Exploitation and utilization of marine resources and protection of marine ecology

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Abstract. With the development of society and the gradual enhancement of information science and technology, marine science and technology are gradually strengthened, the marine economy is playing an important part in our national economy. China's marine Energy Resources Total accumulation is very rich, and it is a great wealth, but the development of marine resources is not unlimited. Although it can promote the development of national economy, the sustainable development of marine resources should be considered. As the marine science and technology are growing today, the sustainability of marine resources is also seriously threatened. This paper analyzes the problems that encountered in the exploitation and utilization of marine resources and also in the protection of marine ecology. After expounding the importance of sustainable development of marine resources, the writer puts forward some methods and suggestions on how to make marine resources develop sustainably.

1. Introduction
Marine resources refer to those substances, energy and marine space existing in the marine environment that can be exploited and utilized by people, including marine biological resources, seawater resources, seabed mineral resources, marine renewable energy and marine space resources, etc [1]. The management of marine resources has become extremely complex due to its natural and social attributes. Along with social and economic development and population growth, there is a serious shortage of land resources, especially energy. There is even the emergence of sensational remarks that one who holds control over petroleum energy will have the world under control. By the end of the 20th century, the ocean began to be taken as the direction of resource development under the compelling circumstances. Advances in science and technology as well as the in-depth exploration have gradually highlighted that the oceans contain far more resources than that of land, thereby coastal countries have rapidly launched a large amount of investment for exploitation and utilization. As a series of disasters that cannot be underestimated have been caused by disorderly development, many professionals have carried out detailed research on marine resources development and ecological protection. Since the sustainable development of the ocean means that of human beings, the development of the ocean should be promoted simultaneously with the protection of the marine ecosystem. Nevertheless, the majority of researches have been carried out from one perspective, such as a certain resource or ecological environment, while researches on the development of marine resources and marine ecological protection are expected to be carried out from a systematic perspective. As a huge and organic multivariate dynamic system, the ocean assumes powerful self-repair and purification functions, with a large amount of renewable and relevant resources in it. Hence, sustainable development and ecological protection has to be taken as the primary premise in the exploitation and utilization of marine resources, so as to ensure the sustainable development of mankind.
2. Current situation of exploitation and utilization of marine resources in China

Since ancient times, the exploitation of marine resources has mainly focused on fishing and collecting marine living resources, obtaining salt by evaporating brine and navigating on the sea. In view of the increasing shortage of energy at home and abroad in recent years, as an energy treasury, there are also abundant renewable energy resources in the ocean such as marine wind energy, tidal energy, wave energy, temperature difference energy, salt difference energy except for a large number of mineral energy, which has attracted the attention of energy developers and led the main direction of current energy development to marine energy development. Apart from a variety of energies, the ocean also contains multifarious other resources [2]. With the gradual improvement of scientific and technological level in the exploitation and utilization of marine resources in the world, the economic value of marine resources is becoming increasingly highlighted.

2.1. Overexploitation of marine resources

Since many years ago, the over-exploitation of marine organisms has actually existed in China. In ancient times, the fishing of marine organisms was limited to fishing and shellfish-picking activities, while modern fishing methods are demonstrating increasingly mechanized and on a large-scale. There is also the emergence of highly destructive and predatory ways such as fishing with explosives. Large-scale fishing results in the failure of marine communities to regenerate within the effective cycle, which leads to the sharp reduction of marine species, the deterioration of living conditions, the gradual disappearance of rare species, the significant reduction of large-scale fisheries and the obvious decline or even depletion of fishery resources. In this way, fishermen's lives in the future will be seriously affected.

2.2. Irrational exploitation of marine resources

In recent years, the irrational and disorderly exploitation of marine resources has become increasingly severe in China. For example, failing to strictly conforming to the regulations in the utilization of the ocean, some local governments conduct land reclamation, sea-filling and even block the circulation of sea water, which has caused serious damage to the marine ecosystem. Among them, the most vulnerable are coral reefs, mangroves, casuarina equisetifolia shelterbelts on sandy coasts in the south and wetlands in estuaries, which are parts of marine resources easy to be damaged. In addition, other impacts include the dramatic shortening of coastlines, the dramatic decline in marine life and even the endangerment of some rare species due to their lack of habitat. Whereas, the damage to marine resources caused by such actions as reclamation will take a period of time rather than immediate manifestation, while the exploitation and utilization of resources such as coastal engineering construction and submarine sand extraction will also aggravate the degree of damage to the coastline. The irrational and disorderly utilization of the ocean will cause serious harm to the sustainable development of marine resources.

