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# Hot spots, evolutionary trends, and future prospects for the sustainable development of the marine economy in the past 30 years: a comparative bibliometric analysis based on CiteSpace

Hui Zheng<sup>1,2\*</sup> and Yong Wang<sup>1</sup>

## Abstract

How to assess the quality of sustainable development is an important issue for the marine economy. This study examined studies on sustainable development of marine economy over the past 30 years using core databases from China National Knowledge Infrastructure and Web of Science. This study introduced bibliometric analysis methods and CiteSpace software to track and comparatively analyze the hotspots of studies from 1994 to 2023. This study showed that (1) the research on sustainable development of the marine economy has achieved extensive results. Researchers have already collaborated with those in China. (2) Hotspots for Chinese research are mainly focused on building an indicator system of marine economy's sustainable development, realizing the path of sustainable development of regional marine economy, and planning the sustainable development goals of specific marine industries. In contrast, other countries focus on protecting marine ecology and identifying the path of sustainable development of the marine industry. (3) Strengthening exchange and cooperation between institutions and scholars from various countries, and further studies on the micro-paths of blue carbon sinks, marine ecological civilization and high-quality development, low-carbon development of marine industries will become new hotspots for research.

**Keywords** Marine economy, Sustainable development, CiteSpace, Knowledge map

## 1 Introduction

Since the 1990s, the world economy has grown rapidly, and the marine economy has become a new growth point for regional economic development (Zhong, 2021). In May 2001, the United Nations treaty document stated that 'the twenty-first century is the century of the sea.' Nearly 60% of the world's total economic output is

contributed by the coastal ports and their hinterlands of the world's economies. In this process, the level of human development and use of the ocean is constantly improving, and problems such as marine environmental pollution and overexploitation of marine resources are persistent (Zhang et al., 2020). In 2015, the United Nations General Assembly's seventh session adopted the '2030 Agenda for Sustainable Development', which urges all countries to achieve several sustainable development goals, including 'protecting and sustainable use of the oceans and marine resources to promote sustainable development'. The 2022 World Summit on Sustainable Development and the 2012 Rio + 20 Summit further advanced sustainable development into global action.

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With the global understanding of the concept of sustainable development and the clear practice of the world's marine economy, researchers have extensively studied sustainable development of the marine economy and created a knowledge graph and research system in its dynamic development process.

Among these, addressing the problems in the development of the marine economy, finding a scientific sustainable development plan, and promoting the healthy development of the marine economy have received much academic attention (Zhu, 2021). Due to time constraints or limited analytical perspectives, earlier studies failed to fully extract the experience, achievements, and contributions of research on the sustainable development of the marine economy and lacked exploration and prospects for new trends. This study quantifies and highlights the literature on the sustainable development of the marine economy since 1994 and comprehensively classifies the thematic lineage, characteristic evolution, hotspot tracking, and trend outlook of the studies from a qualitative perspective to provide a useful reference for future research on the promotion of the high-quality development of the marine economy.

## 2 Data source collection

The World Commission on Environment and Development defines sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. It is an integrated and dynamic concept involving economy, society, culture, technology, and natural environment. The fundamental purpose of sustainable development of the marine economy is to support the development of the national economy and society and continuously contribute to building a strong marine economy. Accordingly, we gathered articles from the Chinese Social Science Citation Index Database and Web of Science Core Collection Database with topics on 'marine economy sustainable', 'marine economy sustainability', 'ocean economy sustainable', and 'ocean economy sustainability'. In 1994, China's State Council adopted the 'China 21 Century Agenda', which laid out the overall strategic framework for China's sustainable development; therefore, the publication year is limited to 1994–2023. Excluding invalid data such as low relevance to the topic, journal, conference call for papers, volume headings, introduction of personal academic achievements, book reviews, missing author details, and duplicates, we finally obtained 1186 articles, in which 366 articles were from CNKI and 232 articles from WOS. The articles examined in this study is closely related to sustainable development. It presents a macroscopic view of the studies on

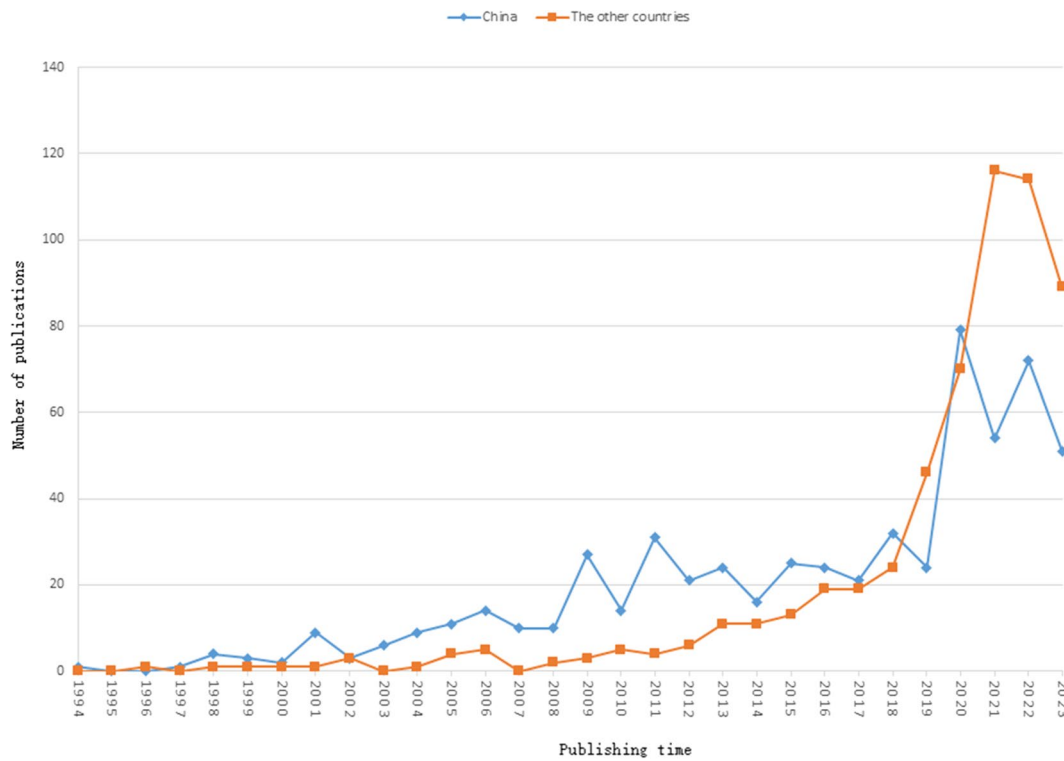
sustainable development of marine economy for China and other countries.

