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RESEARCH ARTICLE

EBM - BASED INNOVATION STRATEGY FOR INTEGRATED MANAGEMENT OF MARINE ECOLOGICAL PROTECTION

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ARTICLE DETAILS

ABSTRACT

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The ecosystem-based coastal zone management (EBCZM) is an innovative integrated management concept that can meet the above practical needs. First of all need to start from the practice of China's coastal zone management, illustrates the management (EBM) based on ecosystem level the concept, connotation, development, principles, etc., and puts forward based on extended ecosystem level of Marine management (EBMM) and based on the ecological system of coastal zone management (EBCZM) concept, and from the jiaozhou bay coastal zone ecosystem, the root cause of ecological risk, and the main indicators of closely related to human activities, preliminary established the "based on index system of coastal zone management level of jiaozhou bay ecosystem".

KEYWORDS

Management based on ecosystem level, Jiaozhou bay, Coastal zone management index system.

1. INTRODUCTION

At present, China's national Environment is in a period of rapid development, the human development intensity of coastal areas also continues to increase, the extent of damage to the Marine environment is also deepening. In the past decade, the approach to planning and management based on ecosystems has been developed with the aim of reducing this threat by defining planning and management USES, thereby mitigating the negative impact on the structure and functioning of ecosystems [1]. The global environmental policy discussion encourages countries to adopt an ecosystem approach to ocean management [2]. Ecosystem-based management is now widely accepted as the best means of managing the complex interactions of Marine systems [3]. In addition, ecosystem-based management necessarily requires a degree of coordination between countries sharing Marine ecosystems and between national institutions and sectors responsible for Marine health and resource utilization [4].

Mohan et al. demonstrated the application of a common framework for establishing cost-effective measures and ecosystem-based integrated management practices [5]. Negny et al. considered various social goals, such as sustainable food supply, clean energy and healthy Marine ecosystem, as well as management measures selected to achieve these goals, providing a comprehensive perspective for ecosystem-based management [6]. Marchi et al. proposed five characteristics of model-based information, and proposed Suggestions for the success information of ocean management decision based on the BBS framework of ocean model [7].

In recent years, with the rapid development of Qingdao's social Environment, the process of industrialization and urban construction along the jiaozhou bay has been gradually accelerated. The water area of jiaozhou bay has been decreasing year by year, and the Marine ecological environment and coastal ecological environment have also been deteriorating. However, in recent years, as the importance of coastal ecosystems has been increasingly recognized, ecosystem-based

management (EBM) provides an opportunity to overcome these challenges [8]. With the increase of human dependence on Marine resources, ecosystem based management (EBM) has been considered as an appropriate way to ensure sustainable development [9]. Ecosystem based management (EBM) has become an appropriate international response to global environmental degradation [10]. Ecosystem management (EBM) has been widely promoted as a comprehensive and comprehensive method to protect and protect aquatic biodiversity [11]. Ecosystem-based management (EBM) promises to largely recognize the need for comprehensive management of ecosystems, including at the human level [12].

EBM is an environmental planning and adaptive management method that takes social and ecological needs into consideration [13]. Of course, the implementation of the ecosystem based management (EBM) planning process also needs to take into account the connectivity of the ocean, transition, freshwater and land areas [14]. Therefore, coastal zone management need to based on the thinking of EBM, highly value: one is the EBM and coastal zone management is to achieve common sustainable development of human society, Enviroment and nature as the ultimate goal, emphasized the human is an important part of ecological system, emphasize human activities should be brought into the ecological system of management; Second, the main disadvantage of coastal zone management is the lack of management tools and scientific and technological support. EBM can provide a management idea and operation procedure for the sustainable development of coastal zone, and has a clear and operable management process, which is conducive to the smart integration with the specific implementation process of coastal zone management planning.

For EBM, the design and ongoing adjustment of management measures should take into account the scale and dynamics of ecosystem characteristics (including a lack of adequate understanding), with the participation of relevant stakeholders [15]. Risk assessment quantifies the likelihood of adverse events and their consequences. They are used to

determine priorities and evaluate trade-offs for management interventions as an important component of ecosystem infrastructure management (EBM) [16]. There are many examples of EBM applications: Marine ecosystems are currently facing many threats to the integrity of ecosystems and to the loss of ecosystem services of social value, and Hawaii's socio-Environmental and ecological complexity creates a clear need for an ecosystem-based management (EBM) strategy [17]. Analysis categories including different stakeholders, ecosystem services and unrest scenarios were selected to understand the role of EBM in coastal environmental impact assessments. In addition, Cuzzocrea et al. identified three rapidly developing fields that will become the changers of the integration of spatial ecology and EBM rules [18].