2.3. Pollution of marine resources due to exploitation and utilization

Petroleum pollution is regarded as the most harmful pollution source in the exploitation and utilization of marine resources. In the process of exploitation, refining and transportation of petroleum and its derivatives, accidental leakage in the sea will form an oil film on the surface of sea water, which will not only prevent sunlight from reaching the seabed but also seriously affect the photosynthesis of animals and plants in the water due to the lack of sunlight so that animals cannot eat, grow and reproduce normally. The harmfulness and toxicity of petroleum and its petrochemical products will also cause corrosion and damage to seawater, marine organisms, marine engineering and even human beings. Pollution of the ocean will destroy the ecological balance of the ocean area, deteriorate the whole marine environment. As a result, a vicious circle will be formed. In view of the variety of potential dangers in the ocean, when improving the utilization rate of marine resources and increasing economic benefits, we should pay due attention to the marine environment, promote low-carbon development, actively cultivate people's awareness of low-carbon life, remind people to reduce the discharge of domestic sewage and change their way of life, so as to achieve the rational exploitation and utilization of marine resources by adhering to the concept of low-carbon development.
In the process of exploiting and utilizing marine resources, another behavior that can cause pollution is mariculture. With the rapid development of the aquaculture industry in the past 30 years, some people in certain areas who merely pursue economic benefits violate relevant regulations and develop aquaculture too intensively, which has led to the increasingly serious self-pollution of aquaculture industry. In order to maximize economic benefits, an increasing number of aquaculture farmers put in excessive amounts of bait and antibiotics, while the aquaculture objects also produce a large number of excreta which will cause serious eutrophication of the water body, thus greatly enhancing the incidence of red tide by facilitating the growth and reproduction of toxic organisms such as red tide in the aquaculture area. As an extremely dangerous phenomenon, except for the harm to the marine environment, marine fisheries and mariculture, serious red tide will also pose threats on human health.

3. Analysis of problems and reasons existing in the exploitation and utilization of marine resources and marine ecology protection

3.1. Analysis of the problems and reasons encountered in the process of overexploitation and overutilization

In order to solve the problem of overfishing, a series of measures have been implemented by the government, including the adoption and formulation of rules on marine fishing relating to overfishing and seasonal fishing, the introduction of regulations on fishing suspension in summer, reproduction and releasing, the enhancement of management of environmental problems around the oceans to ensure the maximum protection of marine resources and the surrounding environment, as well as the constant increase of people's awareness of environmental protection of marine resources and the marine environment by strengthening publicity. Despite the fact that these measures do provide more opportunities for sustainable development of marine organisms, the effect is not as obvious as expected because fishermen are driven by benefits. Those fishermen who live by fishing are most concerned about their actual benefits rather than whether their overfishing will damage the sustainable development of marine resources. The only thing they are sure of is that the more they catch, the more economic benefits they will get. Or simply because of the pressure of life, The less the resources are, the more unscrupulous people will be. Given that the total amounts of marine resources are certain, the more seriously marine resource have been damaged, the more dangerous marine ecology will be.

3.2. Analysis of problems and reasons in exploitation and utilization

It has been found through the survey that for all that the seawater under China's jurisdiction presents slight pollution, the coastal waters demonstrate serious pollution, ecological environment deterioration and frequent natural disasters, which leads to a significant reduction in marine living resources. The major reasons of these phenomena include reclamation of beaches and direct discharge of land-based and sea-based pollutants. In recent decades, the protection of marine resources and the marine environment have been lacking in China. The development of marine economy and the acquisition of wealth from the sea have been emphasized, while the protection of marine resources and marine ecological environment has been neglected. Irrational land reclamation, sea-filling, overfishing and vigorous development of heavy industry aiming at rapid economic growth have resulted in a large number of untreated industrial and domestic sewage which were directly discharged into the sea and caused serious pollution of the sea water in offshore areas, which has seriously affected the normal habitat and reproduction of marine organisms. In serious areas, there has even been a sharp decrease in fishery resources and the abandonment of beach farms, which poses a threat to the natural ecosystem and the living environment of residents.