### 2.1 The annual trend of publications

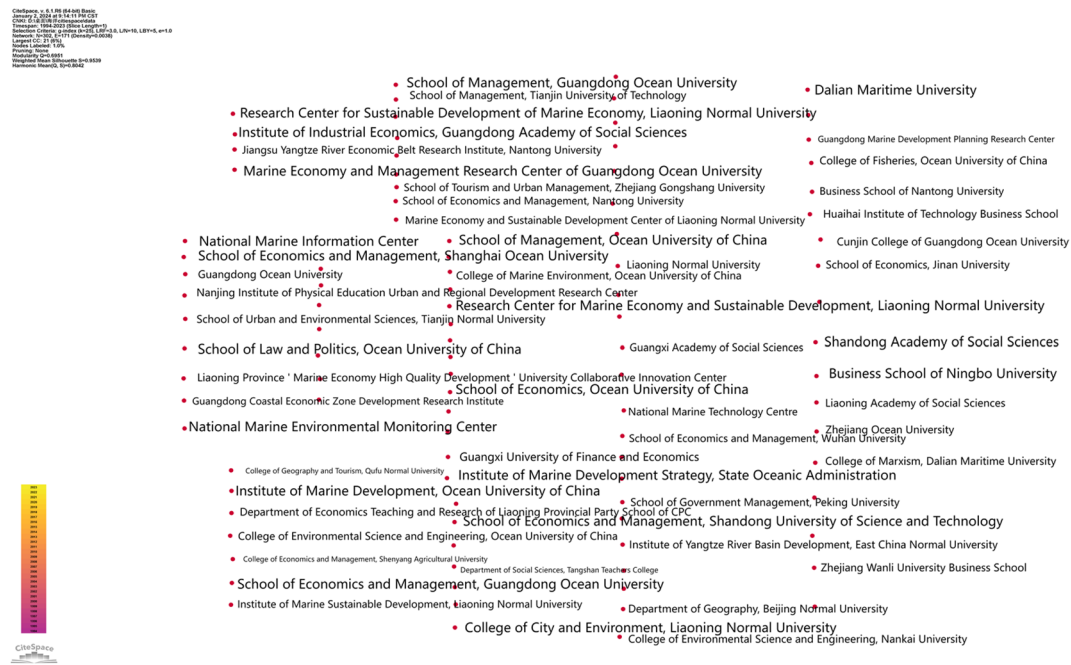
Figure 1 shows the distribution of annual research publications. Little relevant literature was published before 2000, and the number of publications fluctuated between 2000 and 2012. China's Ocean Agenda 21 was proposed in 1996 as a strategy for sustainable development of its ocean industry. In 2003, the National Ocean Economy Development Planning Outline emphasized the need to strengthen the coordination, management, and support of ocean economy development planning. In 1992, the United Nations Conference on Environment and Development adopted Agenda 21. In 1994, the 49th General Assembly of the United Nations declared 1998 the International Year of the Ocean to highlight the importance of oceans, marine environment, marine resources, and sustainable development to the world. After 2012, the number of studies fluctuated steadily, and the annual number of published articles remained relatively flat in China, while those published in other countries increased rapidly and far exceeded that of China. In 2012 the United Nations Conference on Sustainable Development was held in Rio de Janeiro. It proposed the concept of a blue economy focused on marine sustainable development. Since then, sustainable development of marine economy has been hotly debated. Similarly, the 2017 'Sustainable Development Goals Report' proposed by the United Nations has drawn broader attention to this topic.

### 2.2 Major research institutions

CiteSpace software was used for statistical analysis of the institutions publishing literature on the cooperation between research institutions and their contribution to the sustainable development of marine economy (Figs. 2, 3 and 4). Figure 2 shows 302 nodes, 171 connections, and a network density of 0.0038. Figure 3 shows 186 nodes, 259 connections, and a network density of 0.0151. Figure 4 shows 366 nodes, 647 connections, and a network density of 0.0097. The larger font size of the research institution's name in the graph indicates how often the institution has published articles. A combination of the map and frequency table of publishing institutions (Table 3 in Appendix 1) shows that Liaoning Normal University and University of Tasmania have the highest number of publications; however, their research directions are varied. For example, the Research Center for Marine Economy and Sustainable Development of Liaoning Normal University and the School of Economics of Ocean University of China are both outstanding in marine economy research. Their research is conducted



**Fig. 1** Annual number of publications on research on the sustainable development of the marine economy (1994–2023)



**Fig. 2** Map of institutions that publish research on sustainable development of the marine economy in China (Data from CNKI)

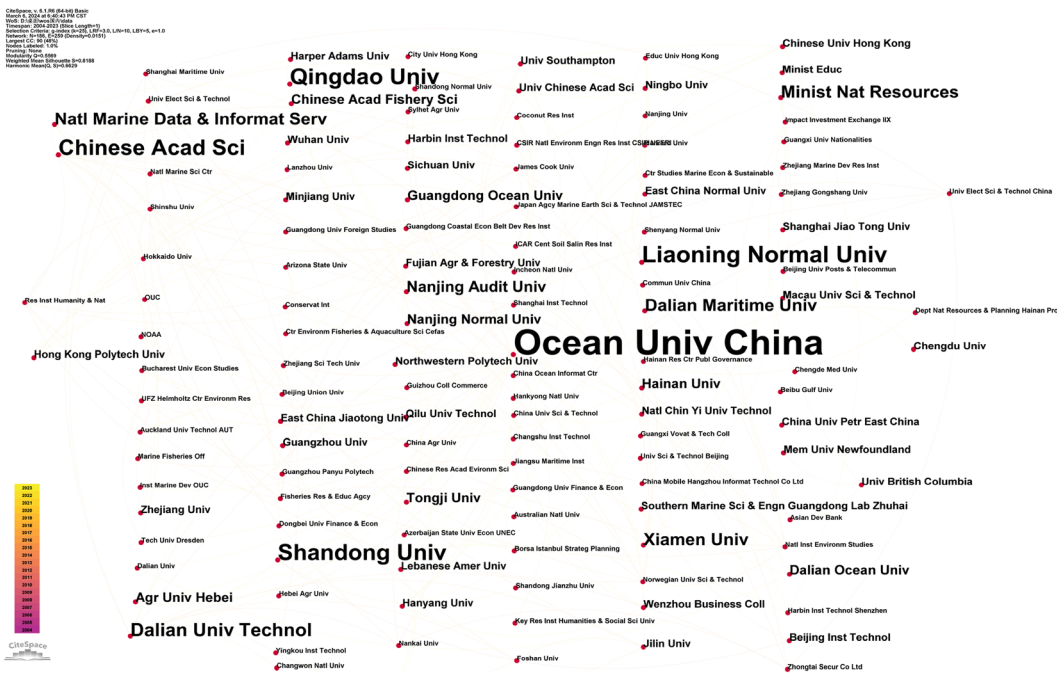


Fig. 3 Map of institutions that publish research on sustainable development of the marine economy in China (Data from WOS)



Fig. 4 Map of research institutions on sustainable development of the marine economy in other countries

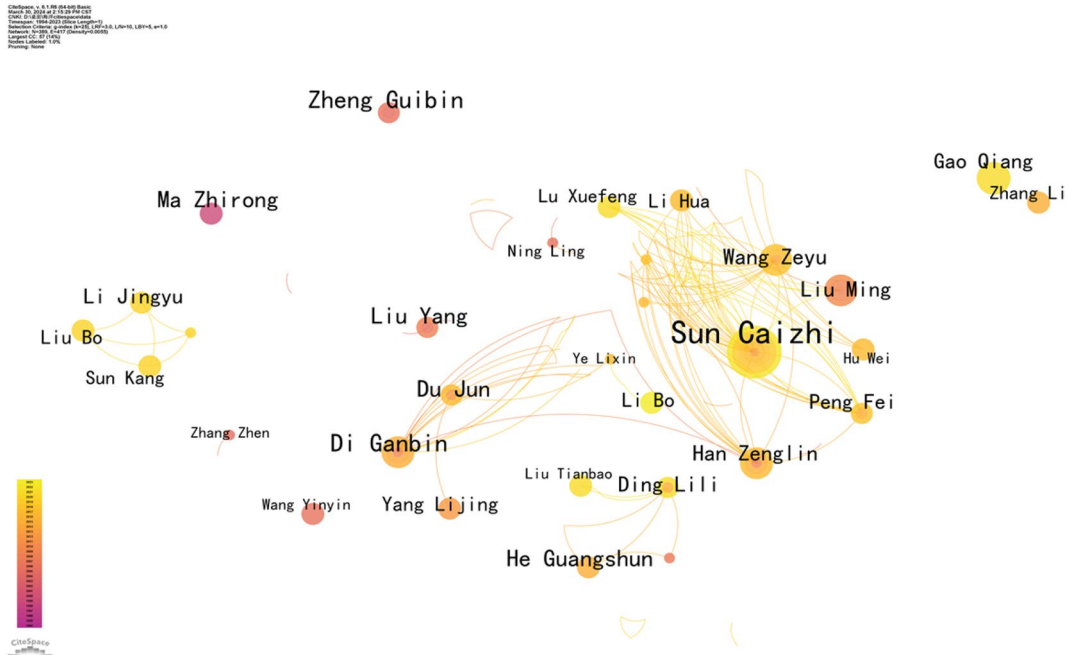
mainly from the economic development or industrial transformation perspective. The Institute of Marine Development Strategy of the State Oceanic Administration focuses on the perspectives of legislation, management, and development planning. The University of

Tasmania and the University of British Columbia both have the geographical advantages of the sea and contribute high-quality scientific research results in the areas of marine environmental science, marine green development science, and technology.

