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Revealing the Current Situation and Strategies of Marine Ranching Development in China Based on Knowledge Graphs

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Abstract: In recent years, marine ranching, as an emerging model of marine industry development, has become a research hotspot in the marine industries of many countries. A marine ranching is an ecological aquaculture fishing ground formed within a specific sea area to increase and restore fishery resources, combined with artificial nurseries and the construction of fish reefs. As a major maritime country, China attaches great importance to the construction of marine ranching and supports them as an important means of conserving aquatic resources, providing fishermen with jobs, and building a marine ecological civilization. Bibliometric methods are considered to be useful tools that can provide a macroscopic overview of large amounts of academic literature, identify research priorities, and track the evolution of science and technology. In this paper, a comprehensive analysis was carried out using three methods: bibliometric analysis, visual analysis with CiteSpace software, and Excel pivoting, presented in the form of visual graphs and data charts. A total of 293 and 522 academic journal papers searched in the China National Knowledge Infrastructure (CNKI) and the Web of Science (WoS) core databases were used, respectively, and to summarize the current status of construction of national marine ranching demonstration areas in China, this study also provides an overview of China's policies on the development of marine ranching over the past two decades. It clarifies the current status, research hotspots and future directions of marine ranching research, and provides a reference for the evolution process and theoretical research of marine ranching in the future. At present, China is focusing on the development of modernized "all-area" marine ranching which is "ecological, precise, intelligent and integrated". Obviously, it cannot be overemphasized that smart marine ranching will become a research hotspot in the future.

Keywords: marine ranching; CiteSpace; bibliometric method; policies; visual analysis

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1. Introduction

The destruction of offshore marine habitats, environmental pollution, overfishing, and other reasons have led to the decline of marine fishery resources and affected sustainable development [1–4]. In order to solve the food problem, many coastal countries have turned their attention to the development of marine ranching as a major strategy for fishery development. As an emerging model of the marine industry, marine ranching is regarded as the best solution to the sustainable development of fisheries and the improvement of marine ecological environment.

The concept of "marine ranching" originated from the "marine fish hatching movement" [5] in the 19th century, and the term "marine ranching" originally originated in the United States and Japan in the 1970s. In Japan, marine ranching is defined as "the basic technology system of future fishery and the system for sustainable development of marine living resources to produce food", and the world's first marine ranching has been successfully built [6–8]. Japan considers various farming methods, including ponds, nets,

and marine freshwater aquaculture, as a category of marine ranching [9,10]. As a result of years of practical research, Japan is at the forefront of research and application of marine ranching-related technologies such as artificial reef construction, algae farms, cultivation of seagrass beds, fish and shellfish stocking, fish behaviors control, selective fishing gear development, and environmental monitoring and assessment of fishing waters [11–13]. In the United States, the benefits of using natural beds to grow macroalgae were proposed in 1968 and implemented in California in 1974 [14,15]. Then in the 1980s, the marine ranching was built in combination with leisure industries such as tourism and fishery to develop leisure fishery, which achieved ecological and economic benefits. In Korea, one of the reasons for developing marine ranching is to increase the production of certain economic species to ensure stable and sustainable growth of aquatic resources. The second is to realize the sustainable development of fisheries while protecting the marine ecosystem. Then, in the 1990s, a long-term development plan for the Korean marine ranching industry was formulated and implemented [16–20].

In China, marine fisheries are an important part of the food security system. High-quality seafood plays an important role in improving people's dietary structure and health. Zhu [21,22] proposed marine fishing as a form of animal husbandry as early as 1963. Then, in 1978, Zeng [23–25] proposed the agro-pastoralization of aquaculture production in the exclusive marine zone of China at the resumed conference of the Chinese Aquatic Society; he defines farming and ranching of the sea as "the modification of the marine environment through anthropogenic interventions to create powerful environmental conditions for the growth and development of economic organisms. At this time, necessary modifications are made to the organisms themselves to improve their quality and productivity" [26]. In the 2010s, with the continuous progress of research, theory, and practice, the definition of marine ranching was also in a state of continuous development and improvement. Yang [27] defined marine ranching as "an artificial fishing ground based on the principles of marine ecology and modern marine engineering technology, making full use of natural productivity to scientifically cultivate and manage fishery resources in specific sea areas". In the latest national standard "GB/T 40946-2021 Technical Guidelines for the Construction of Marine ranching", which was issued on June 1, 2022 by the State Administration of Market Supervision of the People's Republic of China. The definition of "marine ranching" is based on the principle of using a marine ecosystem, in specific sea areas, through artificial reefs, stocking, and other measures, to build or restore the place needed by marine organisms to breed, grow, seek bait, or avoid enemies; to increase the conservation of fishery resources, improve the ecological environment of the sea; and to achieve the sustainable use of fishery resources [28].

In 2017, the "National Marine Rangeland Demonstration Area Construction Plan (2017–2025)" was released, proposing to create 200 national marine rangeland demonstration areas by 2025 [29]. In addition, "The 14th Five-Year Plan and Vision 2035 of the National Economic and Social Development" of China clearly outlines the goal of "Optimize the layout of green farming in the sea, building marine ranching and developing sustainable marine pelagic fisheries". As mentioned above, since China's first technical guidelines was officially implemented in 2022. Up to now, the number of national marine ranching demonstration areas has reached 153, with a total area of 250,695.5366 hectares, covering the Bohai Sea, Yellow Sea, East China Sea, and South China Sea. Private enterprises are almost the main body in the creation, management, and maintenance of marine ranching demonstration areas in China. The Ministry of Agriculture of China has established an assessment and management mechanism of "annual evaluation, target assessment, dynamic management, and the ability to advance and retreat". Some measures have been implemented, such as organizing annual evaluation and supervision and inspection work, building a dynamic supervision information system, and tracking and monitoring the operation of the demonstration area. The construction and modernization of nation-level marine ranching has significantly improved, opening up a new era of marine ranching construction.

Bibliometric methods are recognized as useful decision support tools for identifying research priorities and tracking the evolution of science and technology. Given their versatility, these methods were quickly extended to various scientific fields. The main reason for this spread is the abundance and ease of access of data. Additionally, the proliferation of processing and analysis tools has made current bibliometrics accessible to scientists of any level of expertise [30–32]. The method can provide a macro-overview of a large amount of academic literature and can also be used to effectively identify influential studies, authors, journals, organizations, and countries over a period of time [33,34].

A bibliometric approach using quantitative analytical methods is used to explore the development of marine ranching research. The study also assesses the current state of marine ranching through a visual analysis of journal articles. Based on this, this paper uses CiteSpace software to analyze articles on topics related to "marine ranching" from a visual perspective, collate the relevant national policy documents issued in recent years, and present them in the form of visual mapping and data charts. It helps us to study the current situation, research hotspots, and future development direction of marine ranching to provide some reference for future theoretical research on marine ranching.

2. Materials and Methods

2.1. Data Sources

The China Knowledge Network (CNKI) covers more than 90% of China's knowledge information resources, including humanities, social sciences, natural sciences, science, engineering, agriculture, medicine, electronic information technology, and other disciplines, and forms a database of Chinese journals, doctoral theses, tools, conference papers, newspapers, yearbooks, patents, standards, scientific and technological achievements, ancient books, and other kinds of literature resources. The Web of Science (WoS) is an information service platform developed by Clarivate Analytics, with data from journals, books, patents, conference proceedings, web resources (including free and open resources), etc. The Web of Science includes references cited in papers and indexes them according to the cited author, source, and publication date to ensure the richness and professionalism of the article database sources. Therefore, in the present analysis, the data were downloaded from the WoS, Core Collection database, and CNKI.

In the advanced search mode of the CNKI, a search was run with "TS = marine ranching" as the subject and keywords. To ensure the quality of literature and the authority of data, the classification of literature sources was set to the Science Citation Index, Chinese Science Citation Database, and Chinese Social Science Citation Index. The 293 valid academic articles from 1992 to 2022 were obtained after de-duplication and elimination of invalid literature (briefings, conference announcements, book reviews, recommendations, advertising campaigns).

Further data were obtained through the WoS database. The specific settings are "(((TS = (marine ranching)) OR TS = (the sea ranch)) OR TS = (ocean ranching)) OR TS = (oceanic ranch)". A search of the WoS database retrieved a total of 522 articles from 1981 to 2022.

2.2. Subsection Research Methods

CiteSpace is a software for visualizing and analyzing trends and patterns in scientific literature. It is a tool used to construct and view bibliometric maps of authors, journals, or references based on co-citation data and to construct maps of keywords based on co-occurrence data. The research tool used for this study was CiteSpace software because of its ability to link and visualize the citation structure of articles in graphical form [35]. It is mainly based on co-citation analysis and pathfinder net-work scaling (PDFNET) by measuring domain-specific literature (collections) to identify critical paths and knowledge turning points in the evolution of subject areas [36]. Visual mapping analysis provides a more intuitive understanding of the knowledge dynamics of relevant research and its evolutionary trajectory, and uses clustering views to uncover research focuses, revealing

key turning points in the evolution of knowledge and their intrinsic relationships. The advantages of this software include its relatively stable development, its full range of software functions and types of analysis, and its direct and beautiful visualization.

Therefore, this study uses three methods of bibliometric analysis, CiteSpace (version 6.2) software visual analysis, and Excel pivot to study marine ranching and form a visual mapping and data chart presentation, which helps us to study the current situation of marine ranching research, research hot spots, and future development direction.

3. Results

3.1. Publication Output and Trend

The number of publications in marine ranching disciplines or academics is a vital indicator of the development trend of this research field, since it reflects the change of subject knowledge. By plotting the number of publications over time and performing multivariate statistical analysis, we can understand research findings and future trends in the field of marine ranching.

According to CNKI and WoS literature searches, the earliest literature in the field of marine ranching appeared in 1992 (CNKI) and 1981 (WoS), respectively. To accurately locate the development of marine ranching, the literature retrieval amount from the CNKI and WoS was compared (Figure 1). In terms of the number of periodical documents in the period of 2002–2022, the number from the WoS is much higher than that from the CNKI. The average publication number of the WoS is 20.1 and the average number from the CNKI is 14.05. There is still a gap between the two.

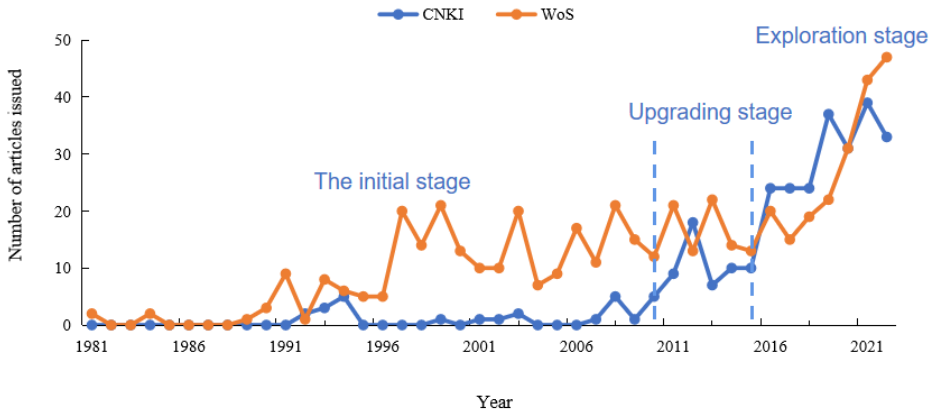

Figure 1. Trends in the number of articles published in CNKI academic journals, master's theses, and WoS journals.

In terms of literature publication time, WoS literature publication began in 1981. Prior to this, Europe, America, and Japan had completed the construction of marine ranching. In 1992, China was just in the initial stage, and the development of marine ranching was relatively late. Since 2011, the number of issued CNKI publications has increased sharply, which shows that China has shown a good development trend.

