

Research on the Popularization Effectiveness and Evaluation of Modern Maritime Science Popularization Bases

Xiang Huang

Jiangsu Maritime Institute, Nanjing, Jiangsu 211170, China

Abstract: Against the backdrop of the nation's prominent maritime strategy and the rapid evolution of the shipping industry, modern maritime science popularization bases have emerged as pivotal platforms for disseminating maritime knowledge and culture. Based on an analysis of their current development in China, this paper systematically elucidates their conceptual framework and classification features. It further examines the key factors influencing base evaluation and critically analyzes the limitations of existing assessment mechanisms. Accordingly, the study proposes multi-dimensional strategies to enhance the effectiveness of science popularization. This research aims to provide theoretical insights and practical guidance for optimizing the construction and evaluation systems of maritime bases, thereby facilitating the high-quality development of the maritime science popularization sector.

Keywords: Modern Maritime Science Popularization Base, Dissemination Effectiveness, Evaluation System, Influencing Factors, Promotion Strategy.

1. Research Background

In the process of global integration, the ocean serves as a vital link connecting the world, and its strategic position has become increasingly prominent. As nations pay growing attention to marine resource development, maritime trade and transportation, and the safeguarding of maritime rights and interests, the maritime sector is experiencing rapid development. Against this backdrop, the importance of maritime science popularization (Sci-Pop) has become increasingly evident, serving as a key force in enhancing public marine awareness, cultivating professional maritime talent, and promoting the sustainable development of the maritime industry [1].

As the core positions for maritime science popularization, modern maritime Sci-Pop bases bear the important mission of disseminating maritime knowledge, promoting maritime culture, and showcasing maritime scientific and technological achievements [2]. Through diverse exhibits, engaging Sci-Pop activities, and advanced display technologies, these bases vividly present the mysteries of the maritime domain to the public. In recent years, with strong national support for the Sci-Pop cause and rising social attention to marine culture, maritime Sci-Pop bases have sprung up, showing significant growth in both quantity and scale.

However, behind this vigorous development, many problems are hidden. Although some bases possess complete hardware facilities, their Sci-Pop content is outdated and forms are singular, making it difficult to attract public interest. Some bases lack effective operation and management mechanisms, leading to low resource utilization and unsatisfactory Sci-Pop results. Furthermore, when evaluating their own development effectiveness, some bases lack scientific and reasonable evaluation index systems and methods, making it impossible to accurately measure their strengths and weaknesses, and thus difficult to formulate targeted improvement measures. Therefore, conducting in-depth research on the popularization effectiveness of modern

maritime Sci-Pop bases and constructing a scientific and comprehensive evaluation system hold important practical significance for improving the construction level and Sci-Pop effectiveness of these bases, and for promoting the healthy development of the maritime Sci-Pop cause [3].

2. Introduction to Modern Maritime Science Popularization Bases

2.1. Conceptual Elaboration

A modern maritime Sci-Pop base refers to a venue or institution that primarily aims to disseminate maritime scientific knowledge, promote maritime culture, and showcase maritime technological achievements. It possesses Sci-Pop venues and facilities of a certain scale, as well as a professional team of Sci-Pop personnel, capable of carrying out systematic and regular maritime Sci-Pop educational activities for the general public. It is not only an important platform for popularizing maritime knowledge but also a crucial position for inheriting maritime culture and cultivating public marine awareness [4]. Compared with traditional maritime Sci-Pop venues, modern maritime Sci-Pop bases place greater emphasis on utilizing modern technological means, such as Virtual Reality (VR), Augmented Reality (AR), and multimedia interaction, to enhance the fun and interactivity of Sci-Pop, allowing the public to understand maritime knowledge and culture more intuitively and deeply.

2.2. Classification

2.2.1. Classification by Operating Entity

Government-led: These bases are usually funded, constructed, and operated by relevant government departments, possessing strong authority and stability. Their advantage lies in the ability to integrate government resources and enjoy significant benefits in terms of policy support, funding guarantees, and the organization of Sci-Pop activities. For example, the China Maritime Museum, as China's first national-level maritime museum approved by the State

Council, is jointly built by the Ministry of Transport and the Shanghai Municipal People's Government. It possesses unique conditions in the collection, collation, and display of maritime Sci-Pop resources, capable of hosting high-standard maritime Sci-Pop exhibitions and activities, and plays a demonstrative leading role in the development of national maritime Sci-Pop bases [5].