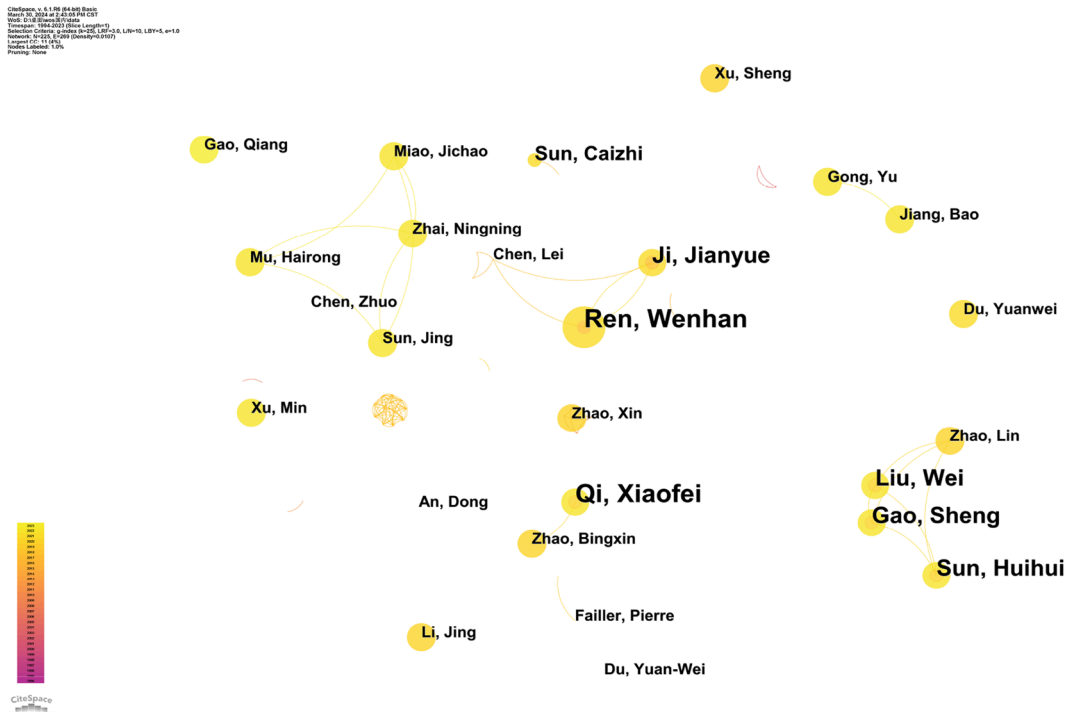
### 2.3 Analysis of authors

Author co-occurrence analysis is used to identify the core authors of a discipline or field and their intensity

of cooperation and mutual citation (Figs. 5, 6 and 7). The larger the nodes in the map, the more frequently the authors appeared. Figure 5 shows 389 nodes, 417

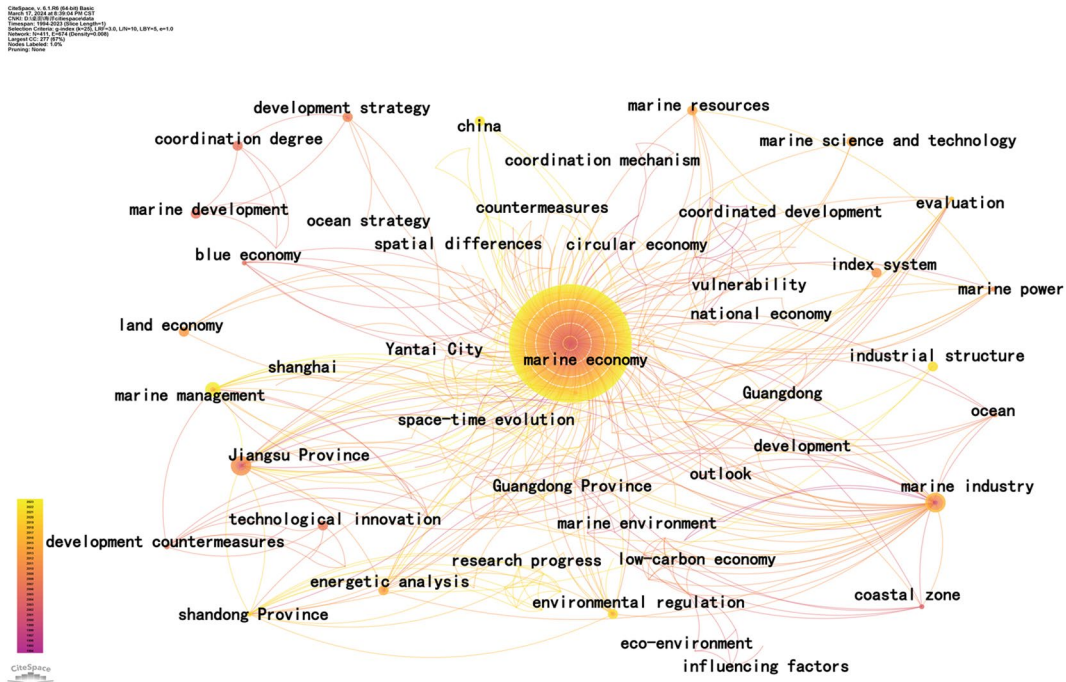


**Fig. 5** Map of authors of published articles in China on sustainable development of the marine economy (Data from CNKI)

