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Marine Ecological Environment Management Based on Ecological Compensation Mechanisms

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Abstract: The level of marine environmental management is a key factor in the successful implementation of marine power strategies. The improvement in management levels of marine environments requires innovation in marine management. In other words, the transformation of marine environmental management into marine ecological environment management must be done in order to achieve sustainable development of the marine economy. As an environmental economic policy that combines both administrative and market measures, ecological compensation mechanisms have significant advantages in marine ecological environment management. Based on the study of the current development of ecological compensation mechanisms in China, through the analysis of the connotation of marine ecological civilization, existing marine ecological protection practices and marine environmental management methods, this paper posits that the current marine ecological environment management in China should be established on the basis of ecological compensation mechanisms. At present, a lack of laws and regulations for overall marine ecological environment management is the key factor restricting the practice of marine ecological environment management. Therefore, it is necessary to explore the current path of marine ecological environment management in China from the perspective of the construction of legal system of ecological compensation law, the establishment of ecological compensation fees, ecological taxes and ecological compensation fund systems, and the clear status for a marine ecological management and supervision body.

Keywords: ecological compensation mechanism; ecological compensation fund; ecological tax; marine ecological environment

1. Introduction

In the new century, humans have begun marine explorations in order to alleviate population, resource and environmental crises. Marine development and utilization have become an irreversible trend, and the marine economy has become an important part of the national economy. However, with the development and utilization of marine resources and space, the marine ecosystems in China have been continuously deteriorating, and marine environmental disasters such as coastal erosion and red tides occur frequently. This shows that the marine ecosystem and environment have been seriously affected. Maintaining the balance of marine ecology has become an important strategic base for China to develop the marine economy and achieve sustainable development.

The national “12th Five-Year” plan clearly stated that “scientific planning of marine economic development, rational development and utilization of marine resources, protection of islands, coastal zones and marine ecological environment” is important. However, since China has not established a controlling policy system to coordinate the development and protection of marine ecosystems, the cost of marine development activities cannot be effectively compensated. With the rapid development of China’s marine economy, marine ecological environmental problems will become increasingly serious. Therefore, marine ecological environmental protection needs to be implemented, and a complete ecological compensation mechanism needs to be established. Ecological compensation is a management system characterized by economic incentives and based on the principle of internalizing the external cost of economic activities. It is to improve, maintain and restore the service functions of the ecosystem, and adjust the distribution of environmental benefits and economic benefits that are generated by activities that are either protecting or destroying the ecological environment for stakeholders. Marine ecological environment management based on marine ecological compensation mechanisms has an institutional guarantee for the protection of marine ecology and the management and development of resources. It strengthens and enriches marine environmental protection.

2. Ecological Compensation Mechanisms and Marine Ecological Environment Management

The research on compensation and management of marine ecology in China is still in the exploratory stage. The theory of marine ecological compensation is still not fully developed. National laws and regulations have not been unified yet, and the compensation system is not yet sound enough [1]. However, through the analysis of the connotation of marine ecological civilization, in connection with the specific practice of marine ecological protection and marine environmental management, we can probe how to protect and manage the marine ecological environment on the basis of marine compensation mechanisms. Therefore, the protection and management of the marine ecological environment are not just theoretical, but rather practical and implementable.

Ecological civilization refers to all of the positive results achieved [2] by people and society through the ecological way of social practice, in dealing with relationships among people, society and nature and the relationship between people by following the objective laws of the three spheres. It embodies the cultural ethics [3] of harmonious symbiosis, the virtuous circle, comprehensive development, and sustained prosperity among humans, society and nature. Initiatives to protect the objective world are considered as it is transformed. By consciously following ecological laws, the relationship between humans and nature is optimized, and the harmonies between humans and nature, and the coordination between economic and social development and ecological environmental protection are realized. Coordination is the emphasis here. Therefore, compromise coordination (which refers to when the problem/situation has a variety of solutions and, by coordinating the views of all parties, to select the appropriate solution that can be accepted by all parties in order to achieve the optimal solution to the problem) is the core of the marine ecological civilization. Humanism leads human society into a serious survival crisis. The extreme ecological doctrine terminates activities to transform nature due to one-sided emphasis on human society and negates the results of industrial civilization, resulting in the human disruption in the development of human civilization. Therefore, environmental management should take the compromising position of being people-oriented while taking into account nature instead of either the extreme humanistic attitude or the extreme ecological ideology [4].

