

Marine Engineering Environmental Protection Based on the Concept of Ecological Environment

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Abstract: The negative effect brought about by the vigorous development of marine engineering construction is the occurrence of marine engineering pollution accidents. Once such a huge construction project has a major accident, it will bring huge losses. The purpose of this paper is to study the environmental protection of marine engineering based on the concept of ecological environment. This paper studies the ways of marine engineering pollution and the marine engineering environmental protection methods under the concept of ecological environment. The proposed marine engineering of refining and chemical projects is evaluated from the perspectives of marine ecological health status assessment and public cognition and attitude of marine engineering environmental impact assessment. Targeted analysis, most people believe that holding relevant public opinion consultations can help marine engineering environmental protection. Prevent, control and even avoid marine engineering pollution from damaging the marine environment from the source, thereby promoting the development of marine resources in marine environmental protection and the protection of the marine environment in the development of marine resources.

1. Introduction

The development of marine space requires a number of technical constructions at sea. With the development of current science and technology, the scale of engineering construction is getting larger and larger, and the marine environment is an important issue that deserves special attention [1]. With the rapid development of the coastal economy and the development of more and more marine projects, the pollution of the marine environment has become more and more serious, and the environmental quality of the marine environment has declined significantly. In order to meet the

research needs of the rapid development of my country's marine economy, the continuous deterioration of the marine environment and the subsequent impact on the development of coastal areas, it is necessary and urgent to conduct important research on the marine environment [2-3].

Under the call of building a "maritime power", the development of seawater resources has gradually been put on the agenda, resulting in the continuous deterioration of coastal ecosystems and seriously affecting the sustainable development of the region [4]. Some scholars start from the status quo of offshore marine science and technology construction, analyze the main ecological problems, and put forward corresponding solutions to these ecological problems, so as to reduce the damage of scientific and technological construction-coastal engineering to the marine ecosystem and promote the improvement of coastal ecology [5]. Some scholars have analyzed the trend of environmental changes in the ocean. The results showed that the total content of various monitoring elements in water quality and sediment showed a trend of first decreasing and then increasing with time, and the overall level of biological environment had a good correlation with the changing trend of water bodies. It shows that the construction of marine machinery has a negative impact on the ecological environment of the marine park, but the impact is not large [6]. It is of great significance to study the environmental protection of marine engineering based on the concept of ecological environment [7].

The indirect or direct ecological damage to the marine environment brought about by the rapid development of marine engineering construction projects is huge. While studying the pollution prevention and control of my country's marine engineering construction, this paper helps to promote the work process of my country's marine environmental pollution prevention and control; It will help promote the construction of marine ecological civilization and lay a good foundation for the realization of a marine power.

2. Research on Marine Engineering Environmental Protection Based on the Concept of Ecological Environment

2.1. Ways of Marine Engineering Pollution

One is pollution caused by marine engineering accidents. The occurrence of marine engineering accidents is something that every construction project wants to avoid, because some accidents are based on long-term accumulation and the potential hazards are not anticipated in advance, and some occur in a short period of time [8-9]. Therefore, the impact of accident pollution on the marine environment can be described as huge, no less than the total pollution caused by the entire engineering process [10].

The second is the pollution during the construction of marine engineering. The pollution of marine engineering in the construction process is mainly manifested in the damage or change of the original physical state of the ocean and the harm caused by the pollutants in the process of engineering sewage to marine organisms. In the successive development of marine engineering, the transparency, turbidity and salinity of seawater will be affected, especially large-scale marine engineering projects such as excavation of submarine tunnels and mineral development will inevitably affect the geology of the ocean and thus affect the quality of seawater in the whole area [11].

The third is the pollution of later facilities disposal. The degree of pollution caused by later facility disposal is smaller than that caused by accident pollution and marine engineering. It is mainly to properly dispose of the stockpiled facilities when the marine engineering is nearing the end, and most of the pollution can be avoided by man-made effective measures [12].

2.2. Environmental Protection of Marine Engineering under the Concept of Ecological Environment

(1) Pay attention to public participation in marine engineering

Environmental protection authorities or other entities obliged to disclose environmental information shall disclose to the public the environmental quality disclosure and environmental behavior disclosure information they have obtained through newspapers, television, the Internet (website, Weibo), WeChat public platform and other channels where the public can easily obtain information. From an international point of view, both the information disclosure platform and the disclosure content have shown a trend of diversification, informatization and convenience. For example, the professional terms and data of environmental monitoring, the adverse effects that environmental conditions may have on the public, and the suggestions for measures that can be taken to prevent adverse effects should be expressed in a way that the public can understand. Enterprise violation records, environmental impact assessment reports, pollutant discharge lists, etc. are stored in the information database, and then these data are placed on the Internet and other places where the public can easily obtain them for easy query and public supervision [13-14].