With the increasingly improvement of living standards and the progress of information as well as science and technology since the reform and opening up, the level of marine science and technology has also been significantly enhanced, which is conducive to people to obtain more considerable economic benefits through the greater exploitation and utilization of marine resources. However, due to immature management and regulations, there are a series of problems arising in the exploitation and utilization of marine resources, such as overexploitation, irrational development and marine pollution, which seriously affects the sustainable development of marine resources. In spite of the existence of
traditional concept of local protectionism and pedantic land economy, unlike land resources, marine resources are mobile. On condition that the marine resources of a certain area are over-exploited, irrationally developed or polluted, in addition to the destruction of the marine ecological environment in this region, the ecological environment in other regions will also be harmed to varying degrees, which is regarded to be one of the crucial factors leading to the unstable relationship between the marine areas and regions.

3.3. Analysis of the problems and reasons in the management of the exploitation and utilization of marine resources

The complexity of marine resource management is determined by its natural and social attributes. At present, the planning and management of marine resources in China are carried out in line with their attributes and industries for exploitation and utilization and according to the fields and departments, which is an extension of the management functions of the exploitation departments of various land resources [3]. From the perspective of their own interests, the exploitation departments of various resources ponder over the exploitation and planning of marine resources and believe that this will ensure the comprehensive advantages and potential of marine resources can be fully developed. However, as a dynamic and huge ecosystem different from the terrestrial ecosystem, marine resources of various types are interdependent and interact in the process of exploitation [4].

Faced with the serious impact of a series of problems in the exploitation and utilization of marine resources on their sustainable development, some countermeasures have been adopted by the relevant administrative departments of China. Despite that there was no relevant marine management organization at the beginning of the exploitation and utilization of marine resources, after years of development, the marine management organization has experienced the stages from scratch to integrated management. However, the establishment of relevant administrative bodies and the distribution of related rights are not perfect enough at present. In the management of marine affairs, China's ocean management institutions are gradually found to be lack of departments with high authority and comprehensiveness. In the distribution of management power, the most unreasonable phenomenon existing in the management system of marine resources is the decentralization and overlap of management institutions, which exerts a serious impact on the exploitation and utilization of marine resources and will lead to the vague allocation of management system in the ecological environment protection. When problems arise in marine management, various departments shift blame on each other while the damage to marine resources fail to be fully taken into account, which will inevitably lead to the destruction of the marine resources and the possible impact on the marine ecosystem.

4. Necessity of marine ecological protection

4.1. Prerequisites for the protection of marine ecology and the exploitation of marine resources

As one of the current concepts of economic development, the sustainable development of marine resources through the implementation of marine ecological protection is considered as a low-carbon development model, which is recognized as an essential direction in the development of national economy. With the decline of global forest coverage, the massive consumption of mineral energy and the emission of tremendous harmful gases, the acceleration of air pollution and climate warming, the destruction of the marine environment and the deterioration of the global environment, the new concept of low-carbon development has been put forward by the international community in response to the demand of human survival [5]. The concept of low-carbon economy has been identified as a major and new development direction by the international community. Since marine resources, especially marine renewable resources, are currently the most abundant resources in the world, we are expected to achieve a full understanding of their significance. Considering that the severe destruction of marine ecosystem will be a great challenge to the survival and development of human beings, the exploitation and utilization of marine resources have to be carried out reasonably, which, except for being able to guarantee a favorable living environment for more marine organisms, is also conducive to the effective solution of the problems including resource scarcity and serious environmental
pollution. Therefore, the concept of sustainable low-carbon development has to be upheld in the exploitation and utilization of marine resources, while the necessity for marine ecological protection shall be highly emphasized.