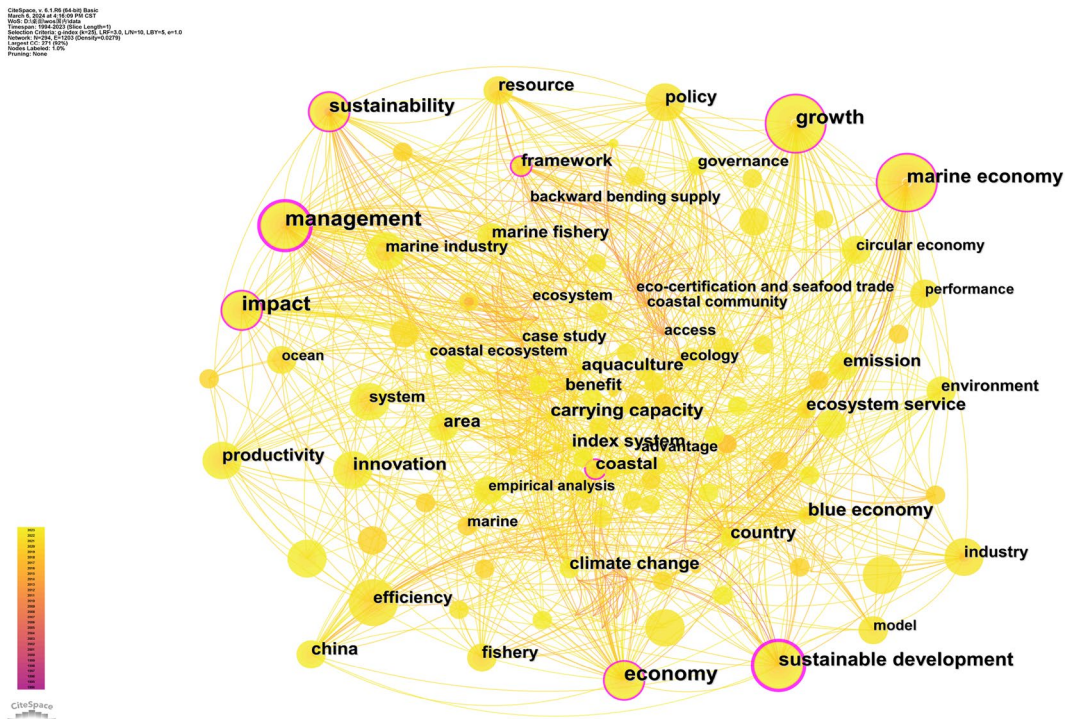


**Fig. 6** Map of authors of published articles in China on sustainable development of the marine economy (Data from WOS)





**Fig. 8** Keyword co-occurrence map of research on sustainable development of the marine economy in China (Data from CNKI)



**Fig. 9** Keyword co-occurrence map of research on sustainable development of the marine economy in China (Data from WOS)

**Table 1** Keywords for research on sustainable development of the marine economy (frequency  $\geq 8$ )

Serial number	Keywords	Frequency	Year of first appearance	Centrality
1	marine economy	222	2000	0.14
2	sustainable development	46	2004	0.20
3	marine industry	33	2000	0.05
4	management	26	2012	0.33
5	growth	25	2020	0.11
6	impact	23	2015	0.14
7	marine resources	22	2000	0.04
8	economy	17	2015	0.17
9	efficiency	17	2015	0.06
10	China	15	2009	0.07
11	sustainability	15	2012	0.13
12	innovation	12	2020	0.07
13	system	12	2020	0.03
14	indicator system	11	2003	0.01
15	marine power	10	2006	0.07
16	marine environment	10	2001	0.05
17	influencing factors	10	2008	0.03
18	ocean	10	1999	0.04
19	industry	10	2018	0.03
20	policy	10	2020	0.06
21	climate change	10	2018	0.03
22	coastal	9	2017	0.12
23	area	9	2019	0.15
24	productivity	9	2020	0.05
25	blue economy	9	2020	0.04
26	industrial structure	8	2001	0.01
27	coastal zone	8	2005	0.02
28	framework	8	2015	0.10
29	fishery	8	2018	0.10
30	ecosystem service	8	2017	0.08
31	resource	8	2012	0.08

research on the sustainable development goal planning of the marine industry. For example, from the industrial agglomeration and marine carbon perspectives, the study discusses the development direction of fisheries, marine manufacturing, and other marine industries in the context of sustainable development (Han et al., 2022; Ji et al., 2023; Xu et al., 2020).

Figure 10 shows 500 nodes and 2409 connections in research keyword co-occurrence map, with the network density of 0.0193. The key nodes are 'management', 'blue economy' and 'sustainable development'. Combined with the keywords in Table 2, we find that the hotspots of the existing research on the sustainable development of the marine economy focus on the protection of marine ecology and the path of sustainable development of the marine industry. The three keyword nodes with the highest betweenness centrality are management (0.15), impact

(0.15), and fishery (0.15). Tahazzud proposed strategic measures for developing Canadian ports to achieve the goal of balancing economic growth, social development, and environmental protection. The 'measures' include sustainability as a key principle in port operations, aiming to achieve the goal of improving environmental quality in the operations of Canadian ports and maintaining competitiveness in the global shipping supply chain (Hossain et al., 2019); Al-Masroori used an improved ecologically sustainable development framework to assess the long-term progress of fisheries in Oman in terms of sustainable development. The study results can be used to guide the evaluation of sustainable development of fisheries in other regions (Al-Masroori & Bose, 2021); Kronfeld-Goharani discussed the implementation of sustainable development strategies by companies investing in marine economy. The study highlights that companies' efforts,





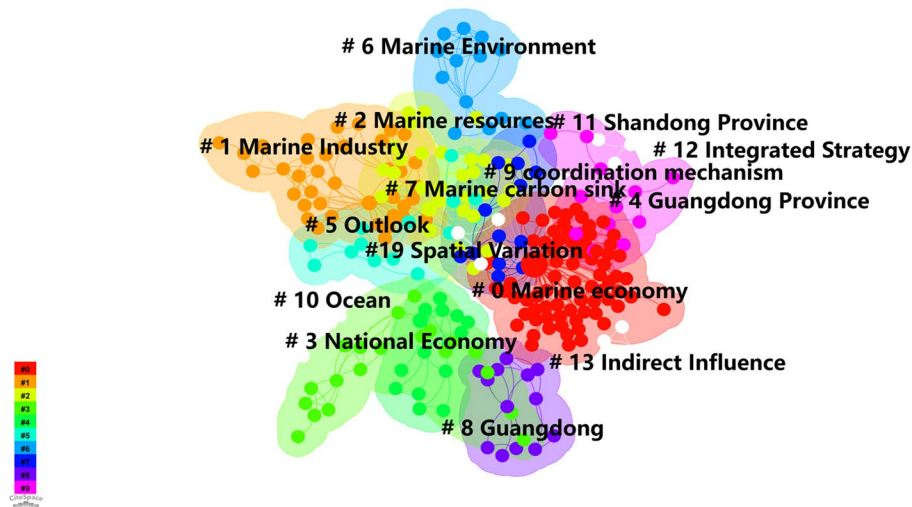
**Table 2** Keywords of research on sustainable development of marine economy in other countries (frequency  $\geq 15$ )

Serial number	Keywords	Frequency	Year of first appearance	Centrality
1	blue economy	114	2015	0.08
2	management	105	2002	0.15
3	impact	71	2005	0.15
4	fishery	55	2005	0.15
5	climate change	55	2008	0.12
6	sustainability	54	2009	0.10
7	conservation	48	2005	0.13
8	circular economy	47	2018	0.03
9	sustainable development	46	2010	0.07
10	growth	46	1999	0.07
11	ocean	37	2017	0.03
12	marine	36	2011	0.05
13	ecosystem service	35	2017	0.03
14	governance	35	2012	0.05
15	framework	30	2006	0.03
16	coastal	29	2010	0.06
17	biodiversity	24	2013	0.05
18	aquaculture	24	2006	0.10
19	marine protected area	23	2005	0.11
20	sea	23	2011	0.05
21	ocean governance	22	2018	0.02
22	blue growth	22	2017	0.02
23	protected area	20	2015	0.02
24	challenge	18	2016	0.05
25	marine spatial planning	18	2011	0.10
26	system	18	2005	0.02
27	economy	18	2015	0.02
28	fish	17	2014	0.06
29	small scale fishery	16	2018	0.01
30	performance	15	2017	0.02
31	science	15	2005	0.01
32	policy	15	2019	0.02

on regional differences, spatial agglomeration, spatial and temporal evolution, and the evolution of industrial structure (Li et al., 2022). Optimization, transformation, and upgrading of marine industries should be based on the use of marine resources and its comparative advantages (Zhao et al., 2022). Cluster #2 is titled 'Marine resources' and includes keywords such as marine resources, influencing factors, industrial structure, marine strategy, marine science, and technology. This cluster reflects the current situation and protection of marine resources, which is a key objective in the research of sustainable development of the marine economy. Resource and environmental problems arising from the process of marine economic development is increasingly attracting attention. Coordinated

development of the marine economy and resource environment should be addressed for the healthy development of the marine economy (Liu et al., 2020). Cluster #7 is titled 'Marine carbon sink' and includes keywords such as blue economy, green low carbon, offshore wind power, and energy transition. This cluster shows that ocean carbon sink is a new hotspot in the research of sustainable development of marine economy in China. The ocean is the largest carbon reservoir on the earth. To achieve the strategic goal of 'peaking carbon dioxide emissions and achieving carbon neutrality', some key methods include promoting the construction of marine carbon sinks, adjusting the development structure of marine industry (Wang et al., 2021), increasing the scientific and technological