2. RESEARCH METHODS

Indicator system refers to the collection of all or the whole specific indicators that are closely related and can reflect the evaluation object. Due to the integrated coastal zone management, high levels of numerous and complicated structure, a single index could not describe all aspects of coastal zone ecosystem change process, we have to build the index system to simplify the complex social, Environmental, ecological system into an idealized multiple index of organic whole, in view of the goal to provide management direction EBCZM, and regulate the management process. The selected index should not only reduce the number of parameters required to state a certain state accurately, but also simplify the communication process of providing observation results to users and make it easy for users to understand [19]. By referring to, screening and synthesizing the most common and frequently used principles of the indicator system in related fields, this paper establishes the following eight principles as the criteria for selecting, setting indicators and establishing China's coastal zone management indicator system [20].

2.1 Purpose and policy orientation

The selection of indicators should reflect the connotation and goal of sustainable development of coastal ecosystem and reasonably answer the questions of stakeholders.

2.2 Scientific and operable

The data must be collected through scientific measurement and statistical methods so that the information reflected in the indicators about coastal ecosystem can be credible and easily understood by both professionals and non-professionals. The design of indicators should be simple and easy to use, considering the availability and reliability of data, and making full use of data and information in existing statistical data [21].

2.3 Systematicness and optimization

Implement EBCZM is a complicated system engineering, so the design of

index system should according to the ecosystem's structure and level, reflect comprehensively the coastal zone environment - Environment - society overall status and interaction in a three-dimension system relations, as well as the different development phase of the dynamic process in coastal zone and the degree of sustainability, the index system of structure optimization.

2.4 Comparability and independence

The selected indexes can reflect the common characteristics of China's gulf coastal zone and are comparable in quantity or quality. The indicators of each level should be independent from each other to avoid the occurrence of similar or overlapping indicators.

2.5 Comprehensive and complete

The index system is an organic whole formed by the comprehensive action of many factors, and the internal and inter-system of the ecosystem are interrelated and interacted with each other. Therefore, the indicator system of coastal zone management based on the level of ecosystem should strive to reflect all levels of coastal ecosystem comprehensively and accurately, and comprehensively consider from different perspectives such as ecology, social Environment and human health.

2.6 Suitability for quantification

In the construction of the index system, indexes that are easy to be quantified should be selected as far as possible. For some indexes that are significant but difficult to be quantified, qualitative indexes can also be used to describe them and combine quantitative and qualitative methods.

3. RESULTS AND DISCUSSION

3.1 Preliminary analysis of the management index system of jiaozhou bay coastal zone based on the level of ecosystem

In the jiaozhou bay coastal zone after the root cause of ecological risk, will be "suit the remedy to the case", further increasing the terrigenous pollutants discharged into the jiaozhou bay and jiaozhou bay reclamation projects identified as EBCZM around the management of the target and the object, in reading, on the basis of a large number of research literature of jiaozhou bay, according to the relative importance of each index for the management goal, and considering the availability of its official data sources, from the origin of jiaozhou bay and coastal zone ecosystem, ecological risk as well as the main index of closely related to human activities, "Management index system of jiaozhou bay coastal zone based on ecosystem level" (table 1 ~ 5). Table 1 Jiaozhou bay coastal zone management indicator system based on ecosystem level (driving force index D: category 4)

Table 1: The Indicator System for EBCZM of Jiaozhou Bay (Driver: 4 kinds)

Level indicators (weight)	The secondary indicators
Population change (0.154)	<ul style="list-style-type: none"> ● Coastal population density and its annual growth rate (resident/seasonal population) ● The proportion of managers involved in the sea in the total population of jiaozhou bay coastal zone
The level of Enviromental development along the coast (0.5)	<ul style="list-style-type: none"> ● The output value of the secondary industries (fishery, aquaculture, port transportation, salt water production, shipbuilding, Marine chemical industry, etc.) and their proportion in the total output value of the major Marine industries ● Qingdao's annual GDP and its growth rate
Coastal tourism and entertainment needs (0.077)	<ul style="list-style-type: none"> ● The annual income of coastal tourism ● The area of binhai park ● Number of tourists within 100 km coastline ● Number of recreational days in the coastal zone
Coastal natural disaster (0.192)	<ul style="list-style-type: none"> ● The intensity, frequency and range of sudden disasters (e.g., tropical cyclones, thunderstorms, hail, cold tides, storm surges, sea ice, sea fog) ● The intensity, frequency and range of slowly occurring Marine geological hazards (e.g

Table 2 Jiaozhou bay coastal zone management index system based on ecosystem level (pressure index P: category 5)