(2) Implement environmental supervision of marine engineering

The implementation of marine engineering environmental supervision is a necessary means to prevent environmental pollution and ecological damage at the source. Generally speaking, marine engineering must be approved by the marine authority before construction. The long-term impact on the marine ecological environment is still difficult to predict [15-16]. Environmental damage is irreversible, and the problems of environmental damage continue to emerge after end-of-pipe treatment. Obviously, this is not a problem that can be solved only by end-of-pipe treatment. It should start from reducing pollution at the source. Strengthening the supervision of marine engineering, strengthening the supervision of the whole process, and establishing a diversified compensation mechanism for marine ecological losses can reduce or even avoid the environmental damage caused by marine engineering construction from the source [17-18].

3. Investigation and Research on Marine Engineering Environmental Protection Based on the Concept of Ecological Environment

3.1. Overview of the Marine Engineering of the Proposed Refining and Chemical Project

(1) Reclamation project

The total area of the project is 548m², of which the reclamation area is 175m². The proposed sea area for the project has been reclaimed in October 2023 according to the regional sea use plan. The land area of the factory mainly constructs oil refining, chemical plant (ie main project), storage and transportation project, environmental protection project and public works. The refinery part is mainly composed of oil refining unit area, storage tank area (crude oil and intermediate tank area), refined oil tank area, loading and unloading and warehouse, sewage treatment, circulating water and thermal facilities. The total area of the refinery is about 301m².

(2) Warm water outlet project

The drainage outlet of this project is planned to be located on the outside of the west revetment on the southwest side of the sewage treatment plant, using the drainage pipes reserved during the construction of the breakwater. The drainage ditch in the plant area is connected with the drainage pipe that passes through the wave break wall, and extends into the sea for 220m, and the warm seawater is discharged through the drainage well. The designed drainage is 21m³/h in winter and 21m³/h in summer, and the drainage temperature rises by 8 °C.

3.2. Marine Ecological Environment Assessment Methods

Based on the existing survey data, the relative pros and cons of the ecological quality of each evaluation unit were calculated. Calculated as follows:

$$ERI_j = PD_j + ZD_j + ZB_j + BD_j + BB_j + SD_j + PP_j + D_{aj} \quad (1)$$

In the formula, ERI_j represents the assignment range of the comprehensive marine ecological response index from 0 to 100 points, and the recommended weights for evaluation are 10%, 10%, 10%, 10%, 10%, 10%, 15%, and 25%, respectively.

The "comprehensive index method" based on the single-factor index evaluation was used for evaluation. Calculated as follows:

$$HQI_j = WQI_j \div SQI_j \div BQI_j \quad (2)$$

In the formula, HQI_j represents the comprehensive index of marine habitat quality at station j, and its assignment range is 0-100.

4. Analysis and Research on Marine Engineering Environmental Protection Based on the Concept of Ecological Environment

4.1. Assessment of the Current Status of Marine Ecological Health

The tide in the sea area where the project is located is irregular semi-diurnal tide, and the tidal current is irregular semi-diurnal tide, and the movement form is basically reciprocating flow. The types of seabed sediments near the project area are mainly medium sand, gravel and pebbles. The sources of sediment in the engineering sea area are not abundant, and the positions of each isobath remain stable, and there is no major scouring and silting.

Table 1. Assessment of hydrodynamics, topography, erosion and sedimentation status

serial number	Indicator name	results of testing	Sea area environmental status assessment
1	trend nature	Irregular	The flow velocity in the area to be selected for the project is relatively large, mainly along the shore current, which is conducive to the diffusion of pollutants.
2	trend movement	reciprocating flow	
3	The vertical mean velocity of ebb and flow	1.62m/s 15 °	
4	Maximum possible flow velocity, flow direction	2.47 m/s 18 °	
5	Residual flow size	25.1cm/s	The average sand content in the project area is small, and the water quality is clear and no large rivers enter the sea.
6	The average sand content of rising and falling	0.015kg/m3	
7	The average maximum sediment content of the vertical line of rising and falling	0.010kg/m3	

Survey data evaluation standard benchmark values: phytoplankton density, zooplankton density, benthic animal density, and primary productivity are derived from marine survey data. In the comprehensive evaluation and assignment of each index, the weights of each evaluation index are

10%, 10%, 10%, 10%, 10%, 10%, 15%, and 25%, respectively.

The comprehensive evaluation results show that the comprehensive index of ecological health in this sea area is 6.1, indicating that the regional ecological disturbance is relatively serious. The evaluation results of the status quo of marine ecological health are shown in Table 2.

