period, the CPC Central Committee proposed that the development of China's marine industry should start with new marine cities as the bridgehead. In the "13th Five-Year Plan" for the development of the national marine economy, it was particularly proposed that "promote the construction of Shenzhen, Shanghai and other cities as global marine central cities", and "Marine central cities" first appeared in government documents. The proposal of this concept caused extensive research by various academic circles and promoted the increase of the number of documents issued by marine cities. With the implementation of the "Maritime Power" strategy and the "the Belt and Road" strategy, more and more scholars have conducted in-depth research on the connotation and path of global marine central cities on the basis of summarizing and analyzing the development experience of global well-known marine cities.

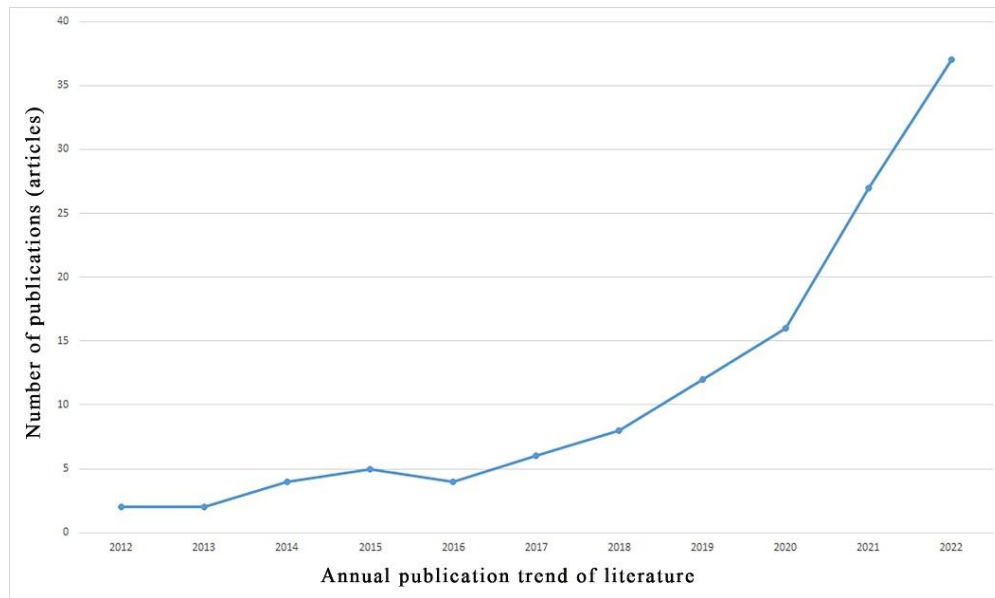


Figure 1. Number of publications

### 3.2 Author Co-citation Analysis

Through author co-citation analysis, we can identify the core authors of a discipline or field and their cooperation strength and mutual citation relationship (Hu et al., 2013). Figure 2 is generated by visual analysis of the authors included in 146 documents. It can be seen from Figure 2 that there are 148 nodes and 118 links in the map, and the network density is 0.108. The larger the nodes in the map, the more times the author appears. It can be seen from the figure that Chenyao Zhang, Jingyu Li, Wenxuan Zhang, Yangqin Ji and Yuqi Lu, as the representative authors with high volume of papers, have formed a certain scale of cooperative groups in the field of marine city research, mainly 2-3 people. On the whole, the map density value is just close to the normal value of 0.1, and the network is relatively loose, belonging to a typical sparse map. Li and Zhang (2015) believe that China should link up and create the headquarters of the world's marine cities, and create the main actors for the strategic cooperation of the maritime Silk Road, which can not only promote the coordinated development of the marine cities of all countries, but also bring positive economic and social effects for the regional development of relevant cities. Liu (2021) believes that during the "Fourteenth Five-Year Plan" period, China should focus on the strategic goal of becoming a maritime power, take the marine economy as the leading factor, and take the marine industry as the starting point to implement and promote the construction of marine cities. Lu and Ji (2022) constructed four first-level evaluation index systems of economic potential, openness, marine resources and marine science and technology innovation, and 16 second-level evaluation index systems of GDP based on the research and review of marine central cities, and proposed that in the perspective of "smart ocean", Zhoushan city should optimize the marine industrial structure, improve the energy level of the city in multiple ways and further improve the level of openness in order to build a global marine central city. However, the cooperation between scholars on marine cities is not close enough, and the distribution of research authors has obvious characteristics of fragmentation and individualization, which further explains that the current academic attention to marine cities is still low, which is not conducive to the development of marine cities. Breaking the isolation of marine city research groups, improving the exchange and cooperation among scholars, and forming efficient resource sharing around marine cities will become a new growth space for marine city research.