Table 2: The Indicator System for EBCZM of Jiaozhou Bay (Pressure: 5 kinds)

Level indicators (weight)	The secondary indicators
Fisheries (0.038)	<ul style="list-style-type: none"> ● Enviromental fish species, sustainable biomass ● Unit fishing effort (kg/ person/day) ● The size of the fish first caught ● Water pollution rate of spawning/seedling farms ● Fishery yield (revenue/cost)
Aquaculture (0.154)	<ul style="list-style-type: none"> ● Sustainable biomass of seafood ● Density of aquaculture organisms/facilities ● Aquaculture capacity ● Annual growth rate of shellfish and algae exploitation ● Yield (revenue/cost) of offshore farming ● The number and area of Marine aquaculture zones
Terrestrial pollution (0.423)	<ul style="list-style-type: none"> ● The number and annual discharge of point source pollution (e.g., runoff pollution source into the sea, direct discharge source, mixed discharge source) ● The quantity and annual discharge of non-point source pollution (agricultural and breeding pollution) ● Urban sewage, industrial wastewater, solid waste output value of ten thousand-yuan emissions
Coastal construction (0.269)	<ul style="list-style-type: none"> ● The quantity of haven, throughput, development utilization rate ● Annual reclamation area
Maritime transport and oil and gas (0.115)	<ul style="list-style-type: none"> ● Capacity of sea lane, traffic volume

Table 3 Index system of jiaozhou bay coastal zone management based on ecosystem level (status index S: category 5)

Table 3: The Indicator System for EBCZM of Jiaozhou Bay (State: 5 kinds)

Level indicators (weight)	The secondary indicators
Water quality (including seawater, fresh water and ground water) (0.538)	<ul style="list-style-type: none"> ● Physical parameters (e.g. salinity, turbidity, sedimentation rate, pH value, oxygen deficit) ● Eutrophication parameters (e.g., occurrence frequency and range of red tide, dissolved oxygen concentration, chlorophyll a concentration) ● The concentration, discharge and accumulation of harmful chemicals (e.g. heavy metals, petroleum hydrocarbons, COD) in water ● Water environment quality standards for different Marine functional zones ● Per capita availability of fresh water/groundwater in coastal zones
Land use along the coast (0.077)	<ul style="list-style-type: none"> ● Land type, area and its proportion ● Ratio of original shoreline to artificial shoreline within 100 km shoreline
Biodiversity (0.269)	<ul style="list-style-type: none"> ● Primary productivity of coastal ecosystems ● Biodiversity index ● Absolute density and relative abundance of species
Landscape and vegetation (0.077)	<ul style="list-style-type: none"> ● The total area of natural landscape resources ● The area and proportion of major vegetation (e.g., beach/dune vegetation, beach, wetland, estuary)
Other resources stock and quality (0.038)	<ul style="list-style-type: none"> ● The resource reserves and unit value of coastal ore (zirconium, ilmenite and magnetite) and mineral resources (laoshan granite) ● The area and utilization of available sea area

Table 4 Jiaozhou bay coastal zone management indicator system based on ecosystem level (impact indicator I: 2)

Table 4: The Indicator System for EBCZM of Jiaozhou Bay (Impact: 2 kinds)

Level indicators (weight)	The secondary indicators
Socio-Enviromental loss (0.346)	<ul style="list-style-type: none"> ● The Enviromental costs of global warming ● Reduction rate of resource/personnel/Enviromental losses caused by coastal disasters ● Enviromental losses caused by land-based pollution ● Enviromental losses caused by Marine pollution
Impact on human health or welfare (0.654)	<ul style="list-style-type: none"> ● Ecosystem health rating (1-5) ● Human health grades (grades 1-5)

Table 5 Jiaozhou bay coastal zone management indicator system based on ecosystem level (response index R: 4 categories)

Table 5: The Indicator System for EBCZM of Jiaozhou Bay (Response: 4 kinds)

