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Research on the Delimitation of Marine Spatial Pattern Based on the Goal of "Carbon Peaking and Carbon Neutrality"

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Abstract: In the context of carbon peaking and carbon neutrality ("double carbon"), it is urgent to clarify the effect of marine spatial planning (MSP) on carbon sink increases and emission reductions, since such planning acts as a spatial governance tool for the earth's largest carbon pool. In this paper, a linkage model between marine spatial functional zones and carbon distribution is established. To explore the relationship between marine spatial functional zones and carbon, the study analyzed the carbon increase or reduction role of sea-use activities in each zone and considered the carbon sequestration function of the marine ecosystem itself. A marine spatial pattern of "Two Spaces and Four Carbon Areas" is proposed to present the linkage. A carbon distribution pattern in marine space is delimited using the linkage model and the current MSP in the case study of the city of Tangshan, Hebei, China. Some measures have been taken or planned to be taken in Tangshan to improve the carbon sink function of the ecosystem and the marine space. The supporting role of MSP in achieving the "double carbon" goal is studied, and the paths and suggestions for integrating the "double carbon" goal into MSP are explored.

Keywords: carbon peaking and carbon neutrality ("double carbon"); carbon emission reduction; carbon sink increase; marine spatial planning (MSP); marine spatial pattern

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1. Introduction

Since the Industrial Revolution in the 18th century, the environment has been seriously polluted and damaged by mankind continuously improving its ability to develop and utilize natural resources. A large number of greenhouse gases emitted from fossil fuels, such as coal and oil, pose a serious threat to the survival of mankind, as well as to the animals and plants on the earth [1]. Carbon dioxide and other greenhouse gases are increasing, and this has become the main human-caused factor, leading to global warming. In the *State of the Global Climate 2020* released by the World Meteorological Organization (WMO) [2], it is pointed out that global mean temperature is about 1.2 °C warmer than the pre-industrial baseline. Meanwhile, the decade from 2011 to 2020 was the warmest on record. Global temperature rise is causing and will continue to cause unpredictable losses and irreversible changes to human society.

Countries all over the world are aware of the importance of reducing carbon emissions and controlling rising temperatures. Therefore, the adaptation to climate change has been incorporated into policies and plans by an increasing number of countries. By 2021, about 79% of countries had adopted at least one national-level adaptation planning instrument [3]. However, it has been predicted that even under the full implementation of national climate commitments, the best warming estimate by the end of this century is 1.8 °C, a level higher than the target of curbing global warming to below 1.5 °C in this century, as outlined in the Paris Agreement [4]. Additionally, during the middle of the 21st century, the world is predicted to see median-expected peak temperatures of around 1.9 °C, which could lead to disastrous changes in the global climate [5]. Climate change crisis, one of the greatest challenges faced by mankind, should be dealt with through global cooperation [6,7].

At the 75th Session of the United Nations General Assembly on 22 September 2020, President Xi Jinping solemnly proposed to the world that China would scale up its Intended Nationally Determined Contributions by adopting more vigorous policies and measures. China aims to have had their carbon dioxide emissions peak before 2030 and to achieve carbon neutrality before 2060. To achieve this "double carbon" goal is an inevitable pathway to solving the problems of resource and environmental constraints, as well as a solemn commitment to building a human community with a shared future. At the ninth meeting of the Central Committee for Financial and Economic Affairs in March 2021, it was further emphasized that this "double carbon" goal should be integrated into the construction of an ecological civilization. The ecological civilization represents a social status based on the coexistence, sustainability, common development, and long-term prosperity between humans, nature, and society. To enhance the capacity of ecological carbon sinks, territorial spatial planning and use regulation should be strengthened and should effectively play the role of marine carbon sequestration. In the *2021 Government Work Report* [8], the continuous improvement of the environment, the promotion of green and low-carbon development, handling the relationship between development and emission reductions, and ensuring harmony between humanity and nature were proposed.

As a key measure in planning the spatial development and protection pattern as a whole and promoting the construction of ecological civilization, spatial planning is widely considered to be able to effectively regulate greenhouse gas emissions, and thereby helps to achieve the "double carbon" goal, which is also one of the systematic policy tools to coordinate carbon emission reductions and carbon sink increases [6,9–12]. In order to establish a territorial spatial planning system in the new era and implement the "double carbon" goal, the guiding requirements for implementing the task of carbon emission reduction and building a low-carbon city were put forward in the *Guidelines for the Formulation of Municipal Territorial Spatial Total Planning* (*Trial*) [13] issued by the Chinese Ministry of Natural Resources. The *Action Plan for Carbon Dioxide Peaking Before 2030* [14] advocates for green and low-carbon planning and design, as well as the building of a territorial spatial development and protection pattern conducive to achieving the "double carbon" goal by combining the formulation and implementation of territorial spatial planning.