The earliest use of ecological compensation is mainly in the fields of ecology and economics. As far as its definition is concerned, there are different emphases for understanding ecological compensation due to different perspectives from scholars in different disciplines. Therefore, there is no commonly accepted generalization to date. The concept of natural ecological compensation in the *Dictionary of Environmental Science* refers to the ability of the organic community and inorganic community in the system to maintain ecological balance by mitigating disturbances and regulating themselves when the ecosystem is disturbed [5]. Cao Mingde defined ecological compensation as

the legal system [6] that requires the lawful user or beneficiaries of ecological resources to make corresponding payments to the owners or the protectors of the ecosystem. Mao Xianqiang summed up ecological compensation as a charge to ecological destroyers, ecological beneficiaries and negative externality producers, and compensation to ecological protectors, ecological victims and positive externality generators. The purpose of protecting the ecological system is achieved by internalizing externalities [7]. Li Ainian [8] defined ecological compensation from an administrative point of view, which is the levy by relevant administrative departments directed to producers and consumers for the protection and recovery of the loss of ecological benefits due to over-exploitation. From an ecological point of view, Liu Guangsheng believed that the ecological benefits compensation fee is levied to control ecological damage and contain resource depletion [8]. However, considering studies at home and abroad and the actual situation in China, the purpose of ecological compensation should be based on the protection of the ecological environment and the promotion of harmony between man and nature. Mainly relying on economic regulation, with the comprehensive use of legal and administrative measures, ecological compensation is a system arrangement to adjust the relationship between relevant interests. Specifically, based on the protection of the ecological environment and the promotion of harmony between man and nature, and through comprehensive use of administrative and market instruments, the ecological compensation mechanism is an environmental economic policy to adjust ecological environment protection and establish an interest relationship among relevant parties according to the value of ecosystem services, ecological protection costs, and development opportunity costs [9].

By referencing the effective experience of ecological compensation mechanisms and combining it with characteristics of the ocean, marine ecological compensation mechanisms can look ahead and create favorable practices from the following three main points. The first is to compensate for the marine environment itself, such as the establishment of marine nature reserves, including the ecological coastline/ecological sea-based protected areas. Protection of the marine space is good for self-repair and compensation of marine environment. Also, based on detailed marine ecological studies, humans can even actively participate in the marine self-repair and compensation process. The second is to compensate the opportunity cost of marine protection from individuals, groups or regions, such as providing subsidies to fishermen who withdraw from marine fishing. By dealing with problems from an economic point of view, human activities in marine ecological systems can be guided from the perspective of economic opportunity costs. The third is to stop the destruction of the marine environment, or make the “beneficiaries” of marine environmental protection pay the corresponding costs. The purpose is to internalize the external costs of economic activities [10] and prevent the violation of marine ecology compensatory behavior from a legal perspective.

Therefore, by combining marine ecological concepts and specific practical experience of marine management, marine ecological environment management is the implementation of marine environmental protection and the activity of marine sustainable development, utilization and production. The core requirement is to protect the marine environment and maintain the sustainable development of marine ecosystems to the maximum extent possible in conjunction with normal development of marine economic activities. This requires the introduction of concepts related to ecological civilization, but neither humanism nor ecologicalism [11,12]. While achieving economic growth, environmental destruction and the impact on ecosystems are internalized into marine economic development costs. In order to achieve marine economic growth, the main body that affects the marine ecological environment has to bear the cost and provide corresponding environmental compensation. This compensation is not limited to money, materials and other forms, but takes a variety of means, such as criminal and civil combinations of legal punishment and administrative coercion for environmental restoration and restitutions.