In the same year, the Fisheries Bureau of the Ministry of Agriculture issued the "National Fishery Development Twelfth Five-Year Plan" [37], which accelerated the development of China's marine ranching. In 2017, the Ministry of Agriculture issued the "National Marine Ranching Demonstration Area Construction Plan (2017–2025)", which will give full play to the comprehensive benefits and demonstration and leading role of the National Marine Ranching Demonstration Area. This implementation has promoted new breakthroughs in the construction of national marine ranching. The number of CNKI papers published in the past five years tends to be consistent with the number of WoS papers.

3.2. Knowledge Graph of Authors and Research Institutions Posting in the Research Field "Marine Ranching" in the WoS

According to Price's law in the statistical analysis of literature, the number of publications by core authors is calculated as $m = 0.749\sqrt{N_{max}}$, where m denotes the minimum publication standard for core authors, and N_{max} denotes the number of papers published by the author with the most publications. From Price's law, the minimum number of publications of this core author is calculated as 3.08, which means that the minimum number of publications is four and above.

The number of publications in a journal reflects the trends and academic interest in the research topic, and the development of research in the field of marine ranching is inextricably linked to the authors and institutions of the literature. By using the CiteSpace bibliometric visualization software, we analyzed and mapped the knowledge graph of authors and research institutions in the WoS database for publications related to marine ranching (Figures 2 and 3). By aggregating the data, we can summarize the highly productive and influential authors and research institutions in the field and see their collaborative relationships. A node in the diagram represents a researcher and the connecting lines between the nodes represent the researcher's collaborative network. All figures and tables should be cited in the main text as Figure 1, Table 1, etc.

By comparing Figures 2 and 3, we can see that the nodes are more scattered and form fewer clusters in the plot of posting authors (Figure 2), while the plot of research institutions (Figure 3) shows a more clustered distribution of nodes.

By aggregating the post volume data, we have compiled the authors with four or more posts, namely Du, Taylor, Cotter, Assaf, Bjorn, and others, as well as the post volume. The institutions with more than 10 publications are Ocean University of China, Institute of Marine Research-Norway, and The Chinese Academy of Sciences Laoshan Laboratory. The most important institutions are Ocean University of China, Institute of Marine Research-Norway, Chinese Academy of Sciences, Laoshan Laboratory, Chinese Academy of Fishery Sciences, etc. The top ten authors and research institutions in terms of number of articles published are summarized in Table 1.

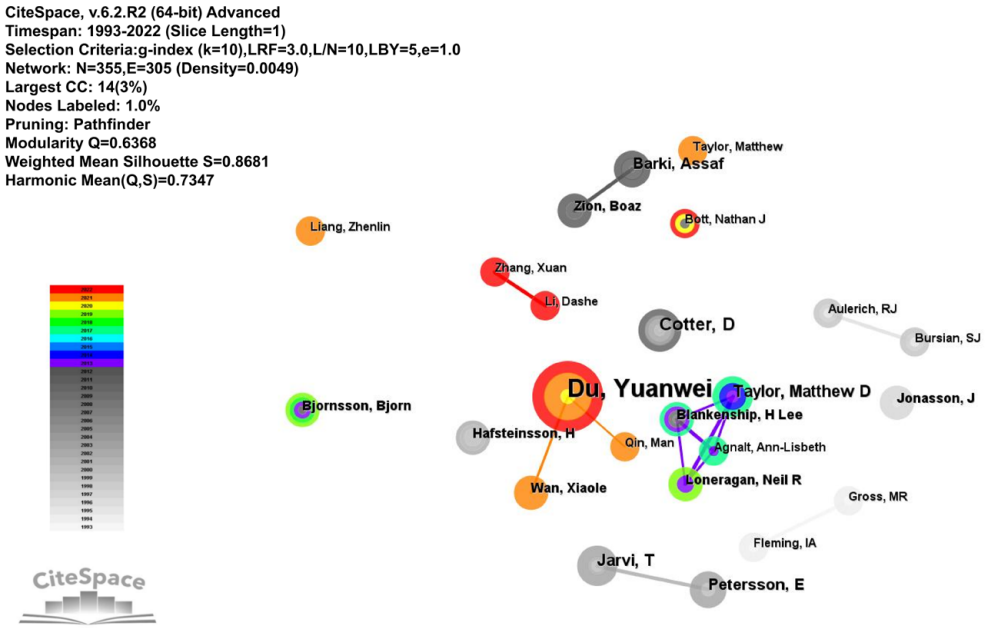

Figure 2. Knowledge graph of authors of articles published in the research field "Marine Ranching" in the WoS.

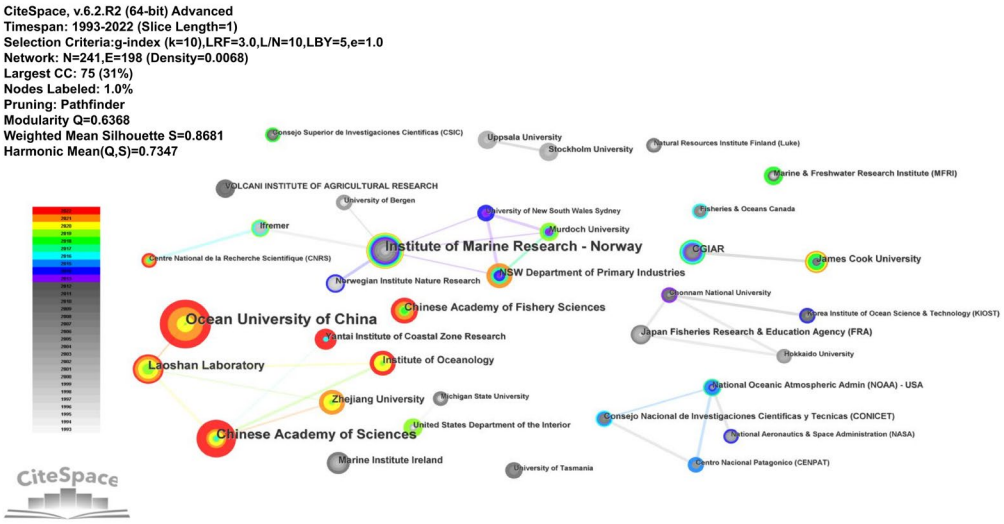

Figure 3. Knowledge map of research institutions in the field of "Marine Ranching" research in the WoS.

Table 1. Top 10 most published authors and research institutions in the WoS.

Number	Number of Publications	Author	Number	Number of Publications	Institution
1	17	Yuan-Wei Du	1	37	Ocean University of China
2	17	Taylor Matthew D.	2	29	Institute of Marine Research-Norway
3	7	Cotter Diane	3	24	Chinese Academy of Sciences
4	5	Assaf Barki	4	15	Laoshan Laboratory
5	4	Bjorn Bjornsson	5	11	Chinese Academy of Fishery Sciences
6	4	Blankenship H. Lee	6	9	Consultative Group on International Agricultural Research (CGIAR)
7	4	Loneragan Neil R.	7	9	Zhejiang University
8	4	Jonasson Jimmy	8	9	Institute of Oceanology
9	4	Hafsteinsson Hannes	9	9	NSW Department of Primary Industries
10	4	Xiao-Le Wan	10	8	Marine Institute Ireland

Comparing the number of publications by authors and institutions, the above conclusion is again confirmed, with the exception of Du and Taylor. The number of publications by authors is low, with no more than ten. The institutions are more productive due to their long and close collaboration, with Ocean University of China, Institute of Marine Research-Norway, and Chinese Academy of Sciences leading the way.

The author with the most academic achievements, Du [38–43], is mainly concerned with fisheries' management policies, as well as the evaluation of ecological safety and benefits, based on the application of various calculation methods to evaluate the factors present in the development of marine pastures, which helps to avoid risks and improve the feasibility of the plan. The institutions in this cluster have some research in this direction. Another author, Taylor [44–48], has used a number of experiments on the release of marine species to assess the potential for increasing fisheries' productivity, combined with the development of bioeconomic and energetic models, in order to develop more scientifically based policies for the stock enhancement of marine organisms. Even research institutions in several countries share the results and draw on successful experiences to develop them in their respective countries in a localized manner [45,49]. There is no doubt that the close links between the institutions have played an important role in driving the development of marine ranching.

3.3. Knowledge Mapping Analysis of the "Marine Ranching" Research Area in the WoS

Keyword analysis uses keywords in the literature to construct a semantic map of the field. It is a quantitative approach to scientifically discover linkages among sub-fields and trace their tendencies. Keywords co-occurrence analysis is used to analyze the link strength between co-occurrence keywords by studying their co-occurrence relation in numerous documents [36].

In order to make a better comparison with CNKI data afterwards, we ran the CiteSpace software and set the time uniformly to 1993–2022, the time slice to 1, the network node to "Keyword", and the selection criterion to g-index (k = 10). The algorithm was used to cluster and analyze the closely linked keywords, resulting in Figure 4.

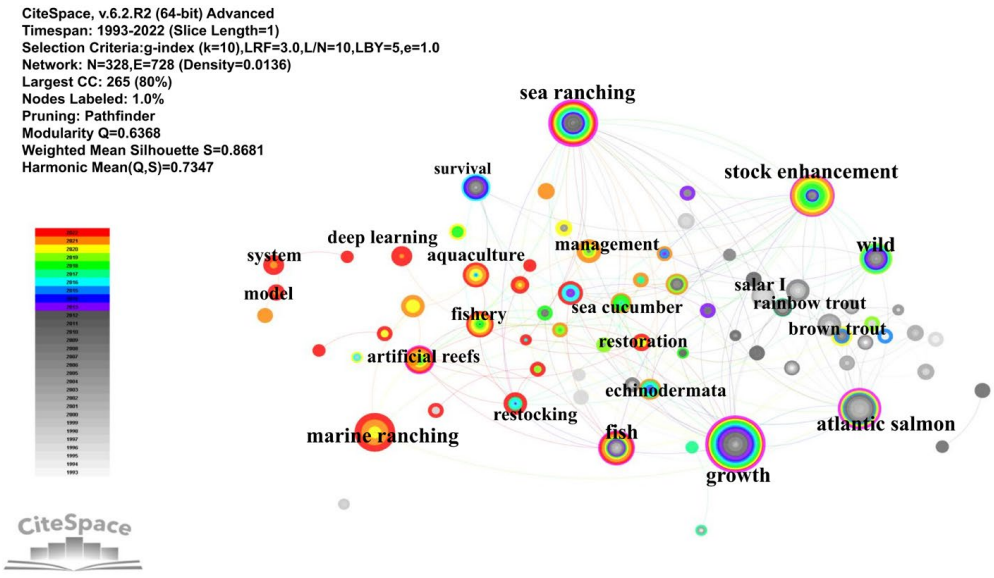

Figure 4. Clustering map of keywords in the field of marine ranching research in the WoS.

CiteSpace uses module values (Q-values) and average profile values (S-values) as a measure of the effectiveness of cluster mapping, based on network structure and the clarity of the clusters. Generally, Q > 0.3 is considered to indicate a clear clustering structure and S > 0.5 a reasonable delineation of surface clusters. In this paper, the calculated values are Q = 0.6368 and S = 0.8681, indicating that the plotted profiles meet the requirements. The larger the nodal circles in the chronology of the graph, the more research has accumulated on this keyword, and the brighter the color representing that the keyword, the more popular the research topic in the field in recent years.

CiteSpace software clusters closely related keywords in the literature using a log-likelihood ratio algorithm and identifies clustering labels for keywords to provide a clear understanding of each research topic [50]. In Figure 4, keyword mapping has the formation of relevant clusters, and then distributes the keywords of the same cluster on the same horizontal line in time order, sets the maximum display cluster value k = 10, and draws the timeline mapping (Figure 5). It obtained the following clusters, including *Corhynchus kisutch* (#0), Sea ranching (#1), Restocking (#2), Marine ranching (#3), Community (#4), Shear force (#5), *Salmo trutta* (#6), On fisheries ecology (#7), and *Homarus gammarus* L. (#9). Then, we calculated the frequency and year information of relevant representative keywords contained in each cluster, and listed them in Table 2 to help subsequent analysis.