Oceans are the most important carbon sinks on the earth, 23% carbon dioxide emitted from human activities was taken up by the ocean over the past decade (2010–2019) [15]. Oceans play the role as carbon sinks through sequestering carbon dioxide and storing it in their interiors by physical, chemical, and biological processes. There are four main mechanisms that have been known for ocean carbon sequestering, transferring, and storage: solubility pump, biological pump, carbonate pump (carbonate counter pump), and microbial carbon pump [16,17]. The principle of solubility pump is the chemical equilibrium and physical transport of carbon dioxide in seawater. The atmospheric carbon dioxide was dissolved into the surface waters and then is followed by the deep mixing of the carbon dioxide-rich water [16]. The biological pump refers to the photosynthetic uptake of inorganic carbon and synthesis of organic carbon by phytoplankton, and the transformation of this carbon from the surface to the deep sea or the bottom through a series of complex processes, including lysis, grazing, aggregation, respiration, mineralization, and sedimentation [16–19]. The mechanism of the biological pump was used to explain why algae culture have the function of carbon sink, especially the macroalgae culture. The carbonate pump refers to the CaCO3 generation, precipitation, and sedimentation. However, it is also called carbonate counter pump because the process of CaCO3 precipitation will release carbon dioxide. Microbial carbon pump refers to the marine microbial processes of converting active dissolved organic carbon into longer-lived dissolved organic carbon, which is the overall effect of a series of microbial activities.

China has vast offshore waters, rich ecosystems, and huge potential in carbon sequestration and storage [20]. The marine spatial planning (MSP) system allocates marine space as a whole, reasonably distributing industrial development and environmental protection, providing scientific support and a policy basis for marine space use regulation, improving ocean carbon sink capacity from the top-level design level, optimizing the layout and structure of marine industry, and promoting the low-carbon development of the marine industry [21,22]. In the context of "double carbon," it is crucial to focus on the largest carbon pool of the earth [23], i.e., marine space, to study the relationship between MSP and carbon, and to explore the integration of the "double carbon" goal into the MSP system.

Through analyzing the current MSP functional zone system, this paper studies the potential role of MSP on increasing carbon sinks and reducing carbon emissions and analyzes the correlation of MSP and carbon. The main method is to analyze the carbon increase or reduction role of sea use activities in each functional zone and consider the carbon sequestration function of marine ecosystem itself in related functional zones. According to the main roles on carbon increase or reduction in different MSP functional zones, a direct relationship between MSP functional zones and carbon distribution was established as a linkage model to match the MSP functional zones to "Four Carbon Areas" and "Two Spaces" (as shown in Figure 1). The model found that every MSP functional zones could make roles in carbon sink increase and carbon emission reduction. However, it is undeniable that this requires corresponding policies are required to play or enhance the functions on carbon sink increase and carbon emission reduction. Using the linkage model, a marine spatial pattern based on the "double carbon" goal was produced in the example of Tangshan city, Hebei, China. The case study found that high-carbon intensive area occupied the largest area. The corresponding measures and policies could encourage intensive and economical industrial development in these areas to reduce the carbon emissions.