3. China’s Marine Ecological Environment Management Status and Problems

3.1. Special Marine Laws and Regulations Are Enacted, but There Is a Lack of Laws and Regulations for Overall Marine Ecological Environmental Management

Since the 1980s, China has recognized the principle of “who develops, who protects; who damages, who pays; who benefits, who compensates”, and in the process of ecological environment protection, restoration and construction has carried out a series of exploratory and pilot projects. However, at present, in terms of detailed implementation of ecological compensation in China, a relatively complete ecological compensation policy system and ecological compensation mechanism have not been established. This not only affects ecological protection in China, but also affects the fair distribution of the complete social environmental economic interests [13] (Figure 1).

Since 1982, China has formulated a series of laws and regulations for marine protection, as shown in Table 1. The implementation of the Marine Environmental Protection Law has also become an important starting point for marine ecological compensation work in China. It has established a basic policy to protect and improve the marine environment, protect marine resources, prevent pollution damage, maintain ecological balance, protect human health and promote sustainable development for the economy and society.

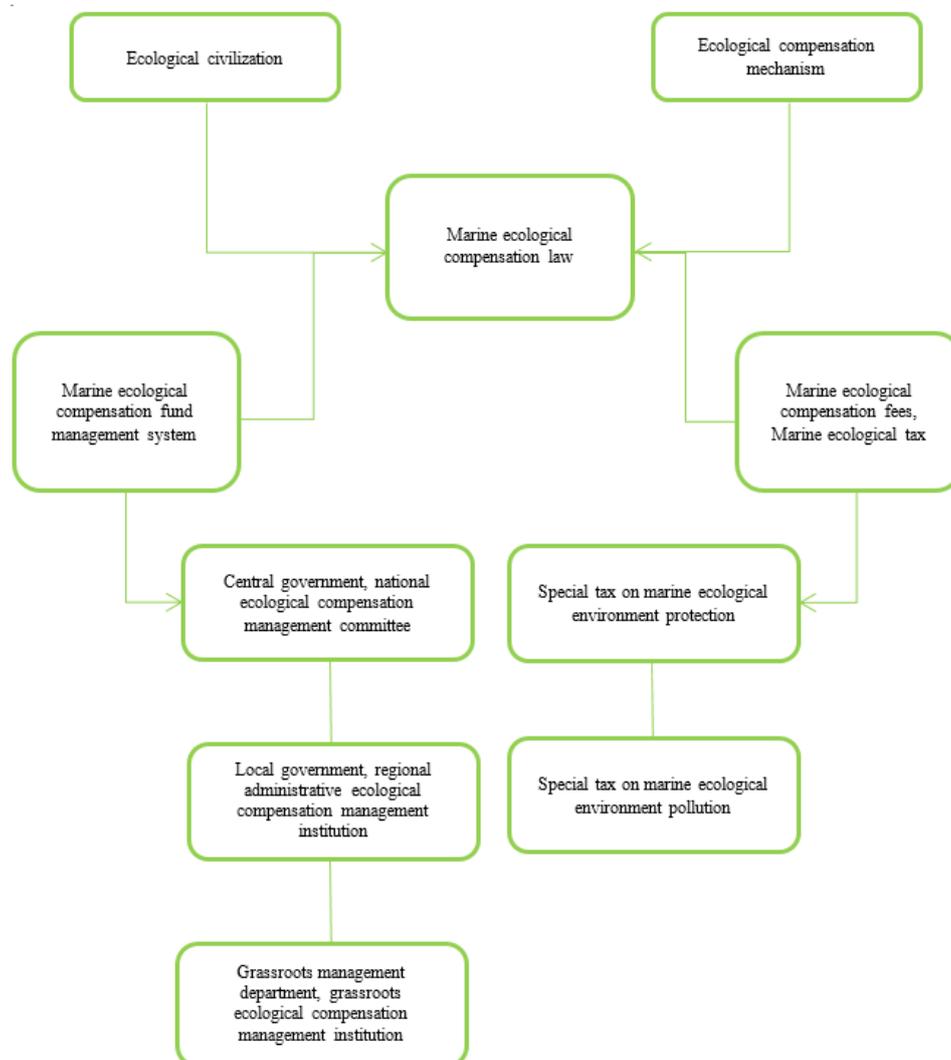


Figure 1. Relationship diagram.