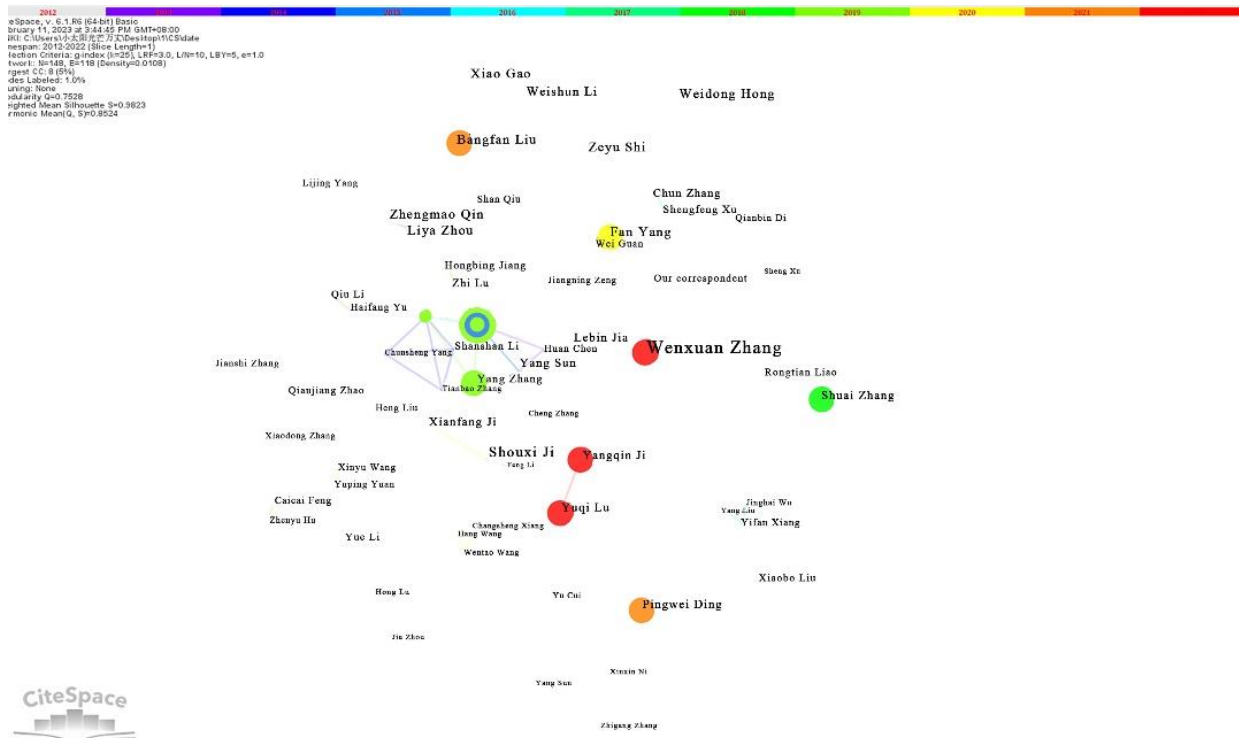


Figure 2. Author co-citation analysis

3.3 Cooperation Network of Marine City Research Institutions

In order to further clarify the cooperation of institutions in the field of marine city research, a network diagram of marine city research institutions was drawn through software (Figure 3). Figure 3 has a total of 130 nodes and 60 connections, with a node density of 0.0072, which indicates that the links between the issuing institutions in the field of marine city research in China are not strong, and the academic exchanges and cooperation between different institutions need to be strengthened. From a regional perspective, the number of documents issued by marine city research institutions is not coordinated in the coastal areas. The number of documents issued by Beijing, Liaoning, Hebei, Guangdong, Zhejiang and other coastal areas is relatively large, while the number of documents issued by other coastal areas is relatively weak. And only a few research institutions have cooperation, which is not conducive to promoting the development, progress and collaborative innovation of marine city research. The Marine Economy and Sustainable Development Research Center of Liaoning Normal University, the Economic and Management Research Center of Guangdong Ocean University, the School of Economics of China Ocean University and the party school of municipal Party committee of Zhoushan are the main forces in the field of marine city research. The scientific research institutions in the picture are relatively scattered, and the lack of a close academic community has become one of the weaknesses of marine city research. How to break the research pattern of marine city fragmentation and strengthen academic exchanges and cooperation in the field of marine city is an urgent problem to be solved in promoting the promotion of marine city.