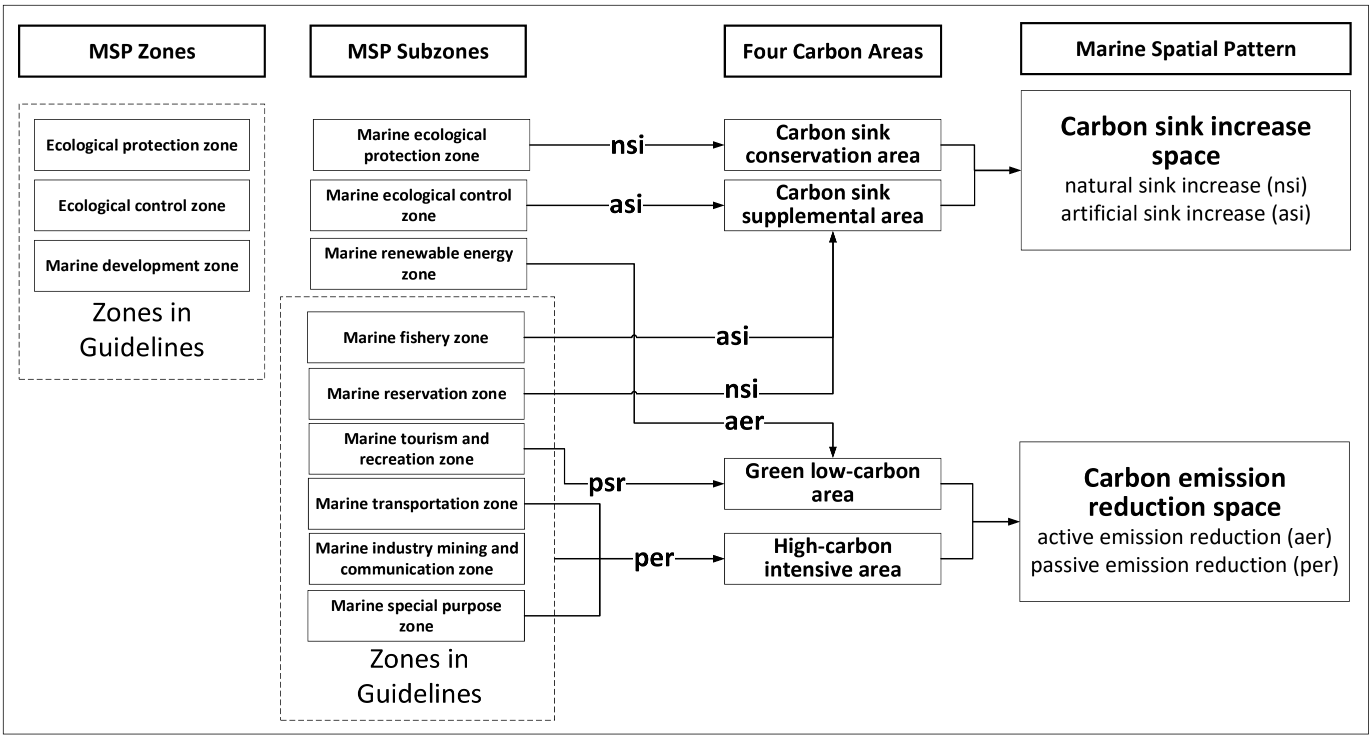

Figure 1. Marine spatial pattern for "Two Spaces and Four Carbon Areas" based on the "double carbon" goal.

According to different marine spatial patterns in different regions, different countermeasures and suggestions could be proposed to increase carbon sinks and reduce carbon emissions, so as to contribute to the "double carbon" goal. Therefore, the paper explored the paths and suggestions for integrating the "double carbon" goal into MSP in terms of the formulation, approval, implementation, and supervision processes. The purposes of the research are to strengthen the integration between MSP and the "double carbon" goal to clear a path for giving increased attention to the function of ocean carbon sinks, to promote carbon emission reduction in the marine industry, and to provide a reference for improving territorial spatial planning systems.

2. Materials and Methods

At present, in the trial guidelines for the Formulation of Municipal Territorial Spatial Total Planning and Guidelines for the Formulation of Provincial Integrated Coastal Zone Protection and Utilization Planning, suggestions on the functional zoning of marine space are put forward. Marine space is recommended to be delimited into three types of zones: an ecological protection zone, an ecological control zone, and a marine development zone. Among these, there are no specific suggestions for subzones of the ecological protection zone and ecological control zone; the marine development zone is suggested to be sub-delimited into a marine fishery zone, a marine transportation zone, a marine industry mining and communication zone, a marine tourism and recreation zone, a marine special purpose zone, and a marine reservation zone. In addition, it is proposed that local governments can supplement types of the subzones according to their actual situation. By optimizing the planning sub-zoning and delimiting the marine spatial pattern based on the “double carbon” goal, a linkage model between marine spatial functional zones and carbon distribution is established; the role of carbon emission reductions and sink increases of MSP is explored, and the differentiated regulations/management suggestions for different carbon areas are proposed in order to promote the low-carbon development of marine space.

2.1. Adding a Marine Renewable Energy Zone

At present, China’s energy structure is dominated by coal, and the use of fossil energy is the main source of carbon emissions. Therefore, an important way to realize green and low-carbon development is to adjust the existing energy structure in a low-carbon way; develop low-emission or non-emission technologies; strengthen the development and utilization of offshore wind power, wave energy, tidal energy, and thermal energy; and gradually increase their proportions in the energy supply structure [24]. Owing to its abundant offshore resources, China’s wind power industry has developed rapidly, and the installed capacity has increased continuously in recent years, making it one of the focuses of new energy development for the future. Characterized by wide sea use area and large-scale development, the present study suggests adding a marine renewable energy zone as a subzone of the marine development zone to reserve space for the layout and development of offshore wind power and marine energy.