Table 1. List of sea-related laws, administrative regulations and departmental rules in China.

Time	Laws and Regulations	Contents
25 December 1999	<i>Law of the People's Republic of China on Marine Environmental Protection</i>	General marine environmental normative law
28 August 2004	<i>Fisheries Law of the People's Republic of China</i>	Specialized legislation for marine fishing/aquaculture industries
29 August 1996	<i>Mineral Resources Law of the People's Republic of China</i>	Specialized laws for the development of mineral resources
27 October 2001	<i>Law of the People's Republic of China on the Administration of Sea Area Use</i>	Special guidance law for the division and management of sea areas
28 June 2003	<i>Port Law of the People's Republic of China</i>	Specialized laws for port administration and maritime transport
12 January 1982	<i>Regulations of the People's Republic of China on the Exploitation of Offshore Oil Resources by Foreign Cooperation</i>	Special laws for the exploitation of offshore oil resources
29 December 1983	<i>The People's Republic of China environmental protection management regulations for offshore oil exploration and development</i>	Special laws for the exploitation of offshore oil resources
29 December 1983	<i>Regulations of the People's Republic of China on the Administration of the Prevention of Marine Pollution by Ships</i>	Legal regulation of the impacts of maritime transport
6 March 1985	<i>Regulations of the People's Republic of China on Marine Dumping</i>	Specific legal norms for marine pollution management
19 October 1987	<i>Implementation Rules of Fishery Law of the People's Republic of China</i>	Specific guidelines for marine fishing/aquaculture industries
18 May 1988	<i>Regulations of the People's Republic of China on the Prevention of Environmental Pollution from Ship Recycling</i>	Specific legal norms for marine pollution management
25 May 1990	<i>Regulations on the Prevention and Control of Marine Environmental Pollution by Land-based Pollutants</i>	Specific legal norms for marine pollution management
5 October 1993	<i>Regulations of the People's Republic of China on the Implementation of Protection of Aquatic Wild Animals</i>	Specific legal norms for the protection of marine life
9 October 1994	<i>Regulations of the People's Republic of China on Nature Reserves</i>	Specific legal norms for the protection of marine protected areas
30 August 2006	<i>Regulations on the Prevention and Control of Marine Environmental Damage by Marine Engineering Construction Projects</i>	Specific legal norms for marine pollution management
20 September 1990	<i>Measures for the Implementation of the Regulations of the People's Republic of China on the Administration of Environmental Protection of Offshore Oil Exploration and Development</i>	Special laws for the exploitation of offshore oil resources
25 September 1990	<i>Measures for the Implementation of the Regulations of the People's Republic of China on Marine Dumping</i>	Specific legal norms for marine pollution management
25 December 2002	<i>Marine Administrative Punishment Implementation Measures</i>	Specialized legal regulations for marine operations and use management
20 October 2004	<i>Measures for the Administration of the Entrustment and Issuance of Marine Dumping Licenses for Wastes</i>	Specific legal norms for marine pollution management
1 April 2008	<i>Provisions on the Punishment of Violation of Law and Discipline in the Use and Management of Sea Areas</i>	Specialized legal regulations for marine operations and use management

Along with the development of China's marine economy, a series of laws and regulations have also been formulated for different marine resources, such as fisheries law, port law, mineral resources law, and oil resource regulations. Their formulation and development has played an important role in regulating the development and protection of project resources, is significant in the prevention and control of marine environmental pollution and rational exploitation and utilization of marine ecosystem services, and also provides a legal basis for marine law enforcement departments and marine administrative departments [14].

However, these laws and regulations are enacted for a specific marine ecosystem issue. Currently, we still need a law or regulation specialized in marine ecological compensation that can achieve an overall marine ecological compensation objective from the perspective of maintaining the service function of the marine ecosystem as a whole [15–17]. Without this law or regulation, we cannot provide a legal basis for the exploration of marine ecological compensation and cannot provide a guiding principle for the protection of the entire marine ecological environment system from a

global perspective. Eventually, this will have an impact on the implementation of marine ecological environmental protection policies in China.