Table 2. Assessment results of marine ecological health status

Evaluation indicators	Evaluation standard benchmark value	Evaluation index assignment	Comprehensive evaluation assignment
Phytoplankton density (pieces/m ³)	14×10 ⁴	5	0.5
Zooplankton density (pieces/m ³)	3840	10	1
Density of benthic animals (pieces/m ³)	98	5	0.5
Density of eggs and larvae (pieces/m ³)	1.64	8	0.8
Ecological Sensitivity Index	National Nature Reserve	8	8
Marine Ecological Health Comprehensive Index	6.1		

4.2. Analysis of the Questionnaire on Public Cognition and Attitude of Marine Engineering Environmental Impact Assessment

This time, the questionnaires were sent to about 200 people, and a total of 145 valid questionnaires were collected. After screening according to the time required to fill in the questionnaires, 140 questionnaires were retained for statistical analysis of the data. As shown in Figure 1, this paper analyzes the role of public opinions on decision-making in the environmental impact assessment of marine engineering. There are five options in the questionnaire: the first option is "decisive role", and the number of people who choose this item is 21 people, accounting

for 15% of the total; the second option is "important role", the number of people who choose this item is 45, accounting for 32% of the total; the third option is "general reference value", the number of people who choose this item 42 people, accounting for 30% of the total; the fourth option is "no effect", the number of people who choose this option is 21, accounting for 15% of the total; only 11 people choose "other", accounting for 7% of the total .

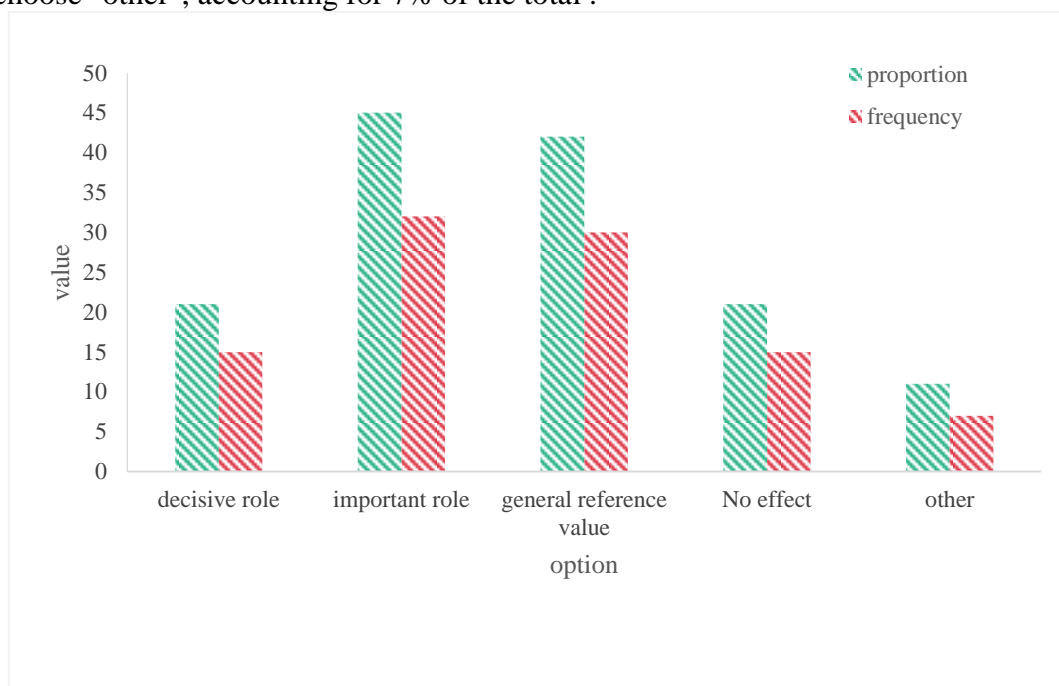


Figure 1. Analysis of the effect of public opinions on environmental impact assessment of marine engineering on decision-making

According to Table 3, it can be seen that the current aspects of public participation in the environmental impact assessment of marine engineering need to be improved. Five options (multiple choices) are designed in this questionnaire: the first option is "protect personal privacy", and the number of people who choose this option There are 105 people, accounting for 75% of the total; the second option is "hold relevant public opinion consultation meetings", and the number of people who choose this option is 124, accounting for 88% of the total; the third option is "need to improve the quality of the questionnaire and the professional level of investigators", the number of people who chose this item is 84, accounting for 60% of the total; the fourth option is "requires public participation in all processes", the number of people who choose this item is 102, accounting for 60% of the total 72%; the fifth option is "Other", and the number of people who choose this item is 35, accounting for 25% of the total, as shown in Figure 2.