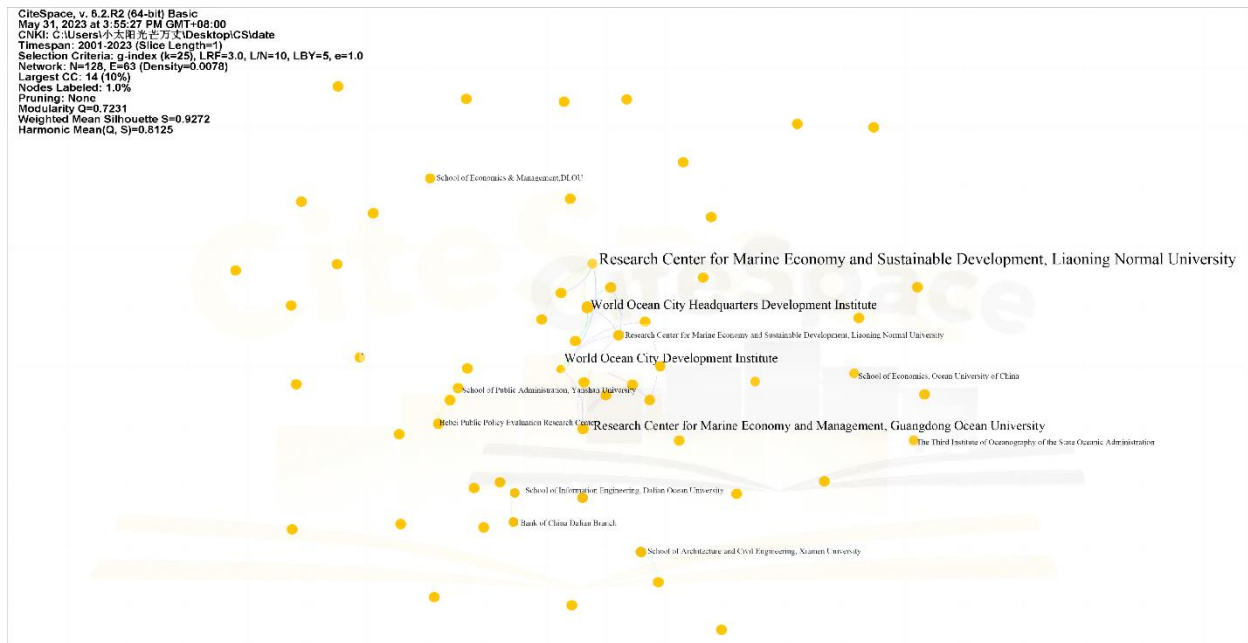


Figure 3. Cooperation network of marine city research institutions

### 3.4 Keyword Co-occurrence Analysis

The key word is to emphasize and highly summarize the core content of scientific literature (Zhang et al., 2017). The sorting and analysis of the key words in the relevant literature of marine cities will help to explore the research hotspots in this field. This study uses CiteSpace to integrate the key words contained in 146 documents related to marine cities, forming a knowledge map of key words co-occurrence in marine city research (see Figure 4), which represents the hot topic of domestic marine cities in a panoramic way. The keyword co-occurrence analysis map has 248 keyword nodes and 481 connections formed by these nodes, with a network density of 0.0157. Among them, the largest node is "marine central city", followed by "global marine central city" and "marine city". Other research keywords are scattered around these three keywords in all directions. Through reading the literature analysis related to the important nodes, it is found that "global marine central city" is an academic hotspot in recent years. In addition, several key words with high influence in other fields of marine cities can be obtained by using the software: "Marine Power", "Marine Industry", "Zhoushan", etc. The research disciplines are mostly basic and policy research of social sciences. "List of key tasks for building a strong marine province in 2020" proposed that Zhejiang Province will work towards the goal of "building a global marine central city" in 2020, and Ningbo-Zhoushan has respectively launched and promoted the planning and construction of a global marine center city. At present, in addition to Ningbo, there are eight coastal cities in China that have explicitly proposed to build a global marine center city, indicating that there is a correlation between academic research on marine cities and current domestic policies.