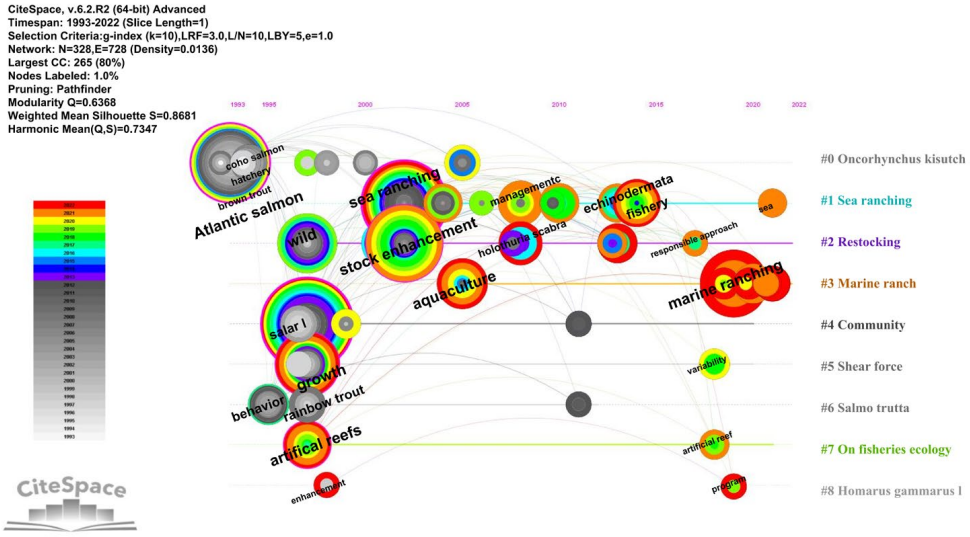

Figure 5. Timeline mapping of keywords in the marine ranching research domain using the WoS.

Table 2. Clustering of keywords in the field of marine ranching research in the WoS.

No.	Year	Clusters	Keywords	Frequency
#0	1999	*Oncorhynchus kisutch*	*Oncorhynchus kisutch*; Captive breeding; *Atlantic salmon*; Breeding success; Breeding competition	44
#1	2012	Sea ranching	Sea ranching; Acoustic training; Integrated multitrophic aquaculture; Memory; *Southern rock lobster*	37
#2	2009	Restocking	Restocking; Wild; Fisheries management; Integrated approach	35
#3	2019	Marine ranching	Marine ranching; Ecological security; Community structure; Prediction; Sustainable Development goals	33
#4	2006	Community	Community; Calcein; *Australostichopus mollis*; Marine ranching; Deposit-feeding	31
#5	2005	Shear force	Shear force; *Salmon*; Microstructure; Aquaculture-based fisheries enhancement; Cybernetics	26
#6	2002	*Salmo trutta*	*Salmo trutta*; Acoustics; Cortisol; Monoamines; Population estimates	21
#7	2016	On fisheries ecology	On fisheries ecology and 6th; International symposium on stock; *Haliotis laevigata*; Mote international symposium; Sea ranch	17
#9	2001	*Homarus gammarus* L.	*Homarus gammarus* L.; Ratio estimator; Tag loss; Larvae; Unbiased estimator	7

A graph showing the start and end of the occurrence of a keyword, leading to an overall picture of the research for that keyword, is what the CiteSpace Keyword High Occurrence Word List is for. By analyzing the keywords one can obtain an idea of the research hotspots in the research field at different times. Therefore, by running the software operation, based on keyword co-occurrence mapping, the 15 strongest highlighted words were selected to plot Figure 6, sorted by time, with the red area indicating that the keyword is in a period of research hotspot.

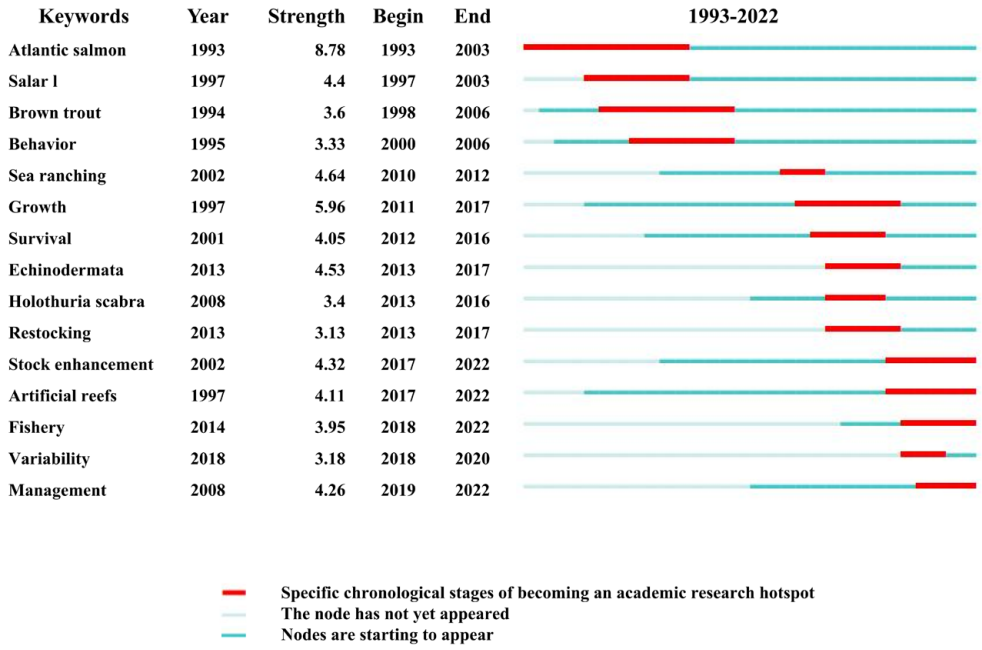

Figure 6. Timeline mapping of keywords in the marine ranching research area in the WoS.

From the results, the development of marine ranching can be divided into two stages.

Stage 1: Basic research stage (1993–2009) (#0, #5, #6), in which early studies focused on the relationships and differences between wild and farmed fish [51–54]. Among these are the differences in reproductive hatchery between farmed and wild salmon and the genetic make-up of the populations [55–57]. For example, Fleming confirmed the influence of early rivers on the reproductive capacity of mature salmon through four quantitative experiments [58]. In Figure 4, from the words that appear in the timeline at this stage, *Atlantic salmon*, salar, *coho salmon*, *brown trout*, the study has shown that salmonids are diverse, widespread, and "migratory" in nature, taking advantage of the natural resources and natural growth forces of the sea [59–61]. The salmon family is a cold-water fishery resource that is highly nutritious and tasty and has great economic value for fisheries, making it suitable for use as a research target in marine ranching.

Stage 2: In-depth development stage (2010–present). This stage focuses on the optimization of marine ranching in the fishing industry. Keywords, which include fisheries management, fisheries ecology, and sustainable development, were mentioned several times in #2, #3, and #7. Scientific management and sustainable development have become one of the main development goals at this stage, with ecological and economic benefits as assessment criteria to optimize the construction of marine ranching.

The marine environment is closely related to the growth and reproduction of fish [62]. Currently, the focus is on the development of global industry and the discharge of wastewater polluting the marine ecosystem. At the same time, the selection of released fish species in the population structure and hatchery is also a technical problem that needs to be improved. Finding better solutions is therefore one of the most important ways to contribute to the optimization and improved management of marine ranching. Some countries have made long-term plans for the development of marine ranching, transforming from the primary industry to tertiary industry since the last century. To protect fishery resources in European and American countries, marine ranching were used to reduce fishing pressure. For example, the United States has established good cooperation and interaction between the government and non-governmental organizations, introduced protection policies, and used a scientific management system to realize the coordinated development of recreational fishery.

Through keyword co-occurrence mapping, the 15 strongest highlighted words were selected for drawing, sorted by time (Figure 6). The red area indicates that the keyword is in the research hotspot period. In the early stage, species were mainly used as keywords, and in the later period, fishery, variability, and management were used as hotspots research.

3.4. Analysis of Trends in the Research Field of "Marine Ranching" in Academic Journals in the CNKI

In China, research in the field of marine ranching has a staged characteristic and can be basically divided into three stages, as shown in Figure 1.

Stage 1: The initial stage of research on the development of marine ranching (1992–2010). In the 1980s, China began to explore the practice of marine ranching, listing artificial reefs as a national development project, and gradually carried out experimental research on artificial reefs in Guangxi, Shandong, Fujian, and other provinces [63–65]. During the 1980s and 1990s, marine ranching research was interrupted for various reasons, including a lack of funding and management experience for artificial reef construction across the country. Currently, the academic output is relatively small, with an average of 1.4 publications per year at this stage. However, at the beginning of the 21st century, the development of marine ranching gradually received national attention [66], and coastal cities across the country actively carried out construction and issued relevant development policies. Therefore, the number of papers published from 2018 to 2010 reached five per year.

Stage 2: Development research and exploration stage (2011–2015). At this time, China's marine ranching entered a stage of comprehensive development, not only carrying out artificial fish reef construction and multiplication and stocking experiment activities, but also gradually improving regulations and management techniques and other related standards. The Ministry of Agriculture and Rural Affairs of China (formerly the Ministry of Agriculture) organized the creation of national-level marine ranching demonstration areas in 2015. The overall number of articles published at this stage increased compared to the initial stage, with the annual number of articles concentrated in the range of 5–20, and the average number of articles published was 10.8. Thanks to the national policy guidance and the development of various coastal areas, the construction of marine ranching has attracted the attention of more domestic scholars.

Stage 3: Upgrading stage of marine ranching development research (2016–present). After the establishment of the National Marine Ranching Demonstration Zone in the second stage, the number of publications in 2016 doubled compared with the previous year [67]. 2017 was an important turning point in the construction of marine ranching. In the same year, the Ministry of Agriculture and Rural Affairs designated the release of marine ranching industry standards for classified aquatic products and issued the "National Marine Ranching Demonstration Area Construction Plan (2017–2015)" and "National Marine Ranching Demonstration Area Management Specifications (Trial)". There are many studies related to marine ranching emerging which combine multiple disciplines to explore the modern transformation of marine ranching. The average number of published articles during this period was 30.2, and it was on the rise. It can be expected that marine ranching will continue to be a hot issue of concern for academics in the longer term.

3.5. Knowledge Map Analysis of the Research Field of "Marine Ranching" in Academic Journals in the CNKI

From Price's law, the minimum number of publications of this core author is calculated as 3.59, which means that the minimum number of publications is four and above. The literature in the CNKI database was collated, and a knowledge map of the volume of author and institutional publications in the field of marine ranching in China was counted and mapped (Figures 7 and 8).