3.2. The Marine Ecological Environment Management Began to Introduce Compensation Mechanisms, but Has Not Adequately Established Them

At present, China has carried out a lot of research and practice in marine resource development and ecological compensation, established a marine paid use system, and implemented a series of ecological compensation measures in the area of marine fishery and seawater pollution, such as a fishing moratorium, artificial reefs, fishermen subsidies and seawater pollution fines. Some provinces and cities have also taken the lead in the management practice of the Interim Measures for the Management of Marine Ecological Damage Compensation and Loss Compensation [18–20]. For example, in order to have long-term sustainable development of fisheries in protected regions and a stable marine ecosystem, the Zhoushan Islands in Zhejiang Province have implemented an annual fishing moratorium. During the fishing moratorium, fishing and other fishing-related activities are prohibited, whereas during the fishing period, the islands also clearly stipulated the minimum size of marine life that can be captured by the fishing net, and marine life below the standards must be released. Therefore, the marine food chain system can be maintained with relative stability and sustainability. This shows that China has begun to pay attention to managing marine resources by using market economic means and to compensate ecological loss caused by resource development and utilization. However, it must be noted that due to the economic interest differences among departments, the establishment of a marine ecological compensation system has still stayed at the research level. A scientific system of ecological compensation mechanisms has not been established. This leads to a shortage of ecological compensation funding in China and a lack of the scientific and rational funding mechanisms. The absence of ecological compensation mechanisms also leads to the need for unified guiding ideology and legislative principles in formulating a guiding principle of marine ecological compensation. Therefore, the purpose and value of ecological compensation system cannot be clearly reflected.

3.3. Unsound Marine Ecological Environment Management and Regulatory Systems in China Overlooked the Main Body in Marine Ecological Environmental Management

There is a serious lack of regulatory systems in China's marine ecological compensation system. At present, there are management issues and mutual prevarication in local government management practices. Meanwhile, the main body of the marine compensation mechanism is missing because the marine ecological compensation mechanism has not been established [21,22]. The current marine ecological compensation system is mostly temporary and consists of advocacy measures, with a lack of strong legal support and supervision. There are no authorities responsible for dealing with the damaged ecological environment and serious pollution in marine ecological environment management [23,24]. This leads to not only the marine ecological environment not getting the attention of the main participants in marine activities, but also the victims in damaged areas not getting protection for the rights and interests they deserve. Their interests are undermined. For example, near Shanghai's estuary in China's East China Sea, both the Huangpu River and Chongming Island Ecological Reserve were polluted due to dead pigs washing down from the upper reaches of the Huangpu River. It posed a great threat to local mariculture and ecological environments. There was a rotten smell coming from the seawater and decayed corpses accumulated on the shoreline. However, the process of determining which department (including the Port Authority/Bureau of Agriculture/Bureau of Marine Authority) was responsible for dealing with the crisis caused the lengthening of the threat and days of delay to resolve the problem. Also, when problems appear upstream, they issue a timely warning for marine management downstream, i.e., an initiative of resolving before threatening. Thus, a sound management and regulatory system must not cause a delay in issues, and should first clarify the management body and then solve the problem quickly.

Therefore, in order to achieve the compensation objective, the parameters of ecological compensation, including the degree of supervision of a specific implementation, the degree of compensation in the compensation process, the use of compensation funds and whether non-capital compensation is in place, must be scientifically evaluated, supervised and managed. Once the management body is missing and the regulatory system is not in place, the implementation of marine compensation mechanisms will fail, which will seriously affect the sustainable development of China's marine economy.

4. Marine Ecological Environment Management Approach and Recommendations under Ecological Compensation Mechanisms

Under ecological compensation mechanisms, the management of the marine ecological environment should be based on the ecological civilization. The compensation mechanism should be infused into law, tax administration, economic management, administrative management and management systems. Therefore, a proper marine ecological management system can be established.