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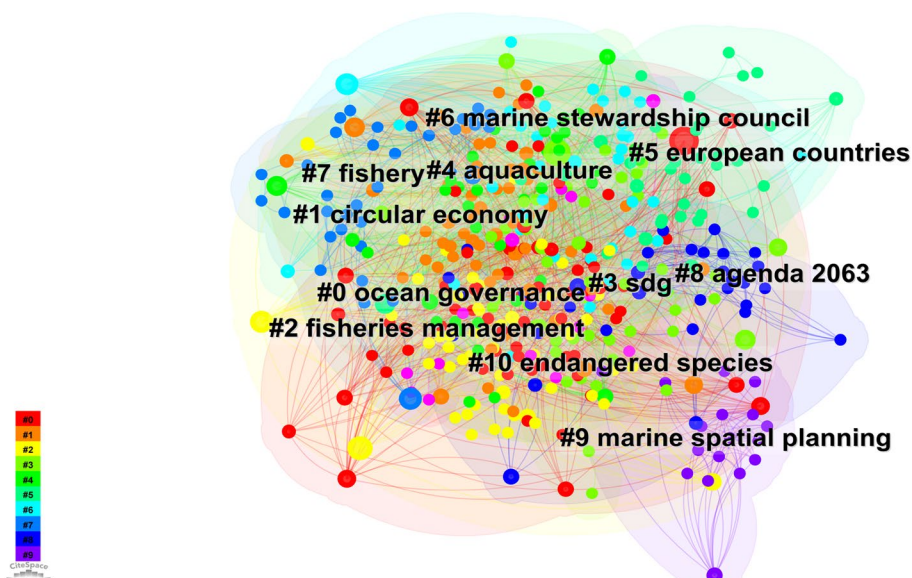


**Fig. 11** Clustering mapping of keywords for research on sustainable development of the marine economy in China

research of marine low-carbon technology, vigorously developing the marine renewable energy resource industry, promoting the low-carbon transformation of marine economy, accelerating the construction of an efficient blue carbon system for marine economic development, and improving the level of intensive, economical and sustainable development of marine economy (Tan, 2022; Wang, 2022).

Figure 12 shows the keyword clustering map of research from other countries. The clustering Modularity Q of the research keyword clustering map in other countries is 0.4707, and the weighted mean silhouette S is 0.7631; therefore, the clustering results are significant and the conclusions credible. Clusters 5, 6, 8, and 10 are not directly related to this study. The keywords contained in cluster 2 ‘fisheries management’ and cluster 4

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 Modularity Q: 0.4707  
 Weighted Mean Silhouette S: 0.7631  
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**Fig. 12** Clustering map of keywords for research on sustainable development of marine economy in other countries

‘aquaculture’ are repeatedly reflected in clusters 7. We, therefore, do not discuss this issue further.

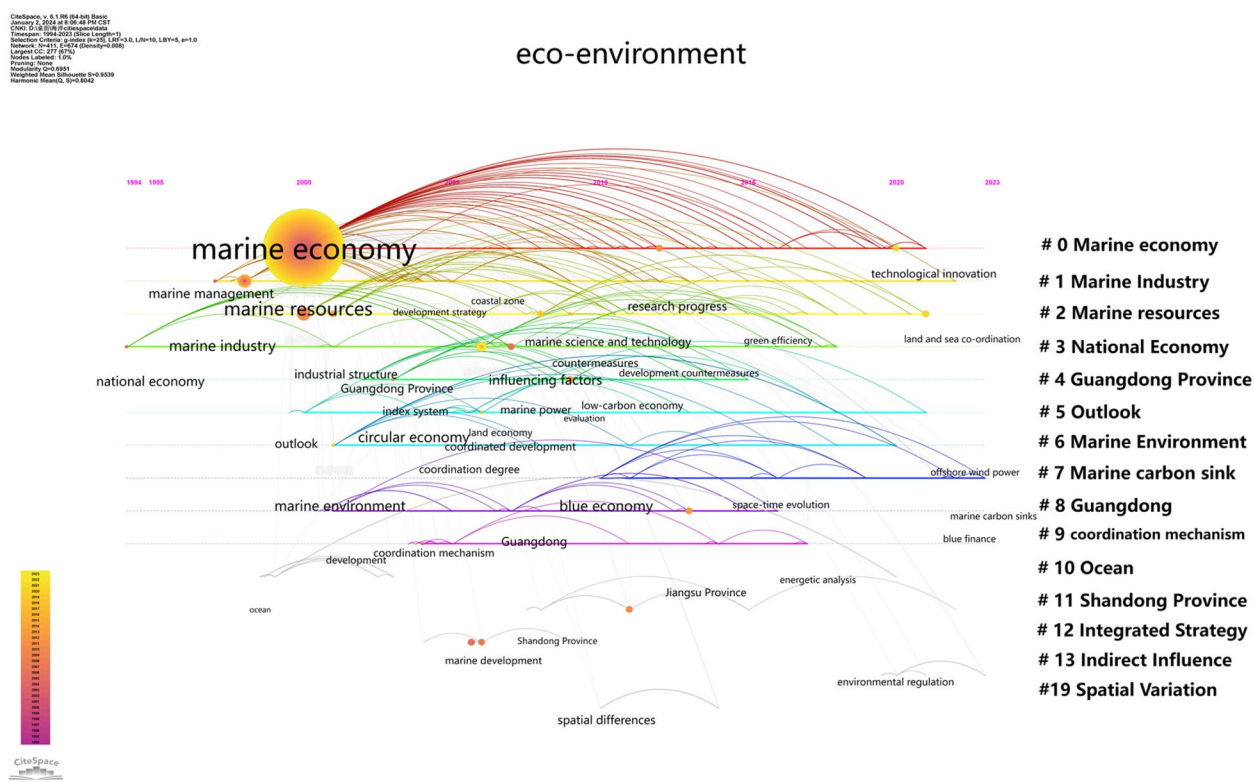
Cluster #0 is titled ‘ocean governance’ and includes keywords such as blue growth, ocean economy, and sustainable development goals. The studies cover various aspects, such as the definition of a blue economy, building a blue economy to achieve sustainable development goals, the importance of healthy oceans for present and future generations, and saving oceans (Lee et al., 2021). Cluster #1 is titled ‘circular economy’ and includes keywords such as circular economy, plastic pollution, sustainable development, and economic complexity, indicating that circular economy is one of the research focuses (Black et al., 2019). Cluster #3 is titled ‘sdg’ (Sustainable Development Goals), and includes keywords such as marine policy, blue carbon, and ocean governance. Most studies on ocean sustainable development are associated with other disciplines to analyze how other industries can contribute to the sustainable development of marine economy, such as examining the impact of the digital economy, financial policy, and various marine industries on marine low-carbon and carbon trading (Ding et al., 2018, 2021). Cluster #7 is titled ‘fishery’ and includes keywords such as management, governance, and marine resources. Studies have mainly focused on marine fisheries, including

development dilemmas, measurement of policy subsidies, fishery ecosystem planning (Cisneros-Montemayor et al., 2022), and comparison and suggestions for fishery development in other regions (Kyvelou et al., 2023). Cluster #9 is titled ‘marine spatial planning’ and includes keywords such as ecosystem services, ecological principles, marine spatial planning, and biodiversity. Studies on marine spatial planning mainly focus on evaluating the applicability of marine spatial planning methods, providing innovations based on practical conclusions, exploring the path of rationally organizing human activities in terms of marine space (Madarcos et al., 2022), and seeking balanced regional development and healthy marine environment.