University/College-supported: Established relying on the professional resources and talent advantages of various maritime colleges and universities, such as the Modern Maritime Sci-Pop Base of Jiangsu Maritime Institute, the Maritime Culture Sci-Pop Education Base of Shandong Jiaotong University, and the Maritime Sci-Pop Base of Xiamen Ocean Vocational College. These bases can fully utilize the teaching facilities, scientific research achievements, and professional teaching staff of the institutions to provide high-quality and professional maritime Sci-Pop services to the public. At the same time, they can combine Sci-Pop activities with the teaching practice of the institutions to cultivate students' Sci-Pop practical ability and social responsibility [6].

Enterprise-participated: Invested in, constructed, or operated by maritime-related enterprises such as shipping companies and shipbuilding enterprises. A typical example is the "Automated Terminal VR Online Exhibition Hall", the first of its kind in China, jointly created by the Smart Maritime Training Base of Qingdao Harbour Vocational & Technical College and the Qingdao Port Automated Terminal. These bases can closely align with actual industry scenarios, focus on displaying the latest maritime technologies and application results, and provide the public with Sci-Pop experiences that are in line with industry frontiers. Meanwhile, through participating in Sci-Pop activities, enterprises can not only convey industry dynamics but also effectively enhance their own social image and brand influence.

2.2.2. Classification by Functional Orientation

Sci-Pop Education Type: With the core function of popularizing maritime scientific knowledge, it systematically imparts content such as maritime history, geographical common sense, ship structure, and navigation technology to the public through diverse activities like exhibit displays, Sci-Pop lectures, and experimental demonstrations, helping to cultivate public scientific literacy and interest in the maritime field. For example, maritime Sci-Pop zones within some science and technology museums mostly adopt the form of interactive exhibits combined with Sci-Pop courses to help audiences understand the basic principles and practical applications of maritime knowledge.

Cultural Inheritance Type: Focusing on the promotion of maritime culture and the inheritance of the maritime spirit, it allows the public to intuitively feel the profound heritage of maritime culture and enhance national pride and marine awareness through carriers such as displaying maritime cultural relics, historical archives, and typical maritime stories. Taking the Naozhou Lighthouse Education Base as an example, relying on the historically valuable Naozhou Lighthouse, this base disseminates navigation mark culture, the lighthouse spirit, and the development context of China's maritime history to the public, becoming an important carrier for inheriting maritime culture.

Technology Display Type: Focusing on the latest achievements and development trends of modern maritime science and technology, it utilizes advanced display technologies such as VR, AR, and simulation to allow the

public to experience the charm of maritime technology immersively and stimulate enthusiasm for scientific and technological innovation. For instance, the "Automated Terminal VR Online Exhibition Hall" created by the Smart Maritime Training Base of Qingdao Harbour Vocational & Technical College allows the audience to intuitively feel the world-leading port automation operation process with the help of virtual reality technology, vividly presenting the technological advantages of smart ports [7].

2.3. Analysis of Development Status

In recent years, China's modern maritime Sci-Pop bases have shown a trend of rapid growth in both quantity and scale. According to statistics from the Chinese Institute of Navigation, by the end of 2024, the number of named national maritime Sci-Pop education bases reached 102, an increase of 15% over the previous year. From a geographical distribution perspective, maritime Sci-Pop bases are mainly concentrated in the eastern coastal areas, with Shandong, Guangdong, Shanghai, Zhejiang, and other provinces/municipalities having a relatively large number of bases, accounting for more than 60% of the national total. This is mainly because these regions have developed marine economies, profound maritime cultural heritage, and a stronger demand for maritime Sci-Pop. In contrast, the number of maritime Sci-Pop bases in the central, western, and inland regions is relatively small, showing an obvious phenomenon of regional imbalance [8].

In terms of operation models, different types of maritime Sci-Pop bases have their own characteristics. Government-led bases mainly rely on fiscal appropriations for operation, and the organization of Sci-Pop activities is both planned and public welfare-oriented. University-supported bases can effectively control operation costs by fully utilizing institutional resources, and at the same time continuously innovate Sci-Pop content and forms in combination with teaching and research work. Enterprise-participated bases pay more attention to market demand and economic benefits, carrying out targeted Sci-Pop activities in coordination with enterprise business to achieve the two-way empowerment of Sci-Pop and industrial development. However, some bases still face common problems in operation such as shortage of funds, lack of professional talents, and imperfect management systems, which restrict the sustainable development of the bases to a certain extent.