4.1. Accelerate the Construction of an Ecological Compensation Legal System and Formulate a Unified and Complete Marine Ecological Compensation Legal System

The legalization of the ecological compensation system is a prerequisite to guarantee the implementation and operation of the ecological compensation system. The legal system of ecological compensation in China is not very sound in general, and it is necessary to establish an effective legal mechanism for ecological compensation. Thus, all aspects of ecological compensation have laws to follow. First of all, we must take the lead in formulating the *Marine Ecological Compensation Law* as the basic law of ecological compensation to ensure there is a uniform and basic guiding principle for marine ecological environmental management under the ecological compensation mechanism. Ecological compensation is the key factor affecting the sustainable development of the economy, society and environment in China. Therefore, it is necessary to regulate ecological compensation with national basic law so as to guarantee its importance and legal status. Secondly, before the *Marine Ecological Compensation Law* is completed, the practice of marine ecological compensation in the current period can be guided through clarifying and improving the status of the ecological compensation system in the *Marine Environmental Protection Law*. When the *Marine Ecological Compensation Law* is completed, the basic principles and guidelines established in the *Ecological Compensation Law* should be included in the *Marine Environmental Protection Law*. The existing *Marine Environmental Protection Law* should be revised as necessary to make it the basic law of marine ecological environment protection. Finally, on the basis of this, the formulation of special laws and regulations on ecological compensation should be done quickly. In combination with a series of laws including civil law and criminal law, the construction of a legal protection system for marine ecological compensation mechanisms can be accelerated.

4.2. Establishing Ecological Compensation and an Ecological Tax System, Strengthening the Intensity of Law Enforcement against Marine Ecological Environment Damage

In order to prevent the destruction of the ecological environment, ecological compensation is an environment management system levying environmental damage and restoration costs on producers, operators and developers engaging in activities that have or may have adverse effects on ecological environments. Its main contents are ecological environmental remediation and restoration, with economic regulation and legal protection. Western developed countries long ago introduced ecological compensation fees and provided legal protection for ecological environment. For example, the United States imposed special regulations on ecological compensation systems and specific measures for marine fisheries' environmental ecological compensation through the formulation of a special *Marine Environmental Protection Act*. It clarified the principles, scope and methods of ecological compensation for marine fisheries. Not only did it provide a clear guarantee through fund

compensation (fishing vessel retirement compensation) and in-kind compensation (giving land to fishermen returning to land from fishing), but also at the same time, more attention was paid to the improvement of ecological compensation and ecological taxes through policy compensation (e.g., tax concessions, preferential loans) and intellectual compensation (e.g., training of specialized technical or managerial personnel).

Therefore, China can learn from the successful experience of developed countries in the West for collecting ecological compensation fees, identifying the collection body and the collection subject, and developing standards and methods in the form of law. Ecological compensation fees should be clearly defined in China's natural resource protection law. How to determine whether marine ecosystems have been destroyed as well as the compensation standards should be clarified. Thus, environmental remediation can have legal assurance and financial support. In the meantime, the responsibility of the main responsible parties can be more clearly divided and recognition and support from all members of the community can be obtained.

In addition, according to the degree of development, utilization, pollution, damage and protection of ecological environment resources, the government also needs to carry out a certain range of tax collection and exemption for companies and individuals who exploit, protect and utilize ecological environmental resources. Thus, participants in marine activities are rewarded and penalized for their costs in terms of ecosystem protection and destruction resulting from their exploitation and use of marine resources. Based on sustainable development, China can draw on the experience of developed countries in implementing eco-taxes to revise and optimize the existing tax structure and improve the ecological tax system as soon as possible. On the one hand, through the introduction of a marine ecological environment protection special tax, special funds can be raised for marine ecological environmental protection; on the other hand, through the introduction of a marine eco-environmental pollution tax, funds can be raised for pollution control. Therefore, marine protection and marine ecological restoration can have strong tax fund support.