### 4 Research and evolutionary trends

The CiteSpace timeline map for keyword clustering uses time as a dimension and connection to establish the inheritance relationship between nodes. By combining the keyword timeline map and the keyword burst map, we can better understand the change process of keywords and the evolution law of hotspots.

In Figs. 13, 14, 15 and 16, keywords appear more frequently during 2000–2010, including marine environment, coordinated development, circular economy,



**Fig. 13** Keyword timeline map of research on sustainable development of the marine economy in China (Data from CNKI)

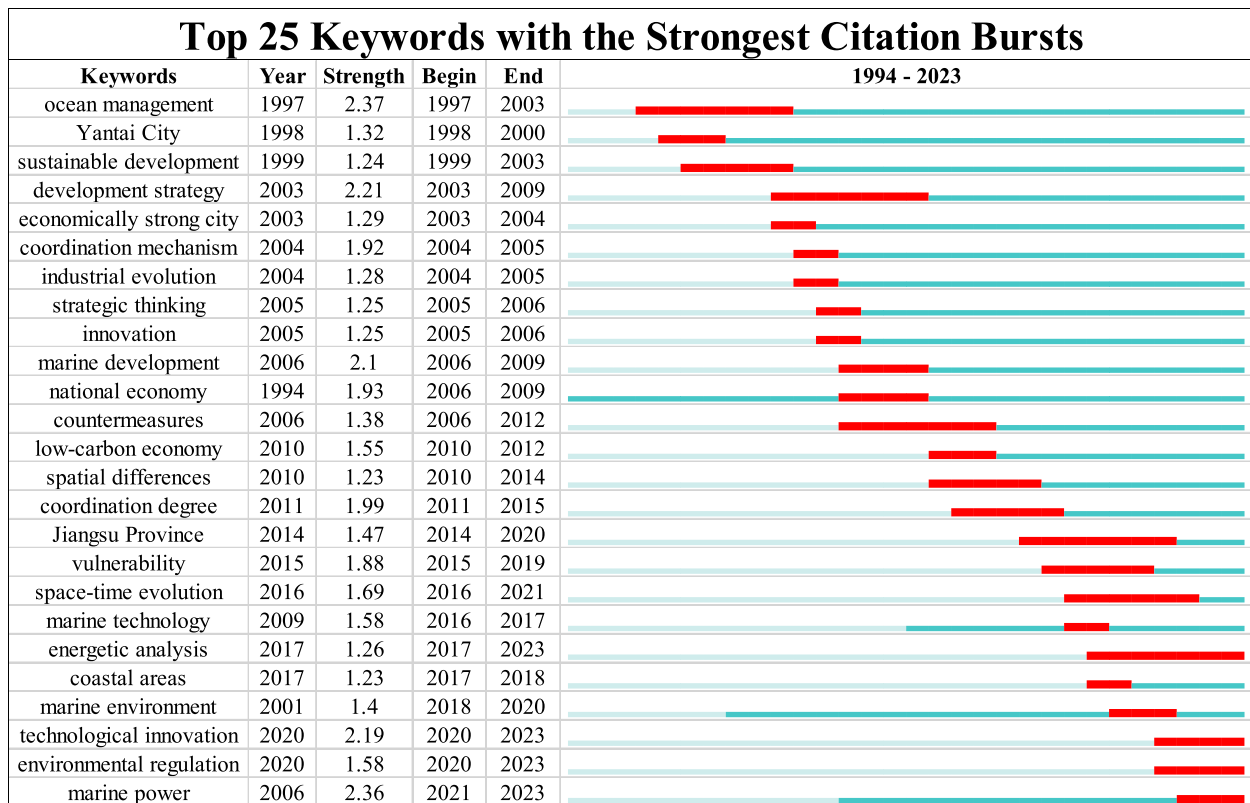


Fig. 14 Keyword burst map of research on sustainable development of marine economy in China (Data from CNKI)

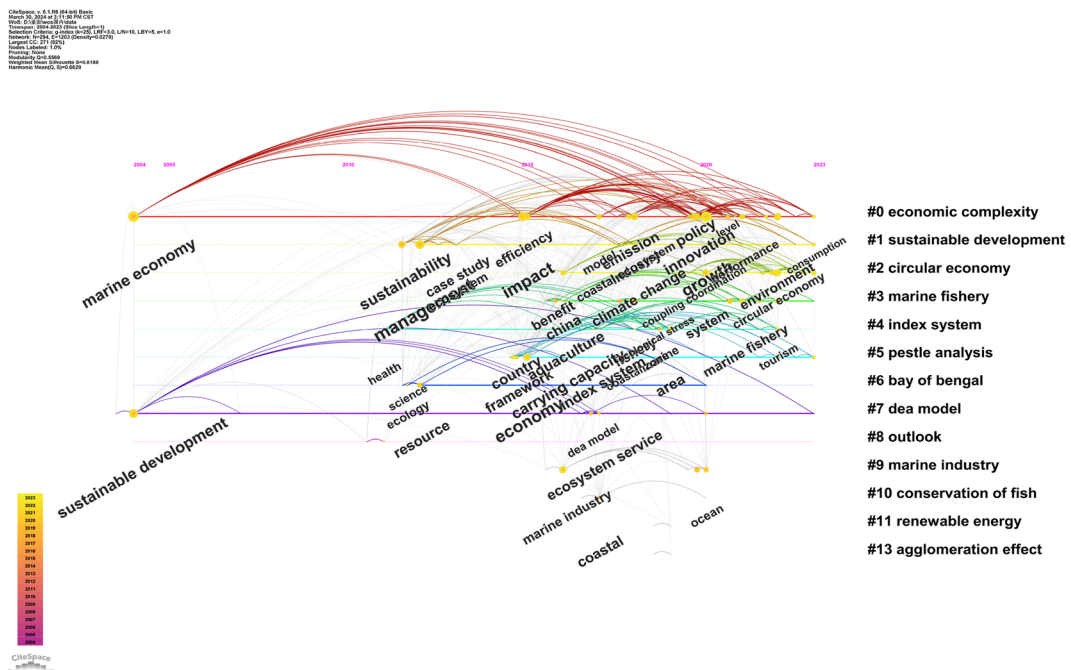
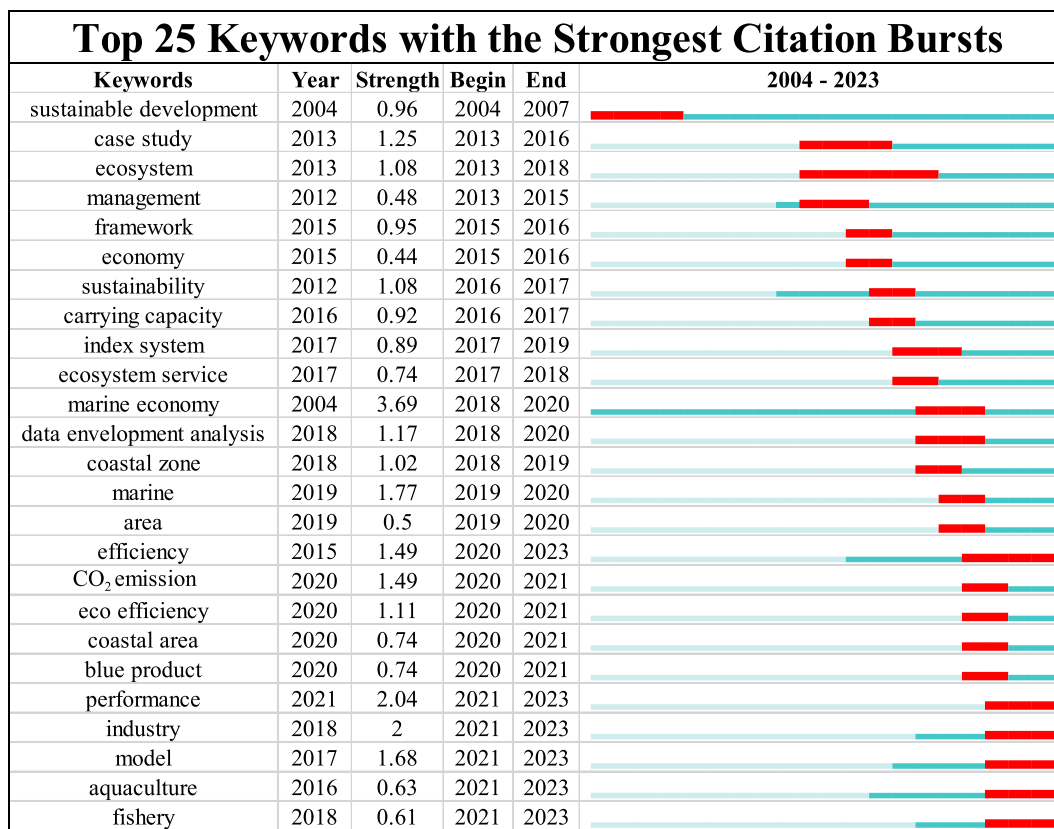