4.2. Marine ecological protection is conducive to the promotion of international competitiveness

In developing and utilizing marine resources, we should adhere to the concept of marine ecological protection and establish a low-carbon model of marine development, which is conducive to enhancing international competitiveness. Historically, as the earliest place where life was conceived, the ocean occupies nearly 71% of the earth's total area. Therefore, the protection of marine ecological environment is the most vital link to protect the global ecological environment, while the state of ecological environment maintenance will exert direct impact on the survival and development of human beings. Besides abundant marine organisms, there are also a large number of oil, gas and mineral resources in the huge marine resources, which are closely related to the production and life of human beings. The destruction of marine resources will not only damage the living environment of marine organisms, but also seriously affect human life [6]. With the increasing concern on the research and development of marine resources nowadays, in addition to strengthening the development of new energy sources, people have also carried out a series of studies on ocean currents, thermal gradients and tides, which will affect the researches on new energy sources of human beings. With an in-depth understanding of the significance of marine resources, Li Guoqiang once said that, the limited land resources would be no longer meet the demand of human survival and development in the current situation of large population growth, the importance of marine resources is expected to be fully recognized to achieve human beings’ better survival and a favorable living environment. For all that the exploitation of marine resources is merely in the primary stage and only a small part of the vast marine resources are exploited, the enormous economic wealth has been brought to the state and society. Therefore, the sustainable exploitation and utilization of marine resources on the premise of protecting marine ecology is a low-carbon development model, which will be conducive to the enhancement of China's competitiveness in the international community.

4.3. The only route of social development

Rather than being put forward merely in light of the current situation, the establishment of an ecological concept of marine protection in the exploitation and utilization of marine resources is also a matter of human survival in the future. The sustainable development of marine resources is closely related to the destiny of the whole nation and is considered as the basis of sustainable economic and social development. Promoting the coordinated development of land and sea industries, strengthening the integrated protection of land and sea ecological environment as well as achieving the coordinated and efficient utilization of land and sea resources are the guarantee for the healthy development of society, while we have no right to deprive or impair the rights of future generations to enjoy marine resources. Through strengthening marine education, drawing up national education development plan for marine knowledge and ecological protection as soon as possible, organizing experts and scholars to compile teaching materials and popular readings for marine education at various levels and types, we can enable marine education to enter schools, teaching materials and classrooms, as well as promote universities and research institutions to speed up the construction process of marine education disciplines. The development of marine resources and the protection of marine ecosystem should be promoted jointly through the education of marine resources and the protection of marine environment from early childhood, the persistence of the concept of sustainable development, the adherence of low-carbon development and the cooperation with relevant departments of marine resources.

5. Suggestions on the exploitation and utilization of marine resources and marine ecological protection

It is required that in the development of marine resources and marine ecological protection, we should adhere to the concept of ecological protection in the exploitation and utilization of marine resources. While in developing marine economy obtaining economic benefits through the development of marine economy has to be based on the concern for marine resources and marine ecological environment.
Only when the development of marine resources and the protection of ecosystem are upheld simultaneously can the comprehensive strength and international competitiveness of China be fundamentally enhanced [7].

5.1. Improvement of integrated management mechanism
Apart from the establishment of national marine legal systems and the improvement of relevant comprehensive marine management laws and regulations, the marine environmental quality standards and marine biodiversity protection standards should be continuously improved in the process of marine management. Local marine policies should be established and rigorous training centers might be set up to regularly conduct training for officials lacking management experience in coastal and island areas to enhance the law enforcement capacity of local marine management; Marine-related coordination and management structure should also be established to strengthen the monitoring capacity of marine resources exploitation and utilization as well as the law enforcement and management system of marine resources; A reasonable marine resources detection system should be set up to monitor marine living resources, marine ecosystems and sea level changes in offshore areas in real time, so as to provide timely feedback on changes in the ocean; The evaluation system for the sustainable development of marine resources is proposed to be established, which will enable relevant departments to make decisions on whether to approve the development projects of marine resources by referring to the relevant data in the evaluation system. It is required to assess the situation of the ocean from the whole region and then to formulate a comprehensive plan for the exploitation and utilization of marine resources based on the situation of each region. In addition, the possible impacts of certain man-made or natural disasters on marine resources should also be taken into account so as to achieve the continuous improvement and perfection of an integrated management system.