2.2. Delimiting the Marine Pattern into “Two Spaces and Four Carbon Areas” Based on the “Double Carbon” Goal

MSP can help achieve the “double carbon” goal largely through carbon emission reductions and carbon sink increases. The former takes “carbon source” as the starting point, and it is necessary to reduce the carbon emissions generated by human activities through structural reform and technological upgrading in energy and industry; the latter takes “carbon sink” as the starting point, and it is necessary to enhance the carbon sequestration capacity of the ecosystem through a series of effective means, such as protection and restoration [25]. Based on the above considerations, the roles of carbon emission reduction and carbon sink increases in marine spatial functional zones are analyzed; the linkage model between marine spatial functional zones and carbon distribution is established; and marine space is partitioned into “Two Spaces and Four Carbon Areas” (as shown in Figure 1). The two spaces include carbon sink increase space and carbon emission reduction space, and the four carbon areas include a carbon sink conservation area, a carbon sink supplemental area, a green low-carbon area, and a high-carbon intensive area. According to the dominant functions, each marine spatial functional zone is classified into the corresponding carbon area, forming a marine spatial pattern of protection, restoration, development, and utilization based on the "double carbon" goal.

According to its source, carbon sink increases can be classified into two approaches: a natural sink increase and an artificial sink increase. In the marine ecological protection zone, marine ecological control zone, and marine reservation zone, the ecosystem can be better restored due to the limitation of human development and utilization activities. Since the carbon sink function of the ecosystem is protected in these zones, the function could fix carbon via natural sink increases. Meanwhile, in the marine ecological control zone, ecological restoration and other projects are also important means to enhance the carbon sink potential and restore the carbon sink function of the ecosystem via artificial intervention. Fishery carbon sinks (such as algae culture, shellfish culture, capture fisheries, and artificial reefs) can give full play to the function of carbon sinks, directly or indirectly absorbing and storing carbon dioxide from water, and thereby reducing the concentration of carbon dioxide in the atmosphere [26]. Therefore, in the delimited marine spatial pattern, the marine fishery zone is classified as a carbon sink supplemental area that can increase carbon sinks through artificial means. In the marine fishery zone, it is necessary to encourage the development of carbon sink fisheries and to develop marine ranching that integrates mariculture, marine resource protection, fishery resource proliferation, sea farming, marine leisure fishing, and other functions [27,28].

Carbon emission reduction can be classified into two types: active emission reduction and passive emission reduction. According to industrial types in the marine development zone, while marine renewable energy belongs to the active emission reduction type, other development modes of marine space belong to the passive emission reduction type and are largely driven by external factors, such as policy regulations, approval restrictions, and environmental assessment constraints. The marine functional zones dominated by renewable energy development, tourism, and recreation are classified into green low-carbon areas due to their relatively low carbon emissions per unit, while the transportation, industry, mining, communication, and special activities, such as sewage discharge and dumping, can give rise to high energy consumption, high levels of pollution, and high carbon emissions. The marine functional zones dominated by such industries are considered to be high-carbon intensive areas. In high-carbon intensive areas, the industrial spatial layout should follow the principles of intensification and conservation. At the government level, adding carbon emission prediction and standard setting to the sea use approval procedure, determining the upper limit of carbon emission for different industries, strengthening the recycling of resources, intensifying the public concept of reducing emissions from the source [6] and standardizing carbon emission rights trading and carbon compensation system. By virtue of increasing the cost of carbon emissions, enterprises with high carbon emissions will be encouraged to upgrade their technologies and to develop and use production modes with low-carbon emissions.

Taking Tangshan, Hebei Province, China as an example, we analyzed the marine development and protection pattern of "Two Spaces and Four Carbon Areas." The data were obtained from the current Tangshan City Marine Functional Zoning. Since the new territorial spatial planning system is under construction, this paper uses the categorization analysis method and the comprehensive analysis method to merge the subzones of Tangshan City Marine Functional Zoning into the established marine spatial Four Carbon Areas to form a marine spatial distribution of carbon. As shown in Figure 2, the distribution of carbon sink increases space and carbon emission reduction space in Tangshan is mostly balanced. With fifty-one percent of its area being high-carbon intensive area, it is indicated that Tangshan needs to encourage intensive and economical industrial development in these areas. The carbon sink supplemental area has the second largest size with a longitudinal zonal distribution; most of this area consists of marine fisheries. The carbon sink conservation areas and green low-carbon areas were primarily distributed in the eastern coastal waters; these comprised a small proportion of the total area of the city, accounting for 2.2% and 3.4% of it, respectively.