Fig. 15 Keyword timeline map of research on sustainable development of the marine economy in China (Data from WOS)



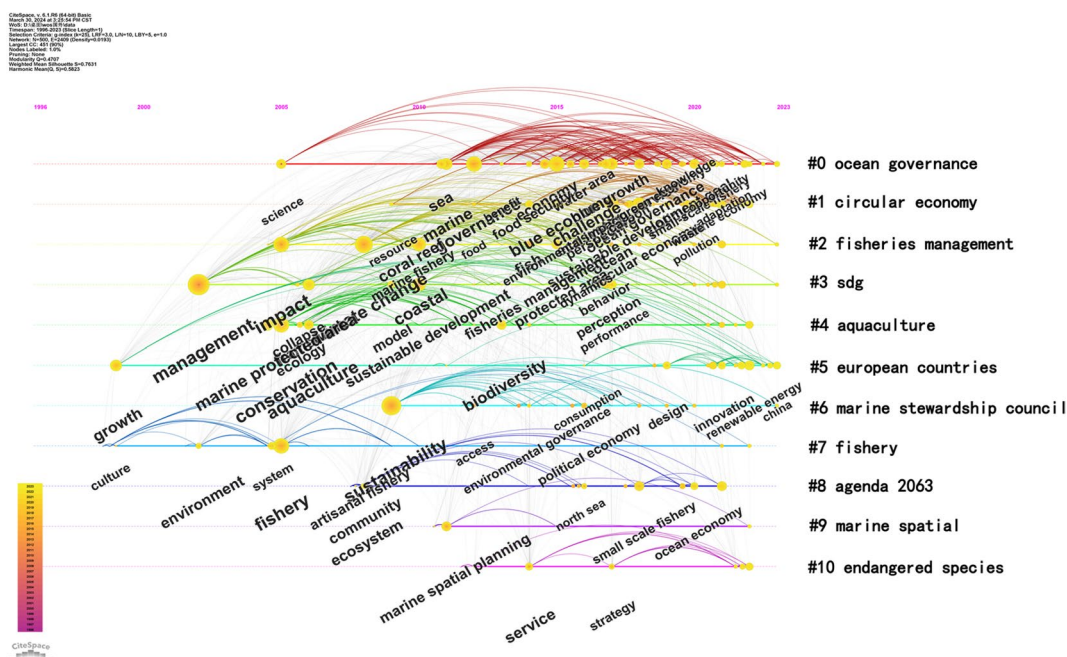
**Fig. 16** Keyword burst map of research on sustainable development of marine economy in China (Data from WOS)

low-carbon economy, regional economy, and path selection. The high-frequency keywords appearing in 2011–2015 are emerging industry, blue economy, evaluation index, marine strategy, index construction, and strong province strategy. The high-frequency keywords appearing after 2016 are relatively fewer than the previous stage. The keyword timeline map shows that sustainable development of the marine economy was extensively studied in China during 2000–2015, and the body of research is constantly evolving.

In Figs. 15 and 16, keywords, such as environment, sustainability, marine reserve, and marine protected, began to appear more intensively between 2000 and 2010. Then, 2010 onward was the most intensive period of keywords, including protected area, efficiency, blue economy, circular economy, CO<sub>2</sub> emission, and green economy. The keyword timeline map shows that research on the sustainable development of the marine economy reached a maturity stage after 2010 in other countries, with new keywords appearing intensively and more keywords from different research perspectives and disciplines.

Over the past three decades, current research topics have constantly evolved over time and process of national development. On the right side of the keyword timeline map are cluster titles of different colors. The timeline axis of the same color as the cluster title represents the evolution of the keywords included in the cluster, and the connection between each keyword represents the existence of evolutionary relationships between different keywords. Figures 13 and 14 show that the marine economy, marine industry, marine resources, national economy, and other clusters of keywords related to the emergence of the time were intensively discussed before 2000. ‘Marine economy’ is closely related to other keywords on the time axis of clustering, indicating the cross-integration of research and knowledge systems of different disciplines. ‘The sustainable development of technological innovation of marine industry’ can be further researched.

Figures 17 and 18 also show similar development characteristics abroad. Take the theme of ‘marine economy’ as an example, the earliest keyword on its timeline is sustainable development; however, studies have found that



**Fig. 17** Keyword timeline map of research on sustainable development of the marine economy in other countries

Top 25 Keywords with the Strongest Citation Bursts					
Keywords	Year	Strength	Begin	End	1996 - 2023
fishery	1999	1.35	1999	2005	[Timeline bar]
ecosystem management	2005	1.33	2005	2008	[Timeline bar]
collapse	2006	2.3	2006	2015	[Timeline bar]
access	2012	1.39	2012	2018	[Timeline bar]
ecosystem	2008	1.33	2013	2016	[Timeline bar]
sustainability	2009	4.33	2014	2017	[Timeline bar]
fisheries management	2014	2.81	2014	2016	[Timeline bar]
economy	2015	1.96	2015	2017	[Timeline bar]
dynamics	2016	1.89	2016	2017	[Timeline bar]
coastal	2010	1.97	2017	2018	[Timeline bar]
governance	2012	1.35	2017	2019	[Timeline bar]
catch	2018	1.56	2018	2019	[Timeline bar]
marine protected area	2005	1.99	2019	2020	[Timeline bar]
political economy	2016	1.99	2019	2020	[Timeline bar]
green economy	2019	1.66	2019	2020	[Timeline bar]
challenge	2016	1.52	2019	2020	[Timeline bar]
small scale fishery	2018	2.09	2020	2021	[Timeline bar]
food	2012	1.74	2020	2021	[Timeline bar]
small-scale fishery	2020	1.47	2020	2023	[Timeline bar]
lesson	2021	2.97	2021	2023	[Timeline bar]
emission	2021	2.42	2021	2023	[Timeline bar]
environmental impact	2015	1.73	2021	2023	[Timeline bar]
life cycle assessment	2021	1.61	2021	2023	[Timeline bar]
opportunity	2021	1.34	2021	2023	[Timeline bar]
future	2021	1.34	2021	2023	[Timeline bar]

**Fig. 18** Keyword burst map of research on sustainable development of marine economy in other countries

research development on marine ecosystem, ecology, and other keywords have evolved over the same timeline. The keywords marine ecosystem, ecology, and circular economy have evolved over the same timeline and are closely

related to the keywords that appear in different years in the other clustered themes. It can be seen that ‘marine environmental protection’ will continue to be the focus of research in the future.