4.3. Improving Management and Regulatory Systems, Exploring the Establishment of an Ecological Compensation Fund System, Guiding and Participating the Division of Interest for Main Bodies

The marine compensation management system and regulation system should be established based on the main bodies composed of the State Council, local government and grassroots administrative departments. The hierarchy, reporting mechanism and information communication mechanism should be clarified to ensure the main bodies of marine ecological environment management are in place, such as the establishment of a national ecological compensation management committee under the unified leadership of the State Council at the central level, a regional administrative government ecological compensation management institution at the local government level, and a grassroots ecological compensation management institution at the grassroots level. At the same time, by combining environmental laws with other laws and regulations, the regulatory responsibility at all levels of government has to be clarified to ensure that regulation is in place.

The ecological compensation fund system is a fund management system with a mainstay of state investment and multi-channel fundraising for ecological compensation. It includes various funding systems constructed for the purpose of ecological construction and ecological compensation, such as ecological construction funds, ecological compensation funds, environmental remediation funds and compensation funds. China can learn from the experience of western developed countries, explore the establishment of an ecological compensation fund system, and ensure that the ecological compensation fund can be managed and utilized scientifically and rationally by adopting a management system that insists on unified planning, unified distribution, unified management and unified organization and the implementation of ecological compensation funds. In order to ensure a fair and reasonable distribution of the ecological compensation fund, an evaluation and validation system can be established before applying for ecological compensation funds to conduct a feasibility study to ensure the legitimate rights and interests of the relevant stakeholders. Local ecological compensation departments at all

levels can also ensure that ecological compensation funds are effectively supervised and managed through the establishment of an ecological compensation fund information management system. In order to better fulfill the responsibility of ecological compensation management and exercise their own administrative authority, regional administrative ecological compensation agencies at all levels may, in accordance with the actual needs of the work, establish grassroots ecological compensation management institutions at various levels. Thus, a unified management system can be formed through specific administrative authorities composed of national ecological compensation management institutions, government ecological compensation administrative agencies at all levels, and grassroots ecological compensation management institutions.

5. Conclusions

At present, the management of marine ecological environments in China needs to combine the concepts of marine ecological civilization and ecological compensation mechanisms in order to ensure management is truly implemented. Through analyzing the core concept of compromise coordination for ecological civilizations, we can maintain a scientific and objective position and avoid extremes when dealing with the relationship between marine economic development and marine ecological environmental protection. At the same time, the introduction of ecological compensation mechanisms will promote the integration of market mechanisms, administrative mechanisms and legal mechanisms in marine ecological environmental protection in China. Thus, marine ecological environment protection and management can be based on environmental cost, and can promote the internalization of marine environmental pollution and destruction and other external costs into marine economic development. Ultimately, the marine economy and marine ecological environment can be managed in coordination and developed sustainably.

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References

1. Jia, X. *Study on Marine Ecological Compensation Mechanism*; Ocean University of China: Qingdao, China, 2010.
2. Zhao, C. *The Rise of Ecological Civilization and the Change of Ecological Environment View on Marx's Theory of Ecological Civilization*; Renmin University of China: Beijing, China, 2006.
3. Huang, H.; Xie, J.; Wang, P.; Lin, L.; Luo, Y. Research on the construction of marine ecological civilization demonstration zone: A case study of Linhai Dayawan Industrial Park. *Ocean Dev. Manag.* **2013**, *7*, 65–69.
4. Zhou, X. Theory of the nature of environmental right, a kind of “anthropocentrism” concept of environmental right. *J. For. Econ.* **2003**, *23*, 313–318.
5. Zhang, J.X.; An, S. Review of the research on ecological compensation both at home and abroad. *J. Xi'an Shiyou Univ.* **2009**, *18*, 23–28.
6. Cao, M. Rethinking on establishing the legal system of ecological compensation. *J. Chin. Univ. Geosci.* **2010**, *10*, 28–35.
7. Mao, X.; Zhong, Y.; Zhang, S. Theoretical study on ecological compensation. *Chin. Popul. Resour. Environ.* **2002**, *12*, 38–41.
8. Li, A. The existing problems and suggestions on the legislation of the compensation for ecological benefit. *Chin. Soft Sci.* **2001**, *1*, 30–34.
9. Li, F. Preliminary study on ecological compensation mechanism of uninhabited islands. *Ocean Technol.* **2010**, *29*, 125–127.