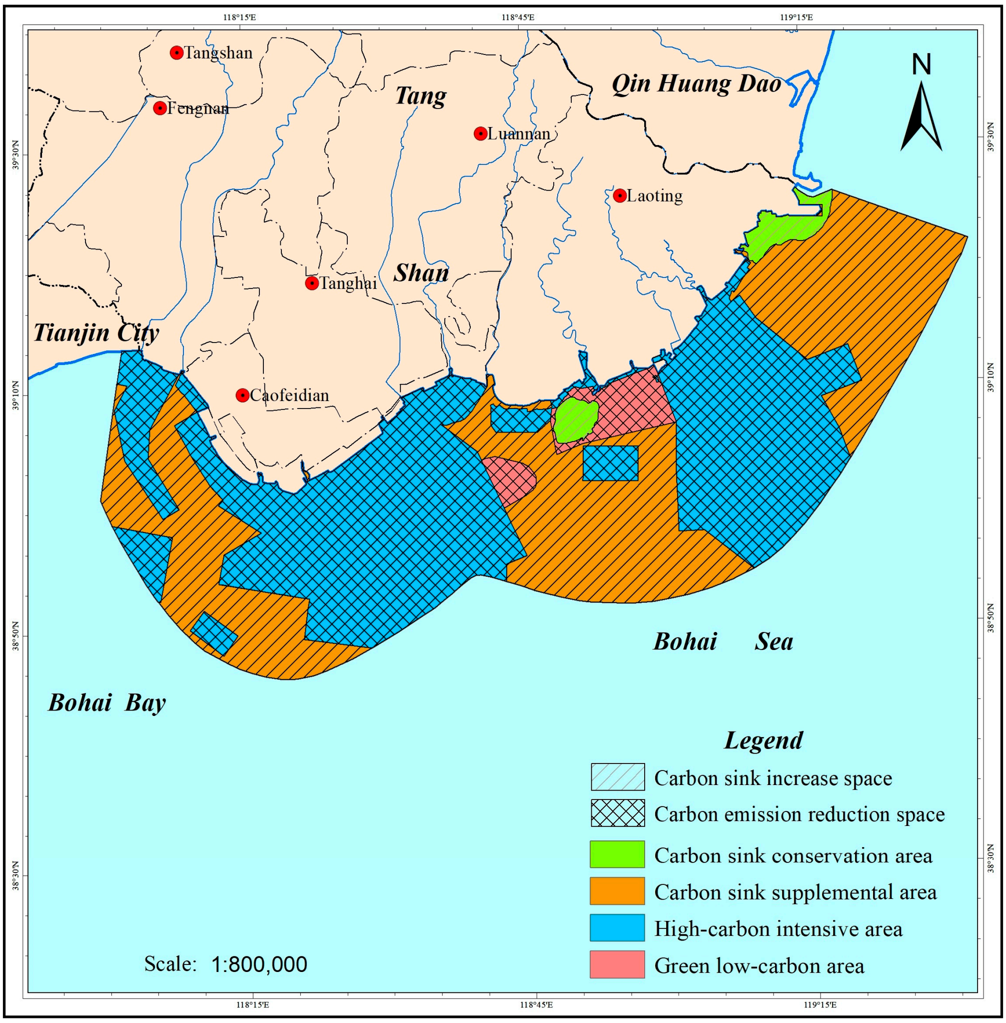

Figure 2. The "Two Spaces and Four Carbon Areas" marine spatial pattern of Tangshan, Hebei, China.

3. Results and Discussion

3.1. The Outcomes from Case Study of Tangshan City

The delimitation of Tangshan's "Two Spaces and Four Carbon Areas" marine spatial pattern shows that the current Marine Functional Zoning of Tangshan has the basic spatial layout for carbon sink increase and carbon emission reduction, and the distribution of carbon sink increase space and carbon emission reduction space is mostly balanced. However, the distribution of the four carbon areas is unbalanced, and the high-carbon intensive area is large. Therefore, it is necessary to take corresponding measures to optimize and promote the carbon emission reduction function of the marine space. The marine industry development in Tangshan city is largely based on industry and fisheries, and the scale of recreational tourism and ecotourism is relatively small. The "double carbon" goal in marine space can be achieved through passive emission reductions in the transportation industry and fishery carbon sinks.

The authorities of Tangshan city have recognized the importance of ocean carbon sink on low carbon development and prepared the work program on promoting the development of ocean carbon sink. The work program plans to delimit the development planning zone, research the basic theory, establish the database and improve the monitoring system for ocean carbon sink. Presently, Tangshan city has carried out the evaluation of the carbon sink function of seagrass bed and salt marsh, investigating the ecosystem carbon sink distribution and carbon storage. According to the status of ecosystem carbon sink, the different marine carbon functional zones could be delimited with complementary measures. The complementary measures emphasis on the increase in carbon sink, including the expansion of marine ranching development, the enhancement of ecosystem protection and restoration, the improvement of carbon sink monitoring, the establishment of local carbon trading system, and the strengthening of publicity and education.