5.2. Protection of marine living resources
As the key part of the ocean, the protection of marine living resources is considered to be the protection of marine resources to a large extent. It is suggested that plans for the protection of marine living resources should be formulated, cooperation with neighboring countries should be strengthened, integrated management of marine biological resources should be enhanced, diversity of marine resources should be protected, management of marine fishery resources should be strengthened, marine aquaculture resources should be vigorously developed, the convenience of science and technology should be made use of to achieve continuous improvement of the aquaculture level of high-quality varieties, new aquaculture varieties to be continuously cultivated, investment in technology to be increased and high-yield and low-consumption aquaculture technology to be developed [8]. In addition, the protection of marine living resources requires the strengthening of national macro-control, the rational exploitation of marine fishing resources, the reasonable evaluation of the sustainable development of marine fishing for marine resources in the exploitation and utilization of marine resources, as well as the continuous rational adjustment of various laws and regulations in accordance with data provided by the evaluation system. Enhance fishermen's awareness of marine living resources protection. Actively encourage them to participate in the sustainable exploitation and utilization of fishery resources and strengthen the legalization of fishery resources management. Protect certain rare marine natural resources through the establishment of marine nature reserves. Protect marine ecosystems, including biological and ecological areas of great research value, as well as establish special marine conservation areas.

5.3. Protection of marine environment
Aiming at protecting the marine environment, it is firstly required to conduct control over the land pollution, including actively controlling the pollution of land-based pollutants to the marine environment, continuously evaluating the level of marine discharge from coastal sewage outlets, adopting sewage treatment measures to strictly control the sewage discharged into rivers and oceans as well as ensuring that all sewage has been treated before discharging. Minimize the discharge of pollutants which may cause eutrophication or red tide in the sea due to enrichment, encourage farmers to reduce the use of pesticides and fertilizers, prohibit the use of fertilizers and pesticides that may lead
to severe pollution to land resources, control the discharge of pollutants and certain pollution activities at sea, require people working at sea to take timely measures to protect the living areas of rare organisms when confronting dangers, protect the living areas of rare organisms, actively assess the impact of the use of oil and gas on sustainable development, strictly prohibit dumping or incineration of dangerous goods at sea, continuously improve the detection system of marine environmental pollution and carry out timely adjustment to the unreasonable systems.

5.4. **Strengthening construction of marine science and technology**

In order to strengthen the construction of marine environmental scientific research system, it is necessary to conduct in-depth research on marine biology and other disciplines relating to marine protection, continuously develop control technologies for land-based and marine pollutant discharge, improve sewage discharge standards and marine ecological nature protection technologies, real-time monitor the impact of pollutants on the marine environment, strictly control the occurrence mechanism of red tide as well as make prediction. Strengthen the research on marine resources development, actively study the environmental capacity and purification capacity of coastline and island areas to determine the reasonable development scale, layout and carrying capacity for population of the marine industry, real-time monitor the impact of marine exploitation and utilization on marine environmental resources, continuously strengthen the protection of marine nature resources, enhance the technology of desalination and direct utilization of seawater, strengthen the technological development of marine food and drugs, increase the construction of new energy sources and the comprehensive utilization of certain resources and products, as well as achieve more rational and greater exploitation and utilization of marine resources through intensifying the construction and research of marine science and technology.

5.5. **Strengthening international cooperation**

The protection of marine resources also calls for continuous strengthening of international cooperation, including active cooperation with other countries in scientific research on marine resources, regular training and exchange of technical knowledge with foreign countries, joint formulation of action plans on ecological environment detection and protection with neighboring countries, as well as achieve joint protection and management of marine ecological resources through positive benefits. Achieve common progress in marine resources development and protection with other countries by actively utilizing international aid funds to develop marine science and technology and share information on marine development.

6. **Conclusion**

From the perspective of sustainable development of marine resources, this paper advocates that the ecological view, future view of sustainable development as well as the responsibility of great powers should be adhered to in the process of marine exploitation and utilization. Except for satisfying the demand of social life and development through appropriate exploitation and utilization of marine resources, the demands of future lives or people of other countries should also be taken into consideration. The exploitation and utilization should be based on the premise that it does not affect the lives and production of future generations or people in other countries. As an irresistible trend of the times and the inevitable requirement of human’s pursuit of a better life, the exploitation of marine resources and the protection of marine ecology are the necessary route to achieve the sustainable development of China's marine economy and the construction of a maritime power, as well as the requirement of strengthening cooperation among coastal countries, promoting the globalization of marine economy and the construction of the community with a shared future for mankind under the "One Belt And One Road" initiative. Covering the production mode, lifestyle and values of human beings, the exploitation of marine resources and the protection of marine ecology should be regarded as an extremely feasible mode of development.

7. **References**
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