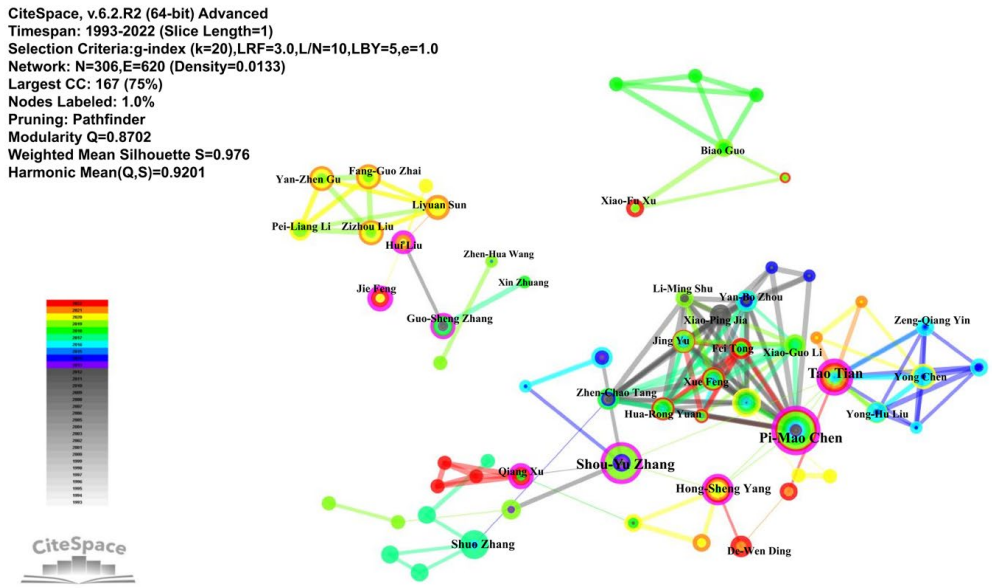

Figure 7. Knowledge graph of authors of articles published in the research field "Marine Ranching" in the CNKI.

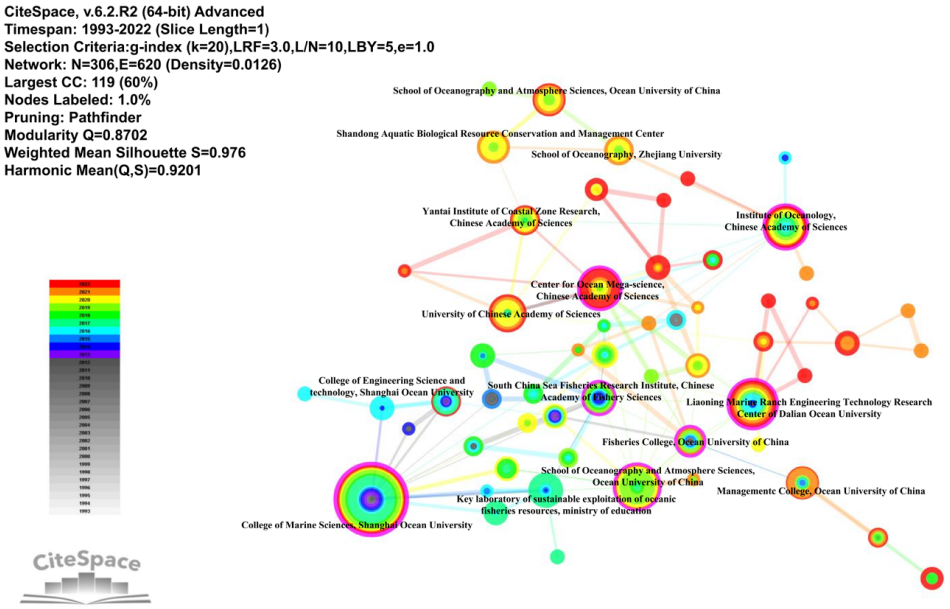

Figure 8. Knowledge map of research institutions in the field of "Marine Ranching" research in the CNKI.

The graph shows that the number of articles published by Chinese authors is high and that there are several authors centered on different areas of in-depth research. For example, Zhang [68–73] has played a leading role in the study of auditory characteristics, using acoustic domestication to improve the utilization of released bait by analyzing the responses produced by different species of fish to acoustic domestication, and has published eight academic articles in this field. Chen [74–78] is a leading researcher in the field of trapping effects, using artificial reef models of different materials for experiments on fish trapping effects.

The relatively small number of nodes in Figure 8 is not the main reason for the low output of Chinese research institutions. A larger proportion of the authors in Figure 8 are employed in university institutions with teamwork and rely on research institutions

to produce fruitful results, resulting in a low output of research institution-based results. Authors with high publication volumes, such as Chen and Qin at South China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, and Tao Tian at Dalian Ocean University, have carried out a number of research projects on marine ranching, relying on the resources of Chinese universities and research institutions.

To summarize the mapping, the main research focus of institutions in recent years has been on species and resources, such as Black bream, Xiangshan Port, and Haizhou Bay. In recent years, marine ranching has become popular for research, and institutions have intensified their research in the field of marine ranching, gradually producing results.

The top ten authors and institutions based on the high number of publication statistics are plotted in Table 3.

Table 3. Top 10 most published authors and research institutions in the CNKI.

Number	Number of Publications	Author	Number	Number of Publications	Institution
1	23	Pi-Mao Chen	1	41	College of Marine Sciences Shanghai Ocean University
2	18	Shou-Yu Zhang	2	22	Liaoning Marine Ranch Engineering Technology Research Center of Dalian
3	16	Chua-Xin Qin	3	17	Ocean University
4	15	Tao Tian	4	16	College of Marine Ecology and Environment Shanghai Ocean University
5	13	Xue Feng	5	14	Institute of Oceanology, Chinese Academy of Sciences
6	13	Shuo Zhang	6	12	University of Chinese Academy of Sciences
7	13	Hua-Rong Yuan	7	11	Center for Ocean Mega-science, Chinese Academy of Sciences
8	12	Hongsheng Yang	8	10	Management College, Ocean University of China
9	10	Jing Yu	9	9	Key laboratory of sustainable exploitation of oceanic fisheries resources
10	10	Liyuan Sun	10	9	

3.6. Knowledge Map Analysis of the Research Field of "Marine Ranching" in Academic Journals in the CNKI

The CiteSpace software was run, and the time was set to 1993–2022, the time slice to 1, the network node to "Keyword", and the selection criterion to g-index (k = 20). According to the visual mapping process, the visual mapping analysis is carried out on the retrieval documents of marine ranching in the CNKI (Figure 9). In this paper, the calculated values were Q = 0.7139 and S = 0.9798, indicating that the plotted profiles meet the requirements. Compared with Figure 4, the development of marine ranching in China is relatively late, so the number of keywords in the research field is relatively small.

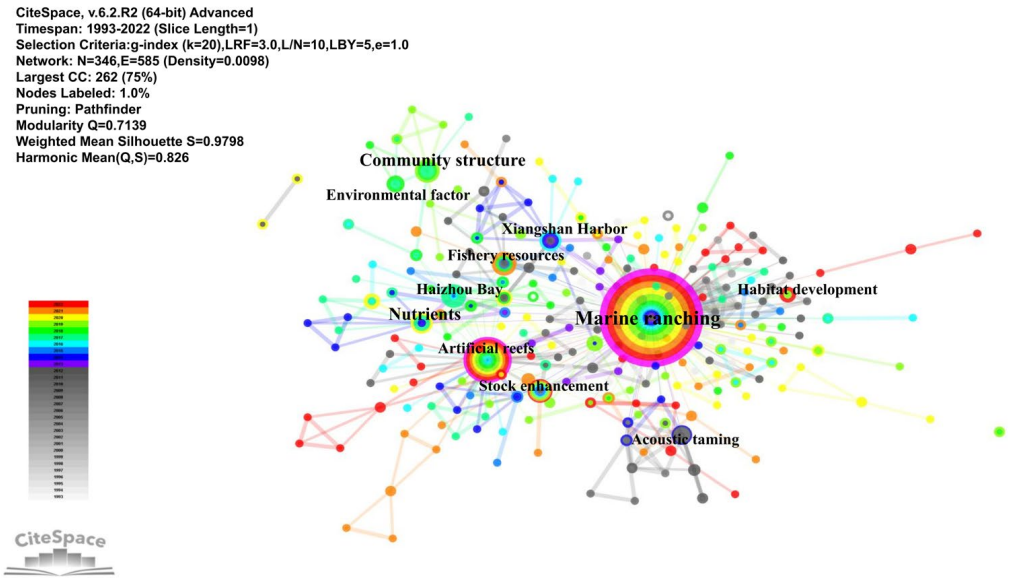

Figure 9. Clustering map of keywords in the field of marine ranching research in the CNKI.

We then distributed the keywords of the same cluster on the same horizontal line in time order, set the maximum display cluster value k = 10, and drew a timeline diagram (Figure 10). The software obtained the following clusters, including Artificial reefs (#0), Stock enhancement (#1), Numerical simulation (#2), Nutrients (#3), Acoustic taming (#4), Community structure (#5), Fishery resources (#6), Cage culture (#7), and Changhai County (#8). On the basis of keyword co-occurrence mapping, the 15 strongest highlighted words were selected to plot Figure 11. Then, we calculated the frequency and year information of relevant representative keywords contained in each cluster, and listed them in Table 4 to help subsequent analysis.

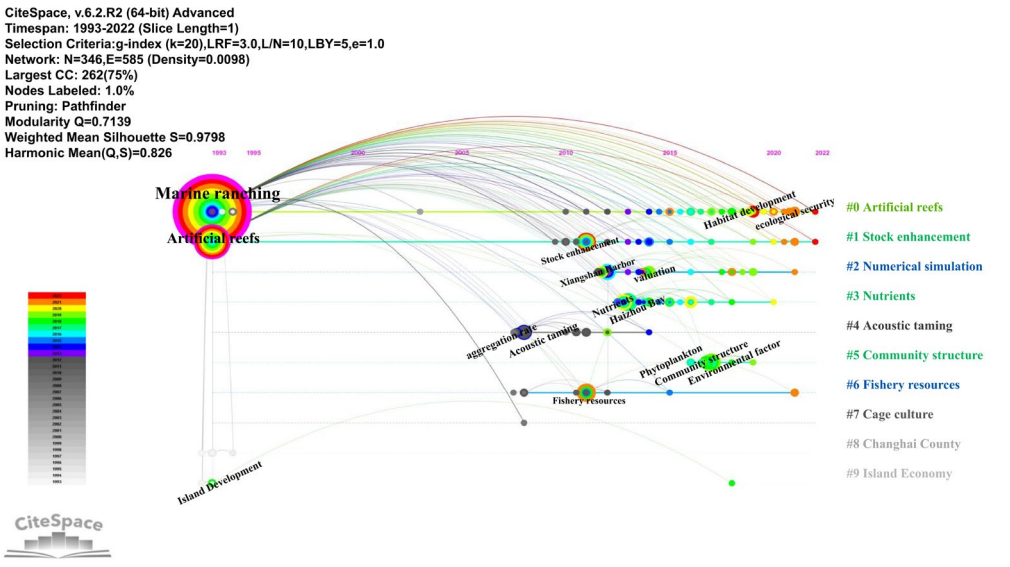

Figure 10. Timeline of keywords in CNKI academic journals on the topic of "Marine Ranching".

Table 4. Keyword clustering in the CNKI in the field of "Marine Ranching" research.