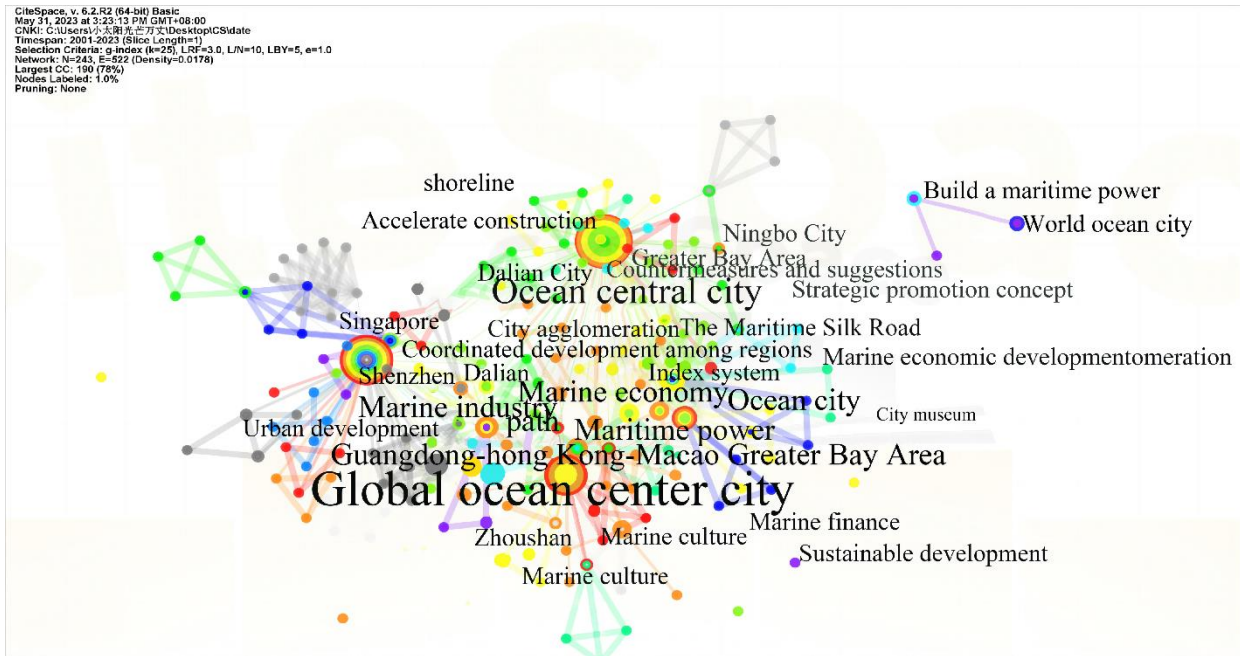


Figure 4. Keyword co-occurrence analysis

3.5 Keyword Co-occurrence Cluster Analysis

In order to better understand the keyword clustering, and then grasp the research hotspots, a cluster map of marine city keyword co-occurrence is drawn (Figure 5). As shown in Figure 5, the key words co-occurrence cluster map of marine cities has generated 236 nodes, 430 lines and 5 typical clusters, with a network density of 0.0155, where the module value (Modularity Q=0.7528) is greater than 0.3, and the average contour value (Mean Silhouette S=0.9823) is greater than 0.7, indicating that the concentration and overlap of the keywords obtained are high, and the clustering results are highly reliable. According to the clustering results, relevant research on marine cities mainly focuses on the following aspects: "Marine Central Cities", "Global Marine Central Cities", "Marine Cities" and "Marine Industry". The concept of "global maritime center city" was translated from "the world's leading maritime capital" by Chinese researchers. The proposal of this concept has aroused the attention of academic and practical fields in China. Niu (2021) believes that global marine central cities are cities with strong foundation for shipping development, and are in an absolute leading position in global marine economic development, marine scientific and technological innovation and marine professional services. With their strong urban comprehensive strength and excellent business environment, they have strong concentration, radiation and dominance in the global urban network. The 13th Five-Year Plan for National Marine Economic Development first proposed to build a marine central city, and then nine cities, including Shenzhen, Shanghai, Guangzhou, Tianjin, Ningbo, Zhoushan, Dalian, Xiamen and Qingdao, successively proposed to build a global marine central city, which further attracted more and more attention from the academic community. From the overall development trend of marine cities, it can be seen that building a global marine central city is an advanced state of marine city development. As the main position for the development of marine industry, the urban development spatial pattern formed by the interaction of land and sea economy has the function of improving the urban scale effect, and bringing the urbanization level of coastal areas to a new height (Di et al., 2015).