3.2. Proposed Paths and Policies to Integrate "Double Carbon" Goal into MSP

From the level of MSP, based on the city's current situation of "Two Spaces and Four Carbon Areas," the "double carbon" goal can be better integrated into the new territorial spatial planning system, and different optimization paths and policy measures can be proposed for different regions.

From the perspectives of planning operation and the planning process, the territorial spatial planning system can be divided into four subsystems, namely the legal and policy system, the technical standard system, the formulation and approval system, and the implementation and supervision system [29]. Under the background of "double carbon," studying and implementing strategies for reducing carbon emissions and increasing carbon sinks starting from these four subsystems is suggested in order to optimize the path of MSP.

With respect to laws and policies, a national adaptation strategy toward climate change and the carbon constraints of laws and regulations should be proposed, and we should study and put forward relevant policy suggestions concerning the integration of the "double carbon" goal into MSP to support national and local policymaking. It is necessary to build a policy framework for MSP to combat climate change and to help achieve the "double carbon" goal from the top down.

As for technical standards, we suggest integrating carbon assessment into the evaluation of resource and environment carrying capacity, evaluating the suitability for territorial spatial development and environmental impact assessment and adding qualitative indicators that can determine the carbon sources or carbon sinks, as well as quantitative indicators that can reflect the intensity of carbon emission and the degree of carbon sink increase. It is indispensable to formulate and issue technical guidelines for carbon information investigation, carbon emission evaluation, carbon measurement, and carbon monitoring. In addition, it is important to improve the standards and regulations of carbon compensation and carbon trading to develop carbon emission measurement tools and to improve carbon emission monitoring tools to develop multi-scenario model prediction technology and to improve the scientific basis of integrating the "double carbon" goal into MSP in order to guide the cycle of carbon monitoring and evaluation in the planning formulation, approval, implementation, and supervision processes [30].

It is necessary to incorporate the "double carbon" goal into marine development objectives, integrate the concept of carbon emission reductions and sink increases into the planning, and add hard constraints on carbon emission indicators during planning approval. Planning should follow the green low-carbon principle, clarify the indicators of carbon emission reduction and sink increases [31], optimize the allocation of marine spatial functional zones based on the marine spatial pattern of "Two Spaces and Four Carbon Areas," increase the scope of marine protected areas, give priority to nature-based solutions, implement integrated marine and coastal zone management, pay attention to the integrity of the ecosystem, and improve the carbon sink capacity of a blue-green ecosystem. At present, in some coastal provinces and cities the "double carbon" goal and the related contents of carbon emission reduction and sink increases have begun to be integrated into the territorial spatial planning. For example, guided by the "double carbon" goal, the *Fourteenth Five-Year Plan for the Protection and Development of Natural Resources in Guangdong* proposes to establish a green and low-carbon spatial pattern by improving exploration and research on ocean carbon sinks and building a standard system. According to the *Territorial Spatial Total Planning of Tianjin (2021–2035)*, Tianjin will coordinate land and oceans and make efforts in carbon emission reductions and carbon sink increases. The marine element is specifically included in this planning to promote the concept of a blue carbon sink.

With regard to planning implementation and supervision, we suggest optimizing the MSP path in the following aspects: (1) Improving the use regulation system and implementing inflexible–flexible combined policies to restrict carbon emission intensity. In terms of inflexible constrains, carbon emission intensity standards for various sea-use activities should be set, and carbon emission assessment should be carried out for marine industries with high carbon emissions when they apply for the certificates of the right to use sea areas. In terms of flexible constraints, the carbon emission intensity standards for the same marine functional zone in different regions could be set independently according to local conditions within a certain range. (2) Investigating carbon information. Based on the natural resources investigation and monitoring systems for carbon emission elements and carbon sink elements, it is imperative to comprehensively determine the carbon source and carbon emission space, as well as the carbon sequestration and carbon sink space, and to collect the information concerning "carbon" activities as the benchmark data for planning formulation, approval, implementation, supervision, and performance evaluation. (3) Full-cycle monitoring of carbon sources and sinks is necessary during the planning and implementing periods. Relying on the present national sea area use dynamic surveillance and monitoring management system, an efficient MSP information supervision system should be established to realize sea area use pre-review of carbon source and sink information, the filing of local sea use activities, the dedicated monitoring of sea use activities, and in assisting decision-making in order to improve the efficiency of carbon emission management.