No.	Year	Clustered Words	Keywords	Frequency
#0	2016	Artificial reefs	Artificial reefs; Marine ranching; Nutrients; Community structure; Acoustic taming	92
#1	2014	Stock enhancement	Artificial reefs; Stock enhancement; Zhangzi island; Seagrass bed; Side-scan sonar	44
#2	2014	Numerical simulation	Stock enhancement; Xiangshan Harbor; Site selection evaluation; Residence time; Seasonal variation	19
#3	2015	Nutrients	Nutrients; Space distribution; HaiZhou bay; Image processing; Surface sediment	18
#4	2009	Acoustic taming	Acoustic taming; Aggregation rate; Reaction time; *Red sea bream*	11
#5	2017	Community structure	Community structure; Hypoxia; Environmental factor; Phytoplankton; Species diversity	10
#6	2012	Fishery resources	Fishery resources; Freshwater Ranch; Sea Surface Temperature; Application prospect; Sound induced fishing technology	9
#7	2008	Cage culture	Cage culture; Fishery development; Operating fishing grounds; Formula feed; Fishery environment	9
#8	1993	Changhai County	Changhai County; Raft cultivation; Implementation stage; 3D development; Artificial reefs	6
#9	1997	Island economy	Island economy; Tourism; Development of marine oil and gas resources; Changshan islands	6

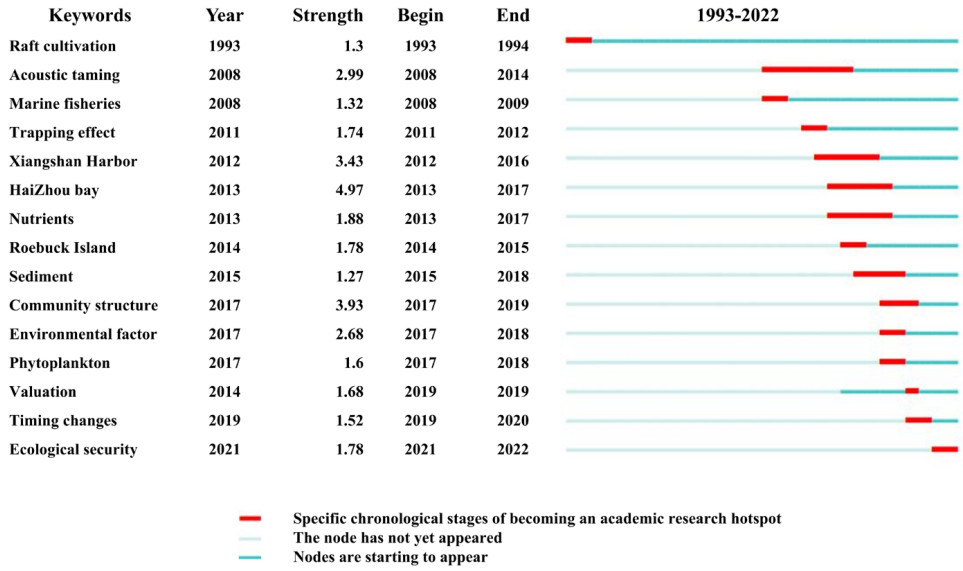

Figure 11. Top 15 keywords with the strongest citation bursts in the CNKI in the field of "Marine Ranching" research.

Similarly, research on marine ranching in China can be divided into three stages and combined with visual mapping for keyword analysis.

Stage 1 (1992–2010): Previous studies have focused on technical aspects and related areas of fisheries resources; key words include "Acoustic taming, Aggregation rate, Raft cultivation, Artificial reefs" etc. in Acoustic taming (#4), Changhai County (#8), and Island economy (#9). The early construction of traditional marine ranching was mainly based on artificial reefs and marine biological proliferation and release. At this time, it was mainly in the stage of single ecological engineering construction, and there was still a lack of experience and clear concepts for the systematic and scientific management of marine ranching. Chen [6,79] put forward the concept of "modern marine ranch" for the first time in China, and then created a new opportunity for the development of marine ranching.

Stage 2 (2011–2015): Chinese scholars were the first to propose the construction concept of "modern marine ranching" through the construction of modern marine ranching to realize the transformation from traditional fisheries to modern fisheries, as well as the transformation of marine fishery production modes from consumption of aquatic resources to resource management. Keyword clustering in the CNKI in the field of marine ranching research include Stock enhancement (#1), Numerical simulation (#2), Nutrient salts (#3), and Fishery resources (#6) (Table 2). The rapid development of modern science and technology provides support and assistance, which is conducive to improving the survival rate of seedlings and improving the marine ecological environment. In 2015, China's Ministry of Agriculture organized the establishment of a national marine ranching demonstration area to promote the construction of marine ranching. At this time, promoting the construction of marine ranching played an important role in the protection of regional fishery resources, ecological environment protection, and comprehensive development of fisheries.

Stage 3 (2016–present): At this stage, the modern management of marine ranching in China began to take a systematic, scientific, and standardized development path, based on the Artificial reefs (#0) and Community structure (#5) clusters, and their keywords, which include artificial reefs, community structure, environmental factors, nutrients, species diversity, etc. The utilization of marine biological resources also focuses on the restoration of marine ecosystems to achieve healthy and sustainable development of the marine economy (Table 4). According to the list of seven batches of national marine ranching demonstration areas released from 2015 to 2022, a total of 153 areas were counted, which are shown in Tables 5 and 6. The distribution shows that the regional development of marine ranching is more in the north than in the south, and the north is fast and the south is slow [29,80]. At present, there are mainly three types of national marine ranching demonstration areas, such as protection, recreation, and enrichment type. Among them, northern ranching represented by Shandong, Liaoning, and Hebei Province mainly use enterprises as the main body of investment and construction to develop sea cucumbers, abalones, sea urchins, and other sea treasures. This shows the development of new marine ranching is focused on increasing breeding and emphasizing economic benefits. In the south, the government is the main body of investment and construction management, carrying out the construction of protected marine ranching. The reason for this is government policy.

Table 5. Statistical analysis of China's national-level marine ranching demonstration areas.

Region	Number (pcs)	Percentage (%)	Area of Sea Area Involved (ha)	Percentage (%)
Shandong Province	59	38.56	43,428.9144	17.32
Liaoning Province	34	22.22	25,601.2664	10.21
Hebei Province	19	12.42	9867.818	3.94
Guangdong Province	15	9.80	125,045	49.88
Zhejiang Province	11	7.19	17,092.8178	6.82
Guangxi Zhuang Autonomous Region	4	2.61	16,779.3	6.69
Hainan Province	4	2.61	462.4317	0.18
Jiangsu Province	3	1.96	7778.626	3.10
Fujian Province	2	1.31	839.3623	0.33
Shanghai City	1	0.65	1440	0.57
Tianjin City	1	0.65	2360	0.94

Table 6. Scale analysis of China's national-level marine ranching demonstration areas.

Marine Ranching Area (ha)	Number (pcs)	Percentage (%)
≤1000	120	78.43
1000~2000	13	8.50
2000~3000	6	3.92
≥3000	14	9.15

3.7. The Evolution of China's National Policies on Marine Ranching in Stages

The keywords were extracted from the policies related to marine ranching issued by China in the past two decades from 2001 to 2022 and collated into Appendix A.

The establishment of marine ranching demonstration areas is mainly based on artificial reefs as a carrier, bottom seeding, and enrichment as a means, supplemented by enrichment and artificial reef operation [81]. In the initial stage of the development of marine ranching, it shows that the policy is dominated by the Chinese government and relatively single. At this time, the government uses economic and environmental policies to create a good ecological environment for the development of marine ranching, then enforces them through laws to strengthen ecological protection and rational use of aquatic biological resources and promote the development of recreational fisheries. As China enters the economic period of the "Twelfth Five-Year Plan", marine economy and ecology are highly valued. The country has promulgated a number of policies and provided special funds, which has made great progress in the scientific research results of marine ranching in recent years.

From 2016 to now, marine ranching in China has been showing a stage of rapid development. The marine ranching policy shows that it is more professional, and the system is gradually improving. Targeted policies focus on the systematic organization and management of marine ranching development. At this time, the construction of marine ranching is mainly in the form of regional comprehensive development. Once again, artificial fish reefs are used as the carrier, bottom seeding and enrichment are used as means, and enrichment and release are supplemented to actively develop aquaculture. It also drives the development of leisure fishing and other industries, increases employment opportunities for fishermen, raises their income, and boosts the economy of fishing areas [82]. The most important policy provisions at this stage include the establishment of marine ranching demonstration areas, which involves strengthening marine technology innovation and providing technical standards and management regulations for artificial reefs. At this stage, the government's key policies focus on how to promote the "modernization and intelligence" of marine ranching [83–85].

We compare and analyze the keywords compiled by the CNKI, WoS, and China Policy, and plotted the Alluvial diagram (Figure 12). In terms of keyword correlation, the most relevant Chinese policies in the WoS and CNKI focus on Stock Enhancement, Artificial Reef, Fishery Resources, and Modern Marine Ranching. The current situation of marine ranching shows that stocking and artificial reefs are still very key measures in the development of marine ranching, and in recent years various countries have also been seeking new directions in the development of marine ranching, including the development of recreational fishing, the use of new energy from offshore wind power, and the development of experiments in complementary fishing and light technologies. Collectively, the development trend for marine pastures is towards modernization, sustainability, and high efficiency.

Figure 12. Correlation diagram between the WoS and CNKI and the three keywords of the China policy.

4. Discussion

The CNKI and WoS core databases are currently the most mainstream and authoritative academic information databases in Chinese and English. Using them as the data collection platform for articles can ensure the richness and professionalism of the article database sources. CiteSpace is the software most commonly used by researchers in bibliometric analysis, and its own functions are relatively complete. Through data conversion, the software can successfully export Chinese and English literature data. In the whole process of building a knowledge graph, the processing of each step can meet the needs of different researchers. In addition, the software also focuses on functional upgrading and innovation, and constantly releases new versions for free use by researchers [86]. The data were therefore analyzed using CiteSpace software to ensure that the knowledge graph presented from different perspectives was diverse.

Combining the above analysis, the WoS and CNKI databases were cross-referenced, tallied, and collated into Appendix B. In terms of the number of articles issued, China's research on marine ranching started late, so there were fewer academic results in the early stages. Comparing the number of articles published in the early years (1993–2010), the international average was 12.47 articles per year, compared to 1.39 articles in China. Due to the huge economic and ecological benefits generated by marine ranching, China has also gradually conducted in-depth research on marine ranching after exploration, and the popularity has been rising. After a five-year exploration period (2011–2015), China absorbed the successful international case experiences and gradually developed the advantages of China's marine ranching resources [13,14], at which time the number of publications showed a rapid upward trend compared with the previous period. After 2016, the annual average number of articles issued by the CNKI exceeded that of the WoS.

When analyzed in terms of the distribution of authors and institutions, Chinese research is generally led by more experienced scholars in the academic field, with several research scholars joining together to form research teams and relying on research institutions in universities to conduct experimental research and thus produce academic results. The analysis in the WOS shows that, typically in Europe and the US, research institutions are particularly well connected to each other and have abundant research resources and substantial financial support, so that most produce research results in institutional form.

Marine ranching is influenced by the marine environment, and China has a natural geographical location advantage, with vast sea areas and rich island resources, which is conducive to the large-scale development of marine ranching and obvious marine economic benefits. The construction of national-level marine ranching demonstration zones has promoted the vigorous development of marine ranching across the country. Although the construction of China's marine ranching has begun to bear fruit, there are still many pressing problems to be solved in terms of the comprehensive benefits of modernized marine ranching, the technical system, and the integrated development model.

Intensive and economical use of the sea and improving the efficiency of sea space use are important ways for the sustainable, efficient, green, and high-output development of the marine industry. This involves adhering to land and sea coordination, based on the "comprehensive" protection and development of coastal and inland waters, using land and sea coordination to help upgrade marine ranching, relying on island and reef resources to develop leisure marine ranching, and paying attention to the protection of island and reef resources. In inland waters, we will explore and promote the construction of ecological pastures with the goal of fish farming and resource conservation. On the basis of actively repairing and maintaining the ecological environment of marine ranching, the development model of marine ranching continuously improves the integration level of the first, second, and third industries of marine fisheries, thereby promoting the modernization of "whole region" marine ranching and the coordinated and sustainable development of the entire industry chain.

Many countries with developed fishery economies have sound regulatory systems, apply scientific and standardized management, produce advanced scientific research results, and have extensive and in-depth multi-level participation from the government to the private sector [87–89]. At present, there are few studies related to the combination of marine ranching and recreational fishery in China, and relevant laws and regulations still need to be improved. At this critical moment of transformation, it is necessary to learn more from the advanced experience of many countries and to enhance the management model according to local conditions [62,90].