10. Cui, F.; Cui, J. Marine ecological compensation: The sustainable development of China's marine ecological reality. *Poyang Lake J.* **2010**, *6*, 76–83.
11. Bennett, N.J.; Blythe, J.; Tyler, S.; Ban, N.C. Communities and change in the anthropocene: Understanding social-ecological vulnerability and planning adaptations to multiple interacting exposures. *Reg. Environ. Chang.* **2016**, *16*, 907. [[CrossRef](#)]
12. Ehler, C.; Douvère, F. *Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-Based Management*; Intergovernmental Oceanographic Commission and Man and the Biosphere Programme: Paris, France, 2009.
13. Koundouri, P.; Giannouli, A. Blue growth and economics. *Front. Mar. Sci.* **2015**. [[CrossRef](#)]
14. Maccarrone, V.; Filiciotto, F.; Buffa, G.; Mazzola, S.; Buscaino, G. The ICZM Balanced Scorecard: A tool for putting integrated coastal zone management into action. *Mar. Policy* **2014**, *44*, 321–334. [[CrossRef](#)]
15. Tsai, S.B.; Huang, C.Y.; Wang, C.K.; Chen, Q.; Pan, J.; Wang, G.; Wang, J.; Chin, T.C.; Chang, L.C. Using a mixed model to evaluate job satisfaction in high-tech industries. *PLoS ONE* **2016**, *11*, e0154071. [[CrossRef](#)] [[PubMed](#)]
16. Tsai, S.B. Using grey models for forecasting China's growth trends in renewable energy consumption. *Clean Technol. Environ. Policy* **2016**, *18*, 563–571. [[CrossRef](#)]
17. Tsai, S.B.; Chien, M.F.; Xue, Y.; Li, L.; Jiang, X.; Chen, Q.; Zhou, J.; Wang, L. Using the Fuzzy DEMATEL to determine Environmental Performance: A case of printed circuit board industry in Taiwan. *PLoS ONE* **2015**, *10*, e0129153. [[CrossRef](#)] [[PubMed](#)]
18. Guo, J.J.; Tsai, S.B. Discussing and evaluating green supply chain suppliers: A case study of the printed circuit board industry in China. *S. Afr. J. Ind. Eng.* **2015**, *26*, 56–67. [[CrossRef](#)]
19. Qu, Q.; Chen, K.Y.; Wei, Y.M.; Liu, Y.; Tsai, S.; Dong, W. Using Hybrid Model to Evaluate Performance of Innovation and Technology Professionals in Marine Logistics Industry. *Math. Probl. Eng.* **2015**. [[CrossRef](#)]
20. Tsai, S.B.; Xue, Y.; Zhang, J.; Chena, Q.; Liu, Y.; Zhou, J.; Dong, W. Models for Forecasting Growth Trends in Renewable Energy. *Renew. Sustain. Energy Rev.* **2016**. [[CrossRef](#)]
21. Tsai, S.B.; Wei, Y.M.; Chen, K.Y.; Xu, L.; Du, P.; Lee, H. Evaluating green suppliers from green environmental perspective. *Environ. Plan. B Plan. Des.* **2015**. [[CrossRef](#)]
22. Lee, Y.C.; Wu, C.H.; Tsai, S.B. Grey System Theory and Fuzzy Time Series Forecasting for the Growth of Green Electronic Materials. *Int. J. Prod. Res.* **2014**, *299*, 1395–1406. [[CrossRef](#)]
23. Lee, Y.C.; Hsiao, Y.C.; Peng, C.F.; Tsai, S.B.; Wu, C.H.; Chen, Q. Using mahalanobis-taguchi system, logistic regression and neural network method to evaluate purchasing audit quality. *Proc. Inst. Mech. Eng. B J. Eng. Manuf.* **2014**, *229*, 3–12. [[CrossRef](#)]
24. Lee, Y.C.; Chu, W.H.; Chen, Q.; Tsai, S.B.; Wang, J.; Dong, W. Integrating DEMATEL model and failure mode and effects analysis to determine the priority in solving production problems. *Adv. Mech. Eng.* **2016**, *8*, 1–12. [[CrossRef](#)]