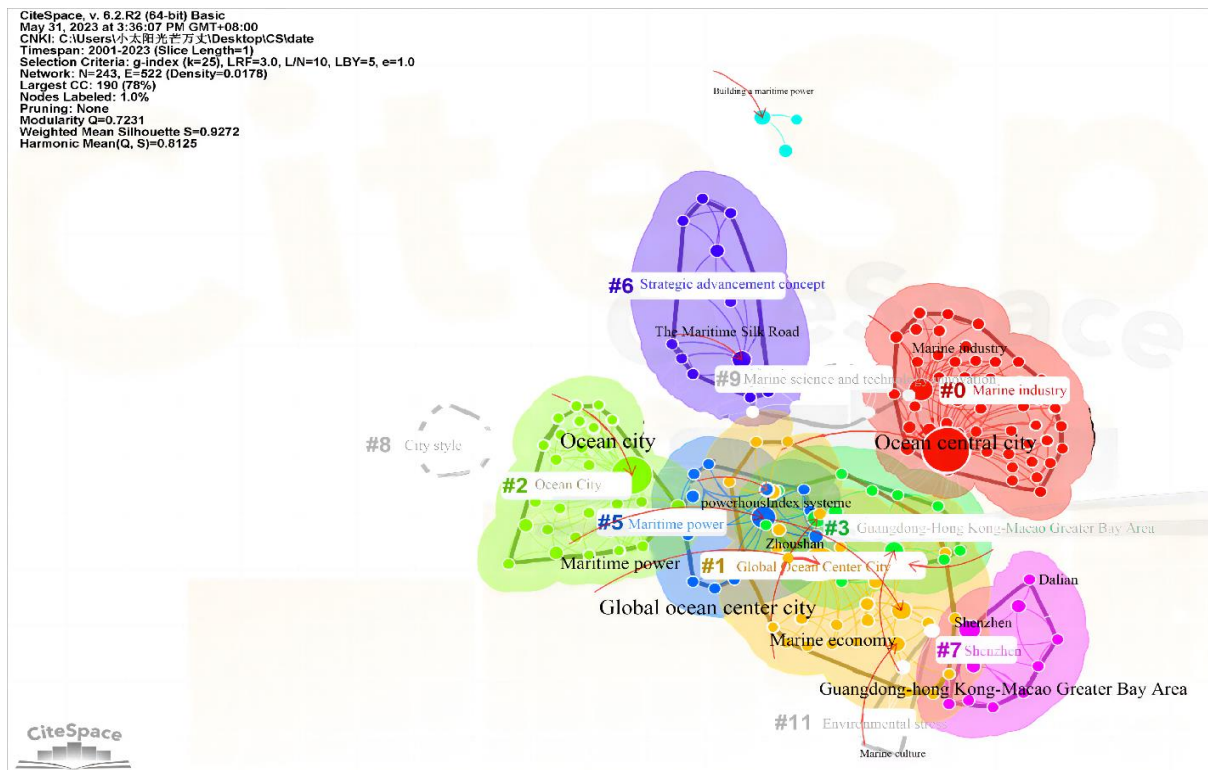


Figure 5. Keyword co-occurrence cluster analysis

### 3.6 Keyword Emergence Cluster Analysis

A graph is formed by clustering of keyword emergence (Figure 6), which reflects the research frontiers in different time periods. In Figure 6, Year indicates the year when the research in the field of marine cities started; Strength indicates the intensity, the greater the intensity of a keyword, the more it appears in a certain period of time; Begin and End indicate the time when the keyword appears and disappears, respectively. According to the keyword emergence time axis, the largest emergence intensity is marine central city (Cluster Intensity 5.29), based on the analysis of the keyword characteristics of "marine city", a research hotspot and its close co-occurrence, the characteristics of the frontier hot topics of marine city-related research are very obvious. With the establishment of global ocean center cities, the fever of ocean center cities has continued since 2019, indicating that Chinese scholars have been comprehensively elaborating the connotation of global ocean center cities, summarizing the characteristics and experience of global ocean center cities and construction strategies. Jinping Xi emphasized the need to improve the capacity of ocean development, expand the field of ocean development, and make the ocean economy a new growth point (Zeng, 2013). Liu et al. (2012) proposed that charming ocean city construction is an important way to establish a sustainable ocean city development model. The construction of global marine center cities can help promote the high-quality development of marine economy and drive the economic growth of coastal regions, which is an important measure to build China into a maritime power and the "21st century maritime silk road"(Huang and Li, 2023). In addition, in the context of regional economic integration, China has conceived the Guangdong-Hong Kong-Macao Greater Bay Area as a national strategy under the vision of regional economic cooperation, which has received wide attention from academics and become a hot spot of current research. Marine industry is an important part of the industrial system of coastal countries. The continuous development of the marine economy in Guangdong-Hong Kong-Macao Greater Bay Area makes the marine new industries grow, which is conducive to the structural adjustment of the marine industry and the rational layout of the marine industry, while the contribution of the marine economy to the regional national economy increases year by year. From the perspective of the purpose of development, the ocean provides development drivers, ultimately to enhance the comprehensive strength of the city and benefit the economy and society in all aspects.