In terms of development direction, the national marine ranching development policy in the past two decades is sorted out, and the scientific research status, research hotspots, and policy development trends of marine ranching are comprehensively analyzed. The development of marine ranching in China can be divided into three stages. The early development was mainly based on artificial reefs and marine biological proliferation and release. In the second stage, the Ministry of Agriculture of China organized the establishment of a national marine ranching demonstration area to promote the construction of marine ranching. Under the guidance of clear policies, it is very important to promote the construction of marine ranching. Some policies have played an important role in protecting regional fishery resources, protecting the ecological environment, and comprehensively developing fisheries. From the third stage to the present, with the support of policies, this period can be called the modern management of China's marine ranching. Obviously, China's marine ranching has begun to follow a systematic, scientific, and standardized development path. According to the list of seven batches of national marine ranching demonstration areas released, a total of 153 areas have been counted. The national marine ranching demonstration areas mainly include three types: protection type, recreational type, and enrichment type. The marine ranching in the north mainly used enterprises as the main body of investment and construction to develop sea cucumbers, abalones, sea

urchins, and other sea treasures. The development of these marine ranching areas mainly focuses on breeding and emphasizes economic benefits. The marine ranching in the south takes the government as the main body of investment, construction, and management, mainly to carry out the construction of marine ranching protection areas.

China's construction of marine ranching is currently dominated by comprehensive regional development. Once again, artificial reefs are used as a carrier, bottom-seeding is used as a means of breeding, and breeding and releasing is used as a supplement to actively develop aquaculture, while at the same time promoting the development of recreational fisheries and other industries [82]. The Chinese government focuses on the development of "ecological, precise, intelligent, and integrated" and modernized "all-area" marine ranching. In recent years, the research direction of China's marine ranching has always followed the national policy, intelligent marine ranching will become the latest research hotspot, and the future development trend of marine ranching will take the road of ecological sustainable development [6,85,91].

Due to the late start of the development of marine ranching in China, there are problems in the supervision system and connotation definition. In addition to scientific and reasonable planning, the construction of marine ranching also needs national policy guidance and support [17]. Scholars believe that reasonable planning should be made in consideration of the geographical location of coastal provinces and cities, the quality of the marine environment, the status of biological resources, and the socioeconomic status [92]. The management of marine ranching horizontally involves multiple sectors and vertically involves different levels, and there are management overlaps, gaps, and even conflicts. Based on this, some scholars have proposed that the policy design of marine rangeland should gradually evolve from a single subject and simple structure to a diversified policy with specialized content. However, there is a need for further in-depth discussion on how to determine the functions of different sectors such as fisheries, natural resources, and ecology, and how to establish a management and service system in which each sector has its own responsibilities and division of labor is assisted. In addition, the government needs to make full use of the existing fishery development subsidy policy to guide the acceleration of the integration of the marine ranching industry with the capital market. Finally, under the premise of scientific and technological support, we believe that it is still necessary to improve the construction of the marine ranching detection network and safety early warning system, use modern information technology and big data platforms to realize dynamic supervision, and enhance the scientific nature of administrative law enforcement of marine ranching.

In the course of the research, due to the limitation of the research method, some problems were encountered. For example, in order to ensure the validity of the content of the analyzed documents, it was necessary to manually screen and eliminate invalid documents when selecting the analysis samples. Therefore, in the case of a large number of documents, the workload was relatively large. Secondly, when running the CiteSpace software, it was necessary to manually adjust the interface to ensure the intuitive visualization of the graphics. The biggest challenge lies in the collection of policy documents. For example, early policies are difficult to find on official government websites, and some documents have passed their release deadlines and cannot be searched. The solution was to search only by mentions in other published literature and offline paper literature.

5. Conclusions

This paper is based on bibliometric analysis of two databases, the CNKI and WoS, 293 and 522 academic journal papers were retrieved from the core databases of the CNKI and WoS, respectively. The data sources are complete, systematic, cutting-edge, and highly authoritative. A comprehensive analysis was conducted using three methods: bibliometric analysis, CiteSpace software visualization analysis, and an Excel data perspective, and presented in the form of visual charts and data graphs. This study systematically compared and analyzed the publication volume, authors, research institutions, keyword clustering,

keyword time graphs, and prominent works of literature. The following conclusions were drawn.

The publication volume of marine ranching is on the rise. Whether it is China or other countries in the world, the research enthusiasm and attention to marine ranching continue to rise. From the distribution of authors and research institutions, research institutions in European and American countries are particularly closely connected, and most of the research results are produced in the form of institutions. Research in China is generally led by experienced scholars in the academic field. Several researchers have formed a research team, relying on university research institutions to conduct experimental research and produce academic results. In the keyword clustering and time map, the earlier countries in marine ranching research focused on species research and technology application. However, China's research started relatively late, taking advantage of local resources, actively restoring and maintaining the ecological environment of marine ranching, and promoting the coordinated and sustainable development of modernized regions and the entire industrial chain of marine ranching.

The development of marine ranching cannot be separated from the guidance and support of the government. This paper combed China's marine ranching development policy in the past 20 years and studied the development trend of China's marine ranching from the policy perspective, and concluded that China's marine ranching construction is currently based on the comprehensive development of the region. Secondly, artificial reefs are used as a carrier, seedling placement is used as a means, and stocking and releasing is used as a supplement to actively develop aquaculture, while promoting the development of leisure fisheries and other industries. The Chinese government focuses on the development of modernized "all-area" marine ranching that are "ecological, precise, intelligent, and integrated". Intelligent marine ranching will become the latest research hotspot, and the future development trend of marine ranching will take a path of ecological sustainable development.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Relevant National Policies and Content of Marine Ranching

Policy	Year	Policy Documents	References to Marine Ranching	Keywords
1	2001	*Aquatic Seedstock Management Methods*	According to the development of aquaculture production needs, natural conditions, and characteristics of germplasm resources, promotes the reasonable layout and construction of aquatic original seed farms.	stock enhancement
2	2006	*Outline of Action for the Conservation of Aquatic Resources in China*	Actively promotes the construction of marine ranching as the main form of regional integrated development, and the establishment of marine ranching demonstration areas.	establish demonstration area
3	2009	*Aquatic Life Value Added Release Management Regulations*	Increases the investment in aquatic life stocking, and actively guides, and encourages social funds to support the cause of aquatic life resources conservation and stocking.	aquatic resources conservation, stock enhancement
4	2012	*Approval of the State Council on the National Marine Functional Zoning (2011–2020)*	Strengthens the conservation of important fishery resources, builds modern marine ranching, actively carries out the increase of drift, strengthens ecological protection, and develops ecological tourism on islands.	conservation of fishery resources, stock enhancement, ecotourism
5	2013	*Several Opinions of the State Council on Promoting the Sustainable and Healthy Development of Marine Fisheries*	Develops marine ranching, strengthens the placement of artificial reefs, increases the efforts of fishery resource enhancement and release, and scientifically assesses the effect of resource enhancement and protection.	marine ranching, Artificial reef, stock enhancement
6	2015	*Opinions of the General Office of the State Council on Accelerating the Transformation of Agricultural Development*	Carries out environmental surveys of fishery resources, increases the efforts to increase the release of water, and strengthens the construction of marine ranching.	stock enhancement
7	2015	*Notice of the State Council on the Issuance of the National Plan for the Main Functional Zones of the Ocean*	Promotes the development of fishery facilities, expands deep-water aquaculture, and promotes the construction of marine ranching as the main form of integrated regional development.	facility fishery, deep-water aquaculture, marine ranching
8	2015	*The Ministry of Agriculture's Guidance on Accelerating the Transformation and Restructuring of Fisheries*	Actively carries out aquatic life increase and release, and accelerates the construction of artificial reefs and marine ranching.	fishery resources, stock enhancement, artificial reef, marine ranching
9	2016	*Notice of the State Council on the Issuance of the National Agricultural Modernization Plan (2016–2020)*	Promotes the sustainable use of fishery resources, expands the scale of aquatic life increase and release, and promotes the construction of artificial reefs, marine ranching.	fishery resources, stock enhancement, artificial reef, marine ranching
10	2017	*Notice of the Ministry of Agriculture on the Issuance of the Thirteenth Five-Year Plan for National Fisheries Development*	Supports the construction of national marine ranching demonstration areas, and formation of a series of artificial reef areas, seaweed fields, and sea grass beds along the coast.	marine ranching, artificial reef, seaweed farm, seaweed bed
11	2017	*Opinions of the Central Committee of the Communist Party of China State Council on Deepening the Structural Reform of the Agricultural Supply Side and Accelerating the Cultivation of New Dynamic Energy for Agricultural and Rural Development*	Supports intensive seawater healthy farming and the development of modern marine ranching, and accelerates regional concerted protection and reasonable control of offshore fishing.	intensification, modern marine ranching, inshore fishing
12	2018	*Opinions of the Central Committee of the Communist Party of China State Council on the Implementation of Rural Revitalization Strategy*	Coordinates the development of marine fishery resources and the construction of modern marine ranching.	fishery resources, modern marine ranching
13	2018	*Opinions of the Central Committee of the Communist Party of China State Council on Comprehensively Strengthening Ecological Protection and Resolutely Fighting the Battle of Pollution Prevention and Control*	Strengthens the construction of marine ranching, and increases the fishery resources to increase the release.	marine ranching, fishery resources, stock enhancement
14	2018	*Opinions of the Ministry of Agriculture and Rural Affairs on the Further Promotion of Ecological Environmental Protection*	Vigorously implements the increase in stocking, and strengthens the construction of marine ranching.	stock enhancement, marine ranching
15	2019	*Opinions of the Central Committee of the Communist Party of China (CPC) and the State Council on adhering to the priority development of agriculture and rural areas and doing a good job in the "three rural areas"*	Reasonably determines the scale of inland water aquaculture, reduces overly dense net box farming in offshore, lakes, and reservoirs, and promotes the construction of marine ranching.	breeding scale, marine ranching
16	2020	*National Marine Ranch Demonstration Area Management Specification*	Creates fishery-related work with mariculture, recreational fishing, the conversion of fishing fishermen, the transformation of fishing vessels, and the management of fishing-related "three noes" vessels, and constructs protected areas to proliferate and release water, etc., and to improve the comprehensive benefits of the demonstration area.	mariculture, leisure fishery, transfer from production to business
17	2021	*Opinions of the Central Committee of the Communist Party of China on Comprehensively Promoting the Revitalization of the Countryside and Accelerating the Modernization of Agriculture and Rural Areas*	Strengthens the construction of marine fisheries' biological germplasm resources.	biological germplasm resource bank
18	2022	*Opinions of the Central Committee of the Communist Party of China and the State Council on the Key Efforts to Comprehensively Promote Rural Revitalization in 2022*	Strengthens the conservation of aquatic organisms, and regulates the increase in stocking.	aquatic biological conservation, stock enhancement