## 5 Conclusion and discussion

This study used a bibliometric method and a literature review method to visualize and analyze research on sustainable development of marine economy over the past thirty years.

An analysis of the number and changing trends of literature on sustainable development of marine economy showed that the research on sustainable development of the marine economy has yielded rich results. Researchers from China already had cooperative teams with stable cooperative relationships, focused on assessing the sustainable development of the marine economy, optimization of marine industry structure, and other areas, with strong policy orientation. Studies on the assessment of marine ecological and environmental benefits analyze the path of sustainable development of the marine industry. The research themes are relatively fragmented and focus more on green development, resource utilization, and the environment. In the past thirty years, sustainable development of the marine economy has gained the much attention. We developed a tentative research framework with systems theory and ecology theory as the theoretical basis, sustainable development of human society as the ultimate goals, and comprehensive sustainable development of politics, economy, society, culture, and ecology as the core content. A multiple evaluation index system for the sustainable development of the marine economy was gradually formed.

Hotspot research on the sustainable development of the marine economy and the visualization and analysis of research frontiers have an important reference value for the issue of development and use of marine resources. Accordingly, an outlook into the future is provided: the factors influencing the sustainable development of marine economy in different regions are not simply linear or non-linear, but a result of the interweaving of several factors. More methods, such as SEM (Structural Equation Modeling) or matter-element model, can be used to accurately identify and determine the impact of various factors on the high-quality development of the marine economy. Existing studies confirm the need for and significance of research on green ocean economic efficiency at the provincial level. Future studies will focus on strengthening of inter-regional linkages, the evolution characteristics, and formation mechanism of marine economic linkage networks from the perspective of flow space. Future studies will also focus on identifying and analyzing the resilience of the subdivided marine economy industry.

## Appendix 1

**Table 3** Frequency table of marine economic sustainable development research institutions in China

Serial number	Frequency	Centrality	Year	Organization
1	44	0.01	2003	Research Center for Marine Economy and Sustainable Development, Liaoning Normal University
2	22	0.01	2008	School of Economics, Ocean University of China
3	17	0.01	2003	School of Management, Ocean University of China
4	9	0	2008	Institute of Marine Development Strategy, State Oceanic Administration
5	7	0	1998	National Marine Data Information Center
6	7	0	2014	School of City and Environment, Liaoning Normal University
7	6	0	2009	School of Economics and Management, Guangdong Ocean University
8	6	0	2004	Research Center for Sustainable Development of Marine Economy, Liaoning Normal University
9	6	0	2018	School of Management, Guangdong Ocean University
10	5	0	2009	Business School of Ningbo University
11	5	0	2009	Marine Economy and Management Research Center of Guangdong Ocean University
12	5	0	2012	National Marine Environment Monitoring Center
13	5	0	2004	Shandong Academy of Social Sciences
14	5	0	2015	School of Economics and Management, Shandong University of Science and Technology



Serial number	Frequency	Centrality	Year	Organization
15	4	0	2009	School of Economics and Management, Shanghai Ocean University
16	4	0	2009	School of Law and Politics, Ocean University of China
17	4	0	2015	School of Marine Development, Ocean University of China

## Appendix 2

**Table 4** Frequency table of marine economic sustainable development research institutions in other countries

Serial number	Frequency	Centrality	Year	Organization
1	20	0.17	2017	Univ Tasmania
2	16	0.07	2009	Univ British Columbia
3	14	0.06	2013	Australian Natl Univ
4	13	0.01	2018	Univ Wollongong
5	12	0	2018	Dalhousie Univ
6	12	0.04	2014	Univ Queensland
7	9	0.04	2012	Univ Western Australia
8	9	0.05	2012	Mem Univ Newfoundland
9	9	0.06	2013	Stanford Univ
10	7	0.01	2014	Univ Washington
11	6	0.02	2008	Univ Plymouth
12	6	0.08	2014	Univ Calif San Diego
13	5	0	2020	Nelson Mandela Univ
14	5	0	2021	Griffith Univ
15	5	0.01	2013	Univ Lisbon
16	5	0.01	2021	Univ Technol Sydney
17	4	0	2011	Duke Univ
18	4	0	2021	WorldFish
19	4	0	2019	Univ Aberdeen

Serial number	Frequency	Centrality	Year	Organization
20	4	0	2021	Univ Melbourne
21	4	0	2020	Aarhus Univ
22	4	0	2022	Simon Fraser Univ
23	4	0.01	2021	Univ Chittagong
24	4	0.01	2016	Bogor Agr Univ
25	4	0.01	2019	European Commission
26	4	0.01	2017	CSIRO Oceans & Atmosphere
27	4	0.01	2002	Stockholm Univ
28	4	0.02	2017	Univ Gothenburg
29	4	0.02	2021	Swedish Univ Agr Sci
30	4	0.03	2006	Univ Victoria

## Appendix 3

**Table 5** Frequency table of authors of marine economic sustainable development research in China

Serial number	Author	Frequency	Year of first appearance
1	Sun Caizhi	16	2011
2	Di Ganbin	12	2009
3	Han Zenglin	10	2009
4	Liu Ming	10	2008
5	Wang Zeyu	9	2014
6	Ding Lili	8	2015
7	Li Jingyu	8	2006
8	Zheng Guibin	6	2004
9	Zhang Li	5	2006
10	Li Bo	5	2015
11	Peng Fei	5	2015
12	Li Hua	4	2017
13	Sun Kang	4	2014
14	He Guangshun	4	2007
15	Gao Qiang	4	2012

## Appendix 4

**Table 6** Frequency table of authors of marine economic sustainable development research in other countries

Serial number	Author	Frequency	Year of first appearance
1	Cisneros-montemayor, Andres M	6	2021
2	Singh, Gerald G	5	2021
3	Foley, Paul	5	2012
4	Voyer, Michelle	5	2020
5	Buck, Bela H	4	2021

Serial number	Author	Frequency	Year of first appearance
6	Krause, Gesche	4	2020
7	Frusher, Stewart	3	2017
8	Islam, Mohammad Mahmudul	3	2018
9	Cheung, William W L	3	2016
10	Novaglio, Camilla	3	2021
11	Sumaila, U Rashid	3	2021
12	Bennett, Nathan J	3	2018
13	Germond-duret, Celine	3	2022
14	Ha, Le Thanh	3	2023
15	Fabinyi, Michael	3	2021
16	Fusco, Leah M	3	2022

### Authors' contributions

Hui Zheng, and Yong Wang conceptualized the study, synthesized the data analysis plan, analyzed the data, interpreted the findings, and have been the leading contributors to this paper. Hui Zheng made further contributions at a later stage. All authors have read and approved the final manuscript.

### Funding

This work was supported in part by the Natural Science Foundation of Shandong (NO. ZR2021MG016) and the National Social Science Foundation of China (NO. 22&ZD125).

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

### Declarations

### Competing interests

The authors declare that they have no competing interests.

Received: 8 January 2024 Revised: 7 April 2024 Accepted: 15 April 2024

Published online: 01 May 2024

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