Table 3. Analysis of selected areas for improvement in public participation

Options	Number of people	Proportion
protect personal privacy	105	75
Hold relevant public consultation sessions	124	88
Need to improve the quality of questionnaires and the professionalism of investigators	84	60
Requires public participation in all processes	102	72
other	35	25

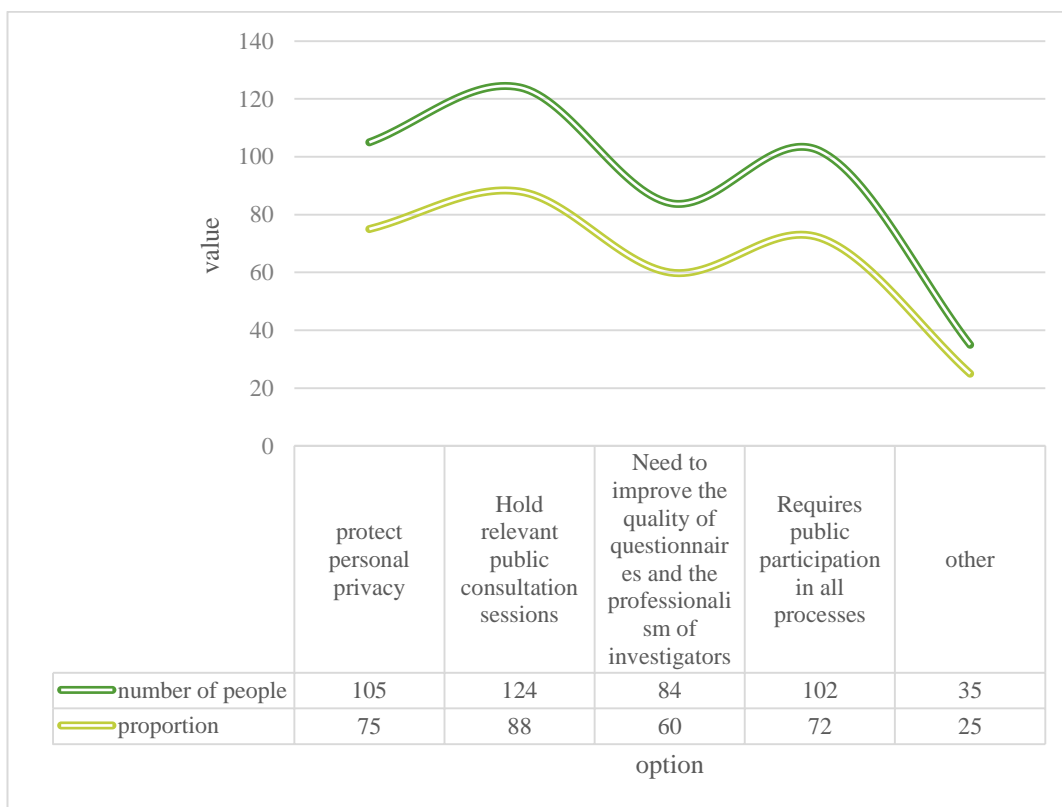


Figure 2. Areas for improvement survey results

Covering public participation in the whole stage also emphasizes the necessity of supervision at this stage after the environmental impact assessment of marine engineering. The reasonable time to raise doubts when problems are discovered afterwards is generally considered to be between three months and one year. It reflects that the public is very concerned about matters related to post-event participation, and the actual effect of post-event feedback is also considered to be carried out within one year, so that the public can better reflect the problem, solve the problem in time, and avoid serious consequences. Therefore, we need to strengthen the participation in the full-stage development and implementation of marine engineering environmental impact assessment.

5. Conclusion

In the construction of marine engineering, there may be many measures that will adversely affect the marine environment. Engineering facilities may destroy the dynamic balance of the original coastal zone and affect the erosion and sedimentation changes of the beach. In this paper, the framework model is verified and analyzed through the marine engineering of the refining and chemical project. In view of the relatively complex data required for the marine engineering research of the petrochemical project, it can be further verified and analyzed through other petrochemical projects, so as to provide more comprehensive data for the early application of the model support and basis. When constructing the status layer of the assessment framework this time, the marine habitat quality assessment adopts a combination of the standard index method based on marine functional areas and the overall comprehensive index of the assessed sea area. Although this method reflects the current situation of the sea area and expresses the trend of changes in the marine environment, this paper does not conduct a deeper analysis of the correlation between the two methods. It is suggested that researchers can further study the correlation between the two in the

future and make it a standard method for environmental impact assessment reports.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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