Appendix B. Comparison Chart of CNKI and WoS Data

Database	Development Stage	Average Number of Articles Published (Articles)	Principal Author	Main Institutions	Main Clusters	Main Keywords
WoS	1993–2009	12.47	Fleming I. A.; Gross M. R.; Aulerich R. J.; Bursian S. J.; Jonasson J.; Cotter D.; Taylor Matthew D.; Hafsteinsson H.; Blankenship H. Lee; Buchmann K.;	Japan Fisheries Research & Education Agency (FRA); Norwegian Institute Nature Research; Institute of Marine Research—Norway; National Oceanic Atmospheric Admin (NOAA)—USA; Ifremer; Marine Institute Ireland; Stockholm University; Consejo Nacional de Investigaciones Científicas y Técnicas, (CONICET); Chinese Academy of Fishery Sciences; Consultative Group for International Agricultural Research (CGIAR);	Oncorhynchus kisutch; Homarus gammarus L; Salmo trutta; Shear force; Community; Restocking;	Atlantic salmon; salar 1; predation; behavior; coho salmon; brown trout
	2010–2022	22.46	Barki Assaf Bott Nathan J. Zion Boaz Bjornsson Bjorn Taylor Matthew D. Loneragan Neil R. Yuan-Wei Du Xiao-Le Wan Da-She Li Xuan Zhang	James Cook University; Volcani Institute of Agricultural Research; Murdoch University; Chinese Academy of Sciences; NSW Department of Primary Industries; Yantai Institute of Coastal Zone Research; Ocean University of China; Laoshan Laboratory; Zhejiang University; Institute of Oceanology; South China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences;	Sea ranching On fisheries ecology Marine ranching	sea ranching; growth; survival; Echinodermata; stock enhancement; artificial reefs; fishery; variability; management
CNKI	1993–2010	1.39	Peimao Chen Guosheng Zhang Liming Shu Xiao-Ping Jia Yanbo Zhou	Fisheries College, Ocean University of China; Management College, Ocean University of China; College of Marine Sciences Shanghai ocean University; Liaoning Marine Ranch Engineering Technology Research Center of Dalian Ocean University;	Changhai County; Island economy; Cage culture; Acoustic taming;	raft cultivation; acoustic taming; marine fisheries
	2011–2015	10.8	Shou-Yu Zhang Chuan-Xin Qin Xue Feng Huarong Yuan Jing Yu Qiang Xu Shuo Zhang Tao Tian Yong Chen	College of Engineering Science and Technology, Shanghai Ocean University; Institute of Oceanology, Chinese Academy of Sciences; East China Sea Fisheries Research Institute; Key Laboratory of Sustainable Exploitation of Oceanic Fisheries Resources, Ministry of Education; Shanghai Ocean University;	Fishery resources; Stock enhancement; Numerical simulation; Nutrients;	trapping effect; Roebuck Island
	2016–2022	30.29	Hong-Sheng Yang Fei Tong Liyuan Sun Zi-Zhou Liu Fang-Guo Zhai Yan-Zhen Gu	University of Chinese Academy of Sciences; College of Marine Ecology and Environment Shanghai Ocean University; Center for Ocean Mega-Science, Chinese Academy of Sciences; School of Oceanography and Atmosphere Sciences, Ocean University of China; Shandong Aquatic Biological Resource Conservation and Management Center; School of Oceanography, Zhejiang University;	Artificial reefs Community structure	Xiangshan Harbor; HaiZhou Bay; Nutrients; sediment; community structure; environmental factor; phytoplankton; valuation; timing changes; ecological security

References

1. Jackson, J.B.; Kirby, M.X.; Berger, W.H.; Bjorndal, K.A.; Botsford, L.W.; Bourque, B.J.; Bradbury, R.H.; Cooke, R.; Erlandson, J.; Estes, J.A.; et al. Historical overfishing and the recent collapse of coastal ecosystems. *Science* **2001**, *293*, 629–637. [CrossRef] [PubMed]
2. Benjamin, S.H.; Shaun, W.; Kimberly, A.S.; Carrie, V.K.; Fiorenza, M.; Caterina, D.; John, F.B.; Kenneth, S.C.; Colin, E.; Helen, E.F.; et al. A global map of human impact on marine ecosystems. *Science* **2008**, *319*, 948.
3. Douglas, J.M.; Malin, L.P.; Stephen, R.P.; James, A.E.; Francis, H.J.; Robert, R.W. Marine defaunation: Animal loss in the global ocean. *Science* **2015**, *347*, 1255641.

4. Taylor, M.D.; Chick, R.C.; Lorenzen, K.; Agnalt, A.L.; Leber, K.M.; Blankenship, H.L.; Haegen, G.V.; Loneragan, N.R. Fisheries enhancement and restoration in a changing world. *Fish Res.* **2017**, *186*, 407–412. [CrossRef]
5. Kenneth, A.R. Stock enhancement and sea ranching: Developments, pitfalls and opportunities. *Fish Fish.* **2005**, *6*, 279.
6. Chen, Y. Research and construction of modern marine ranching in China: A review. *J. Dalian Ocean Univ.* **2020**, *35*, 147–154. (In Chinese)
7. Yang, J.; Wang, W. Building marine ranching to revitalize the marine fisheries economy. *Ocean Dev. Manag.* **2011**, *28*, 126–129. (In Chinese)
8. Kitada, S. Economic, ecological and genetic impacts of marine stock enhancement and sea ranching: A systematic review. *Fish Fish.* **2018**, *19*, 511–532. [CrossRef]
9. Zion, B.; Karplus, I.; Barki, A. Ranching acoustically conditioned fish using an automatic fishing machine. *Aquaculture* **2012**, *330*, 136–141. [CrossRef]
10. Ma, J.Y.; Yang, J.M. Marine ranch studies in Japan. *Mar. Sci.* **1994**, *3*, 22–24. (In Chinese)
11. Qin, M.; Yue, C.X.; Du, Y.W. Evolution of China's marine ranching policy based on the perspective of policy tools. *Mar. Policy* **2020**, *117*, 103941. [CrossRef]
12. She, Y.A. Analysis of the development of marine ranching in Korea and Japan and the need for this work in China. *China Fish.* **2008**, *3*, 22–24. (In Chinese)
13. Yu, P.M.; Zhang, X.M. Inspiration from the construction of Japanese and American Artificial reef to China. *Fish. Modernization* **2006**, *2*, 6–7. (In Chinese)
14. Yang, J.L.; Wu, X.Y.; Shi, G.F.; Chen, Y. Overview of marine ranching technology. *Chin. Fish. Econ.* **2004**, *5*, 48–50. (In Chinese)
15. Bell, J.D.; Leber, K.M.; Blankenship, H.L.; Loneragan, N.R.; Masuda, R. A new era for restocking, stock enhancement and sea ranching of coastal fisheries resources. *Rev. Fish. Sci.* **2008**, *16*, 1–9. [CrossRef]
16. Lorenzen, K.; Leber, K.M.; Blankenship, H.L. Responsible approach to marine stock enhancement: An update. *Rev. Fish. Sci.* **2010**, *18*, 189–210. [CrossRef]
17. Dai, W.Q. Research on legal issues related to the construction of marine ranching. *Econ. Res. Guide* **2020**, *18*, 193. (In Chinese)
18. Kim, D.H.; Seung, C.K.; Seo, Y.I. Multi-regional economic impacts of recreational fisheries: Analysis of small sea ranch in Gyeong-Nam Province, Korea. *Mar. Policy* **2017**, *84*, 90–98. [CrossRef]
19. Han, L.M. The overseas advanced experience for reference about construction of "The blue granary". *J. Ocean Univ. China* **2012**, *2*, 45–49. (In Chinese)
20. Chen, S.Z. Several inspirations from the development of modern fisheries in South Korea. *Dev. Res.* **2009**, *12*, 47–50. (In Chinese)
21. Yang, H.S.; Zhang, S.Y.; Zhang, X.M.; Chen, P.M.; Tian, T.; Zhang, T. Strategic thinking on the construction of modern marine ranching in China. *J. Fish. China* **2019**, *43*, 1255–1362. (In Chinese)
22. Li, Z.Y.; Lin, Q.; Li, J.; Shan, X.J. Present situation and future development of marine ranching construction in China. *J. Fish. China* **2019**, *43*, 1870–1880. (In Chinese)
23. Zeng, C.K. Some issues concerning the agricultural and pastoral production of aquatic products in China's exclusive economic sea area. *Resour. Sci.* **1979**, *1*, 58–64. (In Chinese)
24. Zhang, S.S. On the theory and technology of the marine propagated fisheries. *J. Fish. China* **1983**, *7*, 279–285. (In Chinese)
25. Lu, Z.K. Status, problems and countermeasure for exploitation and research of marine ranching in China. *Fish. Inf. Strategy* **1995**, *10*, 6–9. (In Chinese)
26. Zeng, C.K.; Mao, H.L. The development, current situation, and prospects of oceanography. *Chin. Sci. Bull.* **1965**, *10*, 876–883. (In Chinese)
27. Yang, H.S. Construction of marine ranching in China: Reviews and prospects. *J. Fish. China* **2016**, *40*, 1133–1140. (In Chinese)
28. Chen, P.M.; Shu, L.M.; Yuan, H.R.; Feng, X.; Tong, F.; Chen, Q.; Chen, Y.X.; Yu, J.; Zeng, L.; Li, X.G. Review on development, definition and classification of marine ranching in domestic and overseas. *J. Fish. China* **2019**, *43*, 1851–1869. (In Chinese)
29. Notice of the Ministry of Agriculture on Issuing the Construction Plan for National Marine Ranch Demonstration Zone (2017–2025). Available online: https://www.gov.cn/gongbao/content/2018/content_5277757.htm (accessed on 19 June 2023).
30. Zuccala, A. Inciting the metric oriented humanist: Teaching bibliometrics in a faculty of humanities. *Educ. Inf.* **2016**, *32*, 149–164. [CrossRef]
31. Rousseau, S.; Rousseau, R. Being metric-wise: Heterogeneity in bibliometric knowledge. *Prof. Inf.* **2017**, *26*, 480–487. [CrossRef]
32. Mejia, C.; Wu, M.; Zhang, Y.; Kajikawa, Y. Exploring topics in bibliometric research through citation networks and semantic analysis. *Front. Res. Metr. Anal.* **2021**, *6*, 742311. [CrossRef]
33. Van Eck, N.J.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2010**, *84*, 523–538. [CrossRef]
34. Koo, M. A bibliometric analysis of two decades of aromatherapy research. *Bmc Res. Notes* **2017**, *10*, 46. [CrossRef]
35. Chen, C.M. CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *J. Am. Soc. Inf. Sci. Technol.* **2006**, *57*, 359–377. [CrossRef]
36. Chen, Y.; Chen, C.M.; Liu, Z.Y.; Hu, Z.G.; Wang, X.W. The methodology function of CiteSpace mapping knowledge domains. *Stud. Sci. Sci.* **2015**, *33*, 242–253. (In Chinese)
37. Notice of the Ministry of Agriculture on Issuing the 12th Five Year Plan for National Fisheries Development. Available online: http://www.moa.gov.cn/nybgb/2011/dshiq/201805/t20180523_6142898.htm (accessed on 19 June 2023).