4. Conclusions

In the context of the "double carbon" goal, the ocean, as the largest carbon reservoir on earth, plays a crucial role in promoting carbon sink increases through the marine ecosystem, and different sea use activities are or can be optimized to serve carbon emission reductions and carbon sink increases. This paper has conducted a preliminary theoretical exploration and practical research concerning how marine functional areas can realize the role of carbon emission reductions and sink increases. More research focusing on this topic is planned to be performed to emphasize and further study the details on MSP's function of promoting the "double carbon" goal. The carbon increase or reduction functions of different sea use activities and marine ecosystems in each MSP functional zones needs to be mined deeply using more scientific methods. The linkage model and the marine spatial pattern of "Two Spaces and Four Carbon Areas" will be promoted and updated along with the social development and policy changes. The purpose of future research is to strengthen the integration of MSP and the "double carbon" goal and provide a decision-making reference for marine-related management departments to formulate MSP and to scientifically regulate sea-use activities and optimize the layout of marine industries.

The main findings are as follows:

1. A linkage model between marine functional zones and carbon distribution was established; a marine spatial pattern of "Two Spaces and Four Carbon Areas" was proposed. By analyzing the functions of marine space in terms of carbon sink increases and emission reductions, we matched each MSP functional zones to "Two Spaces and Four Carbon Areas". The two spaces include carbon sink increase space and carbon emission reduction space, and the four carbon areas include a carbon sink conservation area, a carbon sink supplemental area, a green low-carbon area, and a high-carbon intensive area.
2. It is advisable to add the marine renewable energy zone as subzone of the marine development zone in territorial spatial planning system. The paper analyzes the current MSP functional zone system and proposes adding a marine renewable energy zone in the marine development zone based on the "double carbon" goal in order to provide reserve space for the layout and the development of offshore wind power and marine energy in the future.

3. The paths and suggestions for integrating the "double carbon" goal into MSP was explored. In terms of the law and policy, the technical standard, the formulation and approval, and the implementation and supervision, strategies for reducing carbon emissions and increasing carbon sinks are suggested in order to optimize the path of MSP.

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References

1. Wang, F.; Harindintwali, J.D.; Yuan, Z.; Wang, M.; Wang, F.; Li, S.; Yin, Z.; Huang, L.; Fu, Y.; Li, L.; et al. Technologies and perspectives for achieving carbon neutrality. *Innovation* **2021**, *2*, 1–22. [CrossRef] [PubMed]
2. World Meteorological Organization (WMO). *State of the Global Climate 2020*; WMO: Geneva, Switzerland, 2021.
3. UNEP. Adaptation Gap Report 2021. 2021. Available online: https://www.unep.org/resources/adaptation-gap-report-2021 (accessed on 6 May 2022).
4. UNEP, UNEP Copenhagen Climate Centre (UNEP-CCC). 2021. Addendum to the Emissions Gap Report 2021. Available online: https://wedocs.unep.org/bitstream/handle/20.500.11822/37350/AddEGR21.pdf (accessed on 24 August 2022).
5. Carbon Brief. Analysis: Do COP26 Promises Keep Global Warming below 2 °C? 2021. Available online: https://www.carbonbrief.org/analysis-do-cop26-promises-keep-global-warming-below-2c/ (accessed on 24 August 2022).
6. Xiong, J.; Lu, K.; Jiang, Z.; Zhang, C.; Fu, Q.; Jin, Y. Study and Thoughts on Territorial Spatial Planning under the Goal of "Carbon Emissions Peak and Carbon Neutrality". *Urban Plan. Forum* **2021**, *4*, 74–80.
7. Zhao, P.; Hu, X. International blue carbon cooperation and China's choice. *Mar. Sci. Bull.* **2019**, *38*, 613–619.
8. Xinhua News Agency. Report on the Work of the Government. 2022. Available online: http://english.www.gov.cn/premier/news/202203/12/content_WS622c96d7c6d09c94e48a68ff.html (accessed on 9 May 2022).
9. Li, S. How does territorial spatial planning contribute to carbon neutrality. *Contemp. Guizhou* **2021**, *26*, 78.
10. Ding, M.-L.; Yang, X.-N.; Zhao, R.-Q.; Zhang, Z.-P.; Xiao, L.-G.; Xie, Z.-X. Optimization of territorial space pattern under the goal of carbon neutrality: Theoretical framework and practical strategy. *J. Nat. Resour.* **2022**, *37*, 1137–1147. [CrossRef]
11. Zhao, R.-Q.; Huang, X.-J.; Yun, W.-J.; Wu, K.-N.; Chen, Y.-R.; Wang, S.-J.; Lu, H.-L.; Fang, K.; Li, Y. Key issues in natural resource management under carbon emission peak and carbon neutrality targets. *J. Nat. Resour.* **2022**, *37*, 1123–1136. [CrossRef]
12. Chen, K.; Tao, W.; Fang, X.; Wei, J. Carbon Neutrality Assessment and Planning Application Path in Territorial Spatial Planning. *Planners* **2022**, *5*, 134–141.
13. Ministry of Natural Resources of the People's Republic of China. Guidelines for the Formulation of Municipal Territorial Spatial Total Planning (Trial). 2020. Available online: http://gi.mnr.gov.cn/202009/t20200924_2561550.html (accessed on 9 May 2022).