Level indicators (weight)	The secondary indicators
Environmental management and monitoring (0.538)	<ul style="list-style-type: none"> ● Coastal solid waste accumulation, treatment rate, recycling utilization rate ● Standard discharge rate of industrial wastewater and domestic sewage/emission reduction rate ● The location and area of coastal and Marine reserves ● Ecological compensation principle (who protects who benefits; Who pollutes who pays; Who benefits who pays; Fair compensation; The degree of implementation of such principles as compensation in accordance with the law
Public awareness and participation (0.192)	<ul style="list-style-type: none"> ● Level of public awareness of coastal and Marine ecological risks ● The level of public awareness of sustainable development ● The proportion of contents related to jiaozhou bay coastal zone in China's Marine environmental quality bulletin, shandong provincial Marine environmental quality bulletin, Qingdao municipal Marine environmental quality bulletin, Qingdao municipal environmental status bulletin and Qingdao statistical bulletin on national Enviromental and social development
Technology support and capital investment (0.115)	<ul style="list-style-type: none"> ● B/C (ratio of total citizen benefits to overhead costs) ● Amount of financial support for kelp management activities ● The proportion of investment in coastal environmental governance in Qingdao's GDP
Institutional capacity (0.154)	<ul style="list-style-type: none"> ● Water area, shoreline and land functional zoning (classification, scope, proportion) ● Coastal zone management institutions (e.g. Qingdao coastal zone planning and management/advisory committee, Qingdao city ● Planning and management department, Qingdao Marine affairs management/advisory committee, Qingdao Marine development and research center ● The work efficiency of the protection and management commission, the Qingdao office of Marine affairs management, and the maritime surveillance and law enforcement teams

3.2 Management countermeasures and measures

In view of the increasing pollutants entering the gulf, and according to the pollution status of different sea areas in jiaozhou bay (namely water quality grade), the following eight measures are proposed to reduce the ecological risks in the coastal zone and ensure the sustainable development of the coastal ecosystem. (1) Guided by the scientific outlook on development, we will fully implement the strategy of "encircling the bay for protection and supporting its development", and adhere to the approach of "two controls and one control" (i.e., control of reclamation, control of pollution and control of pollution).

(2) The total amount of land-based pollutants shall be controlled, and the management of discharge of pollutants up to the standard shall be strengthened. Untreated sewage shall be strictly prohibited to discharge directly into the bay. The submarine pipe network can be laid to discharge the offshore deep water to the waters south of the red island with strong water exchange capacity, while avoiding the discharge to cangkou bay (wu jianping, 2009). At the same time, the three-dimensional monitoring of water quality, sediment and biology should be strengthened, and the environmental protection input of governments at all levels should be increased to improve the water quality and environment of jiaozhou bay.

(3) Carry out comprehensive river regulation, including pollution control, pollution interception and transformation, dredging of culvert and landscape improvement of licun river, haibo river and other major inlet rivers.

(4) Accelerate the renovation, expansion and new construction of jiaozhou bay coastal sewage treatment plant, and increase the daily sewage treatment capacity. Improve the supporting sewage treatment facilities; Rational allocation of water for production, living and ecological use; Focus on source control. It can draw lessons from the ideas of "two systems of pollution elimination, control (tide absorption) diversion and ecological treatment" adopted in jiangsu water pollution control (liu hongbin, 2008).

(5) Strengthen the technical research of urban sewage regeneration system and improve the utilization rate of water resources. For example, the wastewater discharged from the land sewage treatment plant can be

deeply treated to serve as the landscape and green water for the land water network in the new urban area of Qingdao (wu jianping, 2009).

(6) Optimize industrial structure, develop circular Enviroment, vigorously develop high-tech industries such as tourism, port, logistics, electronics and biology, as well as modern service industry and high-end manufacturing industry along the bay, so as to realize energy saving and reduce the output value of 10 thousand yuan sewage discharge in jiaozhou bay.

In addition, in view of the large-scale reclamation around the root of the ecological risk, should it is prohibited to illegally, disorderly alongshore type reclamation, land reclamation and advocates the permeable breakwater and wharf, pier wharf, offshore structures, such as artificial islands have less effect on the Marine environment for the construction of the new model with the sea (Tian Xiaoming, 2005), in order to prevent the further shrinking the jiaozhou bay. Since August 2006, except for major projects determined by the municipal government and the state, Qingdao has stopped accepting reclamation projects of jiaozhou bay, indicating that the government attaches great importance to the ecological environment of jiaozhou bay and is eager to improve its situation. At the same time, it should be forbidden to examine and approve the reclamation and cultivation projects of tidal flats, and moderately "return the ponds to the sea" for the shrimp ponds, fish ponds and salt flats that have lost their Enviromental value. To control the construction of engineering facilities in the bay, to avoid the deposition of jiaozhou bay.

4. CONCLUSION

The thesis is based on the ecological level of coastal zone management (EBCZM) the central issue, based in China's coastal zone management practice needs, based on the ecological system management (EBM), the construction of the index system of related theory and method, illustrates the principles of the establishment of the index system of coastal zone management and its structure, combining the jiaozhou bay profiles and its scope and characteristics of coastal zone ecosystem, the evaluation index system will be further applied to the jiaozhou bay coastal zone ecosystem, in order to provide a reference for our country's coastal zone management practice value of the index system.

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