38. Du, Y.W.; Fang, J.; Wang, P. Ecological security evaluation of marine ranching based on DEMATEL-Fuzzy comprehensive evaluation. *Math. Probl. Eng.* **2021**, *2021*, 6688110. [CrossRef]
39. Du, Y.W.; Zhang, S.T. PLTS/DEMATEL-based key policy factor identification for marine fisheries management in China. *Reg. Stud. Mar. Sci.* **2022**, *54*, 102464. [CrossRef]
40. Du, Y.W.; Jiang, J.; Li, C.H. Ecological efficiency evaluation of marine ranching based on the Super-SBM model: A case study of Shandong. *Ecol. Indic.* **2021**, *131*, 108714. [CrossRef]
41. Du, Y.W.; Gao, K. Ecological security evaluation of marine ranching with AHP-entropy-based TOPSIS: A case study of Yantai, China. *Mar. Policy* **2020**, *122*, 104223. [CrossRef]
42. Du, Y.W.; Sun, X.L. Influence paths of marine ranching ecological security in China based on probabilistic linguistic term sets and qualitative comparative analysis. *Int. J. Fuzzy Syst.* **2021**, *23*, 228–242. [CrossRef]
43. Du, Y.W.; Wang, Y.C. Emergy ecological footprint method considering uncertainty and its application in evaluating marine ranching resources and environmental carrying capacity. *J. Clean. Prod.* **2022**, *336*, 130363. [CrossRef]
44. Lorenzen, K.; Agnalt, A.L.; Blankenship, H.L.; Hines, A.H.; Leber, K.M.; Loneragan, N.R.; Taylor, M.D. Evolving context and maturing science: Aquaculture-based enhancement and restoration enter the marine fisheries management toolbox. *Rev. Fish. Sci.* **2013**, *21*, 213–221. [CrossRef]
45. Loneragan, N.R.; Jenkins, G.I.; Taylor, M.D. Marine stock enhancement, restocking, and sea ranching in Australia: Future directions and a synthesis of two decades of research and development. *Rev. Fish. Sci.* **2013**, *21*, 222–236. [CrossRef]
46. Taylor, M.D.; Brennan, N.P.; Lorenzen, K.; Leber, K.M. Generalized Predatory Impact Model: A numerical approach for assessing trophic limits to hatchery releases and controlling related ecological risks. *Rev. Fish. Sci.* **2013**, *21*, 341–353. [CrossRef]
47. Carcamo, P.F.; Henriquez-Antipa, L.A.; Galleguillos, F.; Figueroa-Fabrega, L.; Taylor, M.D. Marine stocking in Chile: A review of past progress and future opportunities for enhancing marine artisanal fisheries. *Bull. Mar. Sci.* **2021**, *97*, 729–748. [CrossRef]
48. Taylor, M.D.; Hall, K.C.; Johnson, D.D. Effects of spatial management of a penaeid fishery on other target fish species in eastern Australia. *Fish. Manag. Ecol.* **2022**, *29*, 575–585. [CrossRef]
49. Stilwell, J.; Samba, A.; Failler, P.; Laloe, F. Sustainable development consequences of European Union participation in Senegal's marine fishery. *Mar. Policy* **2009**, *34*, 616–623.
50. Liu, S.X.; Wang, K.X.; Dou, L.; Shi, Z.; Li, S.P. Bibliometrics and visualization analysis of pharmacoeconomic evaluation research at home and abroad. *Stud. Sci. Sci.* **2021**, *41*, 2368–2374.
51. Jonsson, B.; Jonsson, N.; Hansen, L.P. Differences in life-history and migratory behavior between wild and hatchery-reared *Atlantic salmon* in nature. *Aquaculture* **1991**, *98*, 69–78.
52. Fleming, I.A.; Gross, M.R. Reproductive behavior of hatchery and wild *coho salmon* (*Oncorhynchus kisutch*): Does it differ? *Aquaculture* **1992**, *103*, 101–121. [CrossRef]
53. Hindar, K.; Ryman, N.; Utter, F. Genetic effects of cultured fish on natural fish populations. *Can. J. Fish. Aquat. Sci.* **1991**, *48*, 945–957. [CrossRef]
54. Stark, E.J.; Atkinson, E.J.; Kozfkay, C.C. Captive rearing for *Chinook salmon* (*Oncorhynchus tshawytscha*) and *Atlantic salmon* (*Salmo salar*): The Idaho and Maine experiences. *Rev. Fish. Biol. Fisher.* **2014**, *24*, 849–880. [CrossRef]
55. Danielsdottir, A.K.; Marteinsdottir, G.; Arnason, F.; Gudjonsson, S. Genetic structure of wild and reared *Atlantic salmon* (*Salmo salar* L.) populations in Iceland. *Ices J. Mar. Sci.* **1997**, *54*, 986–997. [CrossRef]
56. Fleming, I.A.; Jonsson, B.; Gross, M.R. Phenotypic divergence of sea-ranched, farmed, and wild *Salmon*. *Can. J. Fish. Aquat. Sci.* **1994**, *51*, 2808–2824. [CrossRef]
57. Skilbrei, O.T.; Finstad, B.; Urdal, K.; Bakke, G.; Kroglund, F.; Strand, R. Impact of early *salmon* louse, *Lepeophtheirus salmonis*, infestation and differences in survival and marine growth of sea-ranched *Atlantic salmon*, *Salmo salar* L., smolts 1997–2009. *J. Fish. Dis.* **2013**, *36*, 249–260. [CrossRef]
58. Fleming, I.A.; Lamberg, A.; Jonsson, B. Effects of early experience on the reproductive performance of *Atlantic salmon*. *Behav. Ecol.* **1997**, *8*, 470–480. [CrossRef]
59. Craford, S.S.; Muir, A.M. Global introductions of *salmon* and trout in the genus *Oncorhynchus*: 1870–2007. *Rev. Fish. Biol. Fisher.* **2008**, *18*, 313–344. [CrossRef]
60. Niu, M.; Yu, H.J. Hotspots and progresses of foreign marine ranching researches—A visual analysis with CiteSpace. *Chin. J. Oceanol. Limnol.* **2021**, *43*, 93–99. (In Chinese)
61. Hu, G.; Gu, W.; Bai, Q.L.; Wang, B.Q. Research advances in genetics and breeding in *Salmonids*. *Chin. J. Fish.* **2012**, *25*, 58–62. (In Chinese)
62. Ling, S. Lessons from the US recreational fisheries development experience for the Yangtze River Delta. *Chin. Fish.* **2012**, *439*, 46–48. (In Chinese)
63. Li, C.H.; Jia, X.P.; Qi, Z.H.; Liu, Y.; Chen, P.M.; Xu, S.N.; Huang, H.H.; Qin, C.X. Effect evaluation of a low-carbon fisheries production by marine ranching in Daya Bay. *J. Agron. Environ. Sci.* **2011**, *30*, 2346–2352. (In Chinese)
64. Zhao, H.T.; Zhang, Y.F.; Hao, C.L.; Li, Q.X. Sitting and designing of artificial reefs. *J. Mar. Sci.* **2006**, *4*, 69–76. (In Chinese)
65. Wang, B.; Wu, J.P.; Gao, J.; Jia, S.M.; Zhang, C.Q.; Mou, H.T.; Zhang, J.D. An approach to construction of artificial reef to improve the offshore ecology and fishery environments in Qingdao. *Coastal Eng.* **2004**, *4*, 66–73. (In Chinese)
66. Chen, Y.M.; Li, X.J.; Fu, E.B. The future pattern of fishery in China constructing oceanic ranch. *Resour. Dev. Mark.* **2000**, *2*, 78–79. (In Chinese)

67. Announcement No. 2545 of the Ministry of Agriculture of the Ministry of Agriculture of the People's Republic of China. Available online: http://www.moa.gov.cn/govpublic/ncpzlaq/201706/t20170626_5727676.htm (accessed on 19 June 2023).
68. Zhang, G.S.; Tian, T.; Xu, C.C.; Jiang, Z.Y.; Yu, S.L. Increase in feed conversion efficiency in *Sparus macrocephalus* by acoustic behaviors control. *J. Dalian Ocean Univ.* **2004**, *3*, 204–207. (In Chinese)
69. Zhang, G.S.; Gu, X.X.; Xing, B.B.; Han, J.B. The classification and the impact of marine environment noise on marine animals. *J. Dalian Ocean Univ.* **2012**, *27*, 89–94. (In Chinese)
70. Zhang, G.S.; Yang, C.J.; Xing, B.B. A review of fishing technology by acoustic attraction. *J. Dalian Ocean Univ.* **2012**, *27*, 383–386. (In Chinese)
71. Zhang, G.S.; Zhang, P.D.; Chen, Y.; Xu, C.C.; Zhang, S. Acoustic behaviors control of juvenile *Carassius auratus* Linnaeus. *J. Dalian Ocean Univ.* **2022**, *1*, 48–52. (In Chinese)
72. Li, H.Q.; Zhang, G.S.; Li, J.Y.; Xing, B.B.; Zhang, T.; Dong, S.Q.; Wang, Z.Y.; Yin, L.M. Effects of surgically implanted Ultrasonic Pinger on swimming of crucian carp Carassius auratus Linnaeus and incision healing. *J. Dalian Ocean Univ.* **2019**, *34*, 817–821. (In Chinese)
73. Liu, J.; Tang, Y.; Xing, B.B.; Yin, L.M.; Zhuang, X.; Bi, F.Y.; Zhang, G.S. Ultrasonic biotelemetry and its application to modern fishery. *Fish. Mod.* **2018**, *45*, 75–80. (In Chinese)
74. Chen, P.M. Optimum first capture standards of major capture species of the northern South China Sea. *J. Fish. China* **2004**, *4*, 393–400. (In Chinese)
75. Jiang, Y.E.; Chen, P.M.; Lin, Z.J.; Fang, Z.Q. Comparison of effectiveness of various artificial reef materials for fish attraction. *J. Appl. Oceanogr.* **2013**, *32*, 418–424. (In Chinese)
76. Zhou, Y.B.; Cai, W.G.; Chen, H.G.; Chen, P.M.; Jia, X.P. The mechanism and research progress on fish attraction technique for artificial reefs. *Mar. Fish.* **2010**, *32*, 225–230. (In Chinese)
77. Zhou, Y.B.; Cai, W.G.; Chen, H.G.; Chen, P.M.; Lv, G.M.; Jia, X.P. Attraction effect of various artificial reef models on *Sparus macrocephalus*. *J. Fish. China* **2011**, *35*, 711–718. (In Chinese)
78. Zhang, H.M.; Xie, X.Y.; Chen, P.M.; Yuan, H.R.; Feng, X.; Tong, F.; Liu, Y.; Cheng, Z.J.; Zou, J.H.; Chen, Z.C. Study on attraction effect of artificial reefs vertical plate with different square apertures on *Sparus macrocephalus*. *South China Fish. Sci.* **2022**, *18*, 52–58. (In Chinese)
79. Chen, Y.; Yu, C.Q.; Zhang, G.S.; Zhang, S. The environmental function and fish gather effect of artificial reefs. *J. Dalian Ocean Univ.* **2022**, *17*, 64–69. (In Chinese)
80. Luo, G.; Wu, S.S.; Bing, X.W.; Zhang, D.C.; Li, M. Suggestions for high-quality development of marine ranches in China under the new development concept. *China Fish.* **2020**, *2*, 36–39. (In Chinese)
81. Cheng, J.H.; Jiang, Y.Z. Marine stock enhancement: Review and prospect. *J. Fish. Sci. China* **2010**, *17*, 610–617. (In Chinese)
82. Zhang, W.Y. The enlightenment of the development of Japanese fisheries on China's leisure fisheries. *Rural Econ. Sci. Technol.* **2020**, *31*, 79–81. (In Chinese)
83. Yang, H.S.; Ru, X.S.; Zhang, L.B.; Lin, C.G. Industrial convergence of marine ranching and offshore wind power: Concept and prospect. *Bull. Chin. Acad. Sci.* **2019**, *34*, 700–707. (In Chinese)
84. Zhang, T.; Feng, J.; Song, H. Principles and technology of biological resources maintenance in marine ranching. *Sci. Technol. Dev.* **2020**, *16*, 206–212. (In Chinese)
85. Liu, H.; Feng, J.; Zhao, J.M. Research process and perspective on the monitoring and evaluation of marine ranch ecosystem. *Sci. Technol. Dev.* **2020**, *16*, 213–218. (In Chinese)
86. Xiao, M.; Qiu, X.H.; Huang, J.; Li, G.J.; Feng, Z.H. Comparison of software tools for mapping knowledge domain. *Libr. J.* **2013**, *32*, 61–69. (In Chinese)
87. Wang, Y.N.; Han, Y. On international marine fishery resources management system and major policies comparison. *World Agric.* **2018**, *3*, 78–85. (In Chinese)
88. Han, Y.; Rita, C. Key-Policies and implications of marine fisheries resources development in united state. *Issues Agric. Econ.* **2017**, *38*, 103–109. (In Chinese)
89. Yue, D.D.; Wang, L.M.; Geng, R.; Xiong, M.S.; Xiao, L. The common fisheries policy of the European union and enlightenment to China. *J. Shanxi Agric. Sci.* **2015**, *43*, 1523–1530. (In Chinese)
90. Chen, H.F. Insights into the success of recreational fishing in the US and Japan. Leis. *Agric. Beautiful Ctry.* **2013**, *6*, 84–85. (In Chinese)
91. Yang, H.S.; Ding, D.W. Marine ranching version 3.0: History, status and prospects. *Bull. Chin. Acad. Sci.* **2023**, *37*, 832–839. (In Chinese)
92. Du, Y.W.; Cao, W.M. Theoretical framework for the supervision of the ecological security of China's marine ranching. *China Popul. Resour. Environ.* **2013**, *31*, 182–191. (In Chinese)