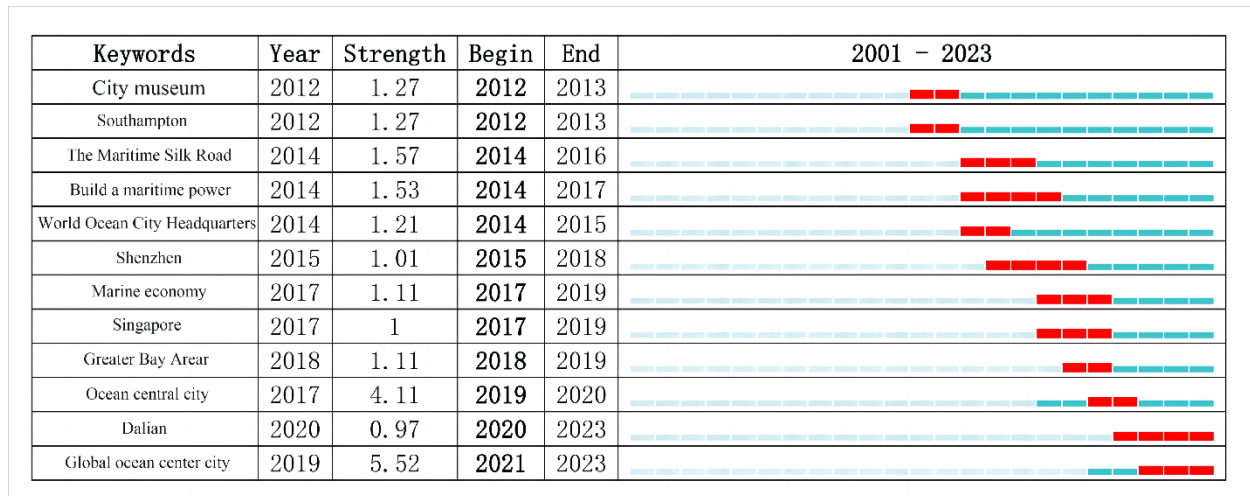


Figure 6. Keyword with the strongest citation

#### 4. Conclusion and Prospect

##### 4.1 Research Conclusion

By using CiteSpace software, this study systematically sorted out the research evolution and research hotspots of domestic marine cities, and on the basis of clarifying the development characteristics and context of marine cities, the following conclusions were reached.

Firstly, from 2012 to 2022, the study of marine cities presented three stages of development. At the initial stage, the CPC Central Committee proposed for the first time to "build China into a maritime power". Creating a marine city is not the main idea, and the development trend of the study is slow; In the medium term, with the introduction of the concept of "global marine center city", the number of documents issued increased; In the later stage, the research on marine cities that benefited from the impact of policies showed a high growth, indicating that the research on marine cities has a positive policy impact effect.

Secondly, although there is a certain degree of cooperation among various scholars and research institutions in academia concerning marine city research, they have not yet formed an academic community with extensive and close communication, which indicates the weak phenomenon of cooperation trend among marine city researchers and institutions, and there are obvious weaknesses of cooperation in research.

Thirdly, the keyword co-occurrence analysis shows the hot spot of marine city research, and the exploration of experience and its construction in the issue of building marine central cities, the essence of which still lies in the realization of "build China into a maritime power". The construction of marine center cities is conducive to promoting the development of land and sea integration, improving the level of openness to the outside world, and even driving the overall national economic development, which is an important task for the development of "blue economy" in China.

Fourth, the research frontiers of marine cities mainly focus on global marine central cities. The global marine central cities have better demonstrated the comprehensive capabilities of modern cities, and have multiple functions of global cities, marine cities and central cities. Accelerate the construction of global marine central cities such as Shanghai, Qingdao, Shenzhen and Guangzhou, build a highland for scientific and technological innovation in the marine industry, improve China's global marine governance capacity, and provide leading support for achieving the goals of "marine power" and "21st Century Maritime Silk Road".