14. The State Council. Action Plan for Carbon Dioxide Peaking Before 2030. 2021. Available online: http://www.gov.cn/zhengce/content/2021-10/26/content_5644984.htm (accessed on 11 May 2022).
15. Canadell, J.G.; Monteiro, P.M.S.; Costa, M.H.; da Cunha, L.C.; Cox, P.M.; Eliseev, A.V.; Henson, S.; Ishii, M.; Jaccard, S.; Koven, C.; et al. (Eds.) Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. In *Global Carbon and other Biogeochemical Cycles and Feedbacks. In Climate Change 2021: The Physical Science Basis*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2021; pp. 673–816. [CrossRef]
16. Louis, L.; Richard, B.R.; Markus, G.W.; Lionel, G.; Julia, U. The microbial carbon pump concept: Potential biogeochemical significance in the globally changing ocean. *Prog. Oceanogr.* **2015**, *134*, 432–450.
17. Huang, Q.; Qiu, Y.; Chen, J. Progress and prospects on the study of marine biological pump. *J. Appl. Oceanogr.* **2019**, *38*, 474–483.
18. Di, J.; Porter, H.; Ken, O.B. The value of scientific research on the ocean's biological carbon pump. *Sci. Total Environ.* **2020**, *749*, 141357.
19. Robert, J.W.B.; Shubha, S.; Trevor, P.; Heather, B.; Stefano, C.; Giorgio, D.; James, D.; Steve, G.; Bror, J.; Tihomir, S.K.; et al. Sensing the ocean biological carbon pump from space: A review of capabilities, concepts, research gaps and future developments. *Earth-Sci. Rev.* **2021**, *217*, 103604.
20. Wang, X.; Zhang, H.; Han, G. Carbon Cycle and "Blue Carbon" Potential in Chin's Coastal Zone. *Bull. Chin. Acad. Sci.* **2016**, *31*, 1218–1225.
21. Ehler, C.N.; Douvere, F. *Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-Based Management*; IOC Manuals and Guides: Pairs, France, 2009.
22. Teng, X.; Zhao, Q.; Zhang, P.; Liu, L.; Dong, Y.; Hu, H.; Yue, Q.; Ou, L.; Xu, W. Implementing marine functional zoning in China. *Mar. Policy* **2021**, *132*, 1–9. [CrossRef]
23. Qiu, X.; Cheng, C.; Liu, Q.; Tang, Y.; Zhao, S. Ocean carbon sinks and greenhouse effect. *Manage. Observer.* **2017**, *35*, 77–81+84.
24. Zhang, Z. *Carbon Peaking and Carbon Neutrality under Global Vision and Its Enlightenment to China*; National Center for Climate Change Strategy and International Cooperation (NCSC): Beijing, China, 2022.
25. Tang, J.; Ye, S.; Chen, X.; Yang, H.; Sun, X.; Wang, F.; Wen, Q.; Chen, S. Coastal blue carbon: Concept, study method, and the application to ecological restoration. *Sci. China Earth Sci.* **2018**, *61*, 637–646. [CrossRef]
26. Tang, Q.; Liu, H. Strategy for Carbon Sink and Its Amplification in Marine Fisheries. *Strateg. Study CAE* **2016**, *18*, 68–73.
27. Xu, J.; Qin, T.; Han, L. A review of research on marine carbon sink fisheries. *Resour. Sci.* **2018**, *40*, 161–172.
28. Shen, J.; Liang, R. Study on the blue carbon sink pricing of marine ranch. *Resour. Sci.* **2018**, *40*, 1812–1821.
29. The State Council Information Office of the People's Republic of China. Territorial Spatial Planning is Divided Into "Five Levels and Three Types" According to the Hierarchy and Content. 2019. Available online: http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/39595/40528/zy40532/Document/1655483/1655483.htm (accessed on 2 June 2022).
30. Costa, M.D.D.P.; Lovelock, C.E.; Waltham, N.J.; Moritsch, M.M.; Butler, D.; Power, T.; Thomas, E.; Macreadie, P.I. Modelling blue carbon farming opportunities at different spatial scales. *J. Environ. Manag.* **2022**, *301*, 113813. [CrossRef] [PubMed]
31. Jia, J. Research on carbon neutrality planning path in territorial spatial planning system. *Intell. City* **2021**, *7*, 105–107.