##### 4.2 Research Prospects

At present, although the research of marine cities in China has made phased progress, there are still many problems. With the continuous promotion of the "Marine Power" and the "21st Century Maritime Silk Road", in view of the fact that many cities in China have proposed to build a global marine central city one after another, the study of marine central cities is also increasingly urgent. Therefore, there is still a huge development space for the study of marine cities.

Firstly, improve the relevance of academic cooperation. Based on the current situation that the authors and institutions of marine cities are not close enough, increasing the cooperation modes of scholars, disciplines and



research institutions, and improving the operation mechanism among the three can effectively promote the sharing of resources, deepen the research content of marine cities, and provide a basis for cooperation in building the institutional system of marine cities.

Secondly, expand the research field. In terms of interdisciplinary disciplines, the development of scientific research depends on the integration and integration of disciplines (Cao et al., 2020). The research and development of marine urban land covers a wide range. At present, most of the research focuses on marine economy and marine ecology, mixed with marine planning, marine scientific and technological innovation, maritime services, culture and tourism, and the research heat is on the rise. Therefore, more attention should be paid to comprehensive research of disciplines.

Thirdly, strengthen the empirical research of marine central cities. The existing academic literature has a detailed discussion on the basic theory, background, connotation and measures of marine central cities, but the empirical research needs to be strengthened. Select typical cities with different levels, scales and characteristics to carry out empirical research. According to the research content and the current actual situation of China, improve the relevant indicator system, definitions and standards of marine central cities.

Fourth, as the three global frontiers of ocean, space and Brain-inspired Intelligence, the future research of marine cities is in a great situation and developing fast. Marine city research following the national ocean power strategy has been in a dynamic evolutionary process, which will be influenced by the policy and evolve. In the future research process, we should focus on the actual development status of each domestic coastal city to start, take the strengths and complement the weaknesses, and develop a framework for the construction of conditions that meet the construction of local marine center cities.

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