3. Factors Affecting the Evaluation of Sci-Pop Bases

3.1. Internal Factors

3.1.1. Management System and Operation Mechanism

A scientific and reasonable management system is the basic guarantee for the efficient operation of maritime Sci-Pop bases. Currently, some bases have problems such as ambiguous division of responsibilities among management agencies and non-standard decision-making processes, which directly lead to low work efficiency and unreasonable resource allocation. For example, some bases have redundant management hierarchies and unsmooth information transmission, affecting the timeliness of work advancement. Others lack clear institutional constraints in key links such as project approval and fund use, making them prone to management loopholes. In terms of operation mechanisms, the imperfect incentive mechanism is a common shortcoming.

Due to the lack of competitiveness in remuneration and unscientific performance appraisal systems, it is difficult to fully mobilize the enthusiasm and creativity of Sci-Pop personnel, leading to the loss of outstanding talents and affecting the quality of Sci-Pop services.

3.1.2. Talent Team Construction

Sci-Pop talents are the core support for the work of maritime Sci-Pop bases. Currently, the talent teams of the bases generally face problems of insufficient quantity and uneven quality. On the one hand, maritime Sci-Pop work is highly professional and requires compound talents who possess both solid maritime professional knowledge and Sci-Pop communication skills. The supply of such talents in the market is scarce, making recruitment difficult for the bases. On the other hand, existing Sci-Pop personnel lack systematic professional training and further education opportunities, and their knowledge update lags behind, making it difficult to match the growing diversified Sci-Pop needs of the public. For example, the Sci-Pop explainers in some bases are not professionals, have insufficient understanding of the latest maritime scientific and technological achievements, and cannot provide accurate and vivid explanation services to the audience.

3.1.3. Innovation in Sci-Pop Content and Forms

With scientific and technological progress and social development, the public has put forward higher requirements for the timeliness and depth of Sci-Pop content, as well as the interactivity of communication forms. However, the Sci-Pop content of some current maritime Sci-Pop bases is relatively outdated, failing to keep up with the latest scientific and technological achievements and development trends in the maritime field. They still mainly focus on traditional ship models and historical data displays, with a lack of introduction to emerging fields such as smart ships and unmanned shipping. In terms of communication forms, there is excessive reliance on exhibition boards and traditional explanation modes, lacking interactive experience design, making it difficult to attract public attention. Compared with advanced foreign maritime Sci-Pop bases, China still has significant room for improvement in the innovation of Sci-Pop content and forms.

3.2. External Factors

3.2.1. Policy Support and Capital Investment

Policy support plays a crucial role in promoting the development of maritime Sci-Pop bases. Currently, although the state has issued a series of policies encouraging the development of the Sci-Pop cause, such as the Science and Technology Popularization Law of the People's Republic of China and the 14th Five-Year Plan for National Science and Technology Popularization Development, there are still some problems in the specific implementation process. For example, some local governments do not attach enough importance to maritime Sci-Pop bases, and the intensity of policy support in terms of land planning and tax incentives is insufficient. In terms of capital investment, the sources of funds for maritime Sci-Pop bases mainly rely on government appropriations, social donations, and ticket revenue. However, government appropriations are limited, social donations are unstable, and ticket revenue is greatly affected by the popularity of the base and the number of tourists, leading to a shortage of funds for the bases, which cannot meet the needs for updating Sci-Pop facilities and carrying out Sci-Pop activities.

3.2.2. Social Demand and Public Cognition

Social demand for maritime Sci-Pop is the core driving force for the development of the bases. Along with the rapid development of China's marine economy and the in-depth implementation of the national marine strategy, the social demand for the popularization of maritime knowledge and the enhancement of marine awareness continues to grow. However, the current public cognition of the maritime field is generally low, and the awareness and attention to maritime Sci-Pop bases are insufficient. Some members of the public believe that maritime Sci-Pop content is too professional and has little relevance to daily life, resulting in weak participation enthusiasm. In addition, there are obvious differences in the Sci-Pop needs of the public in different regions and age groups. When carrying out activities, the bases need to fully consider these differences and provide personalized and precise Sci-Pop services.

3.2.3. Scientific and Technological Development and Industry Dynamics

The rapid development of science and technology has brought new opportunities and challenges to maritime Sci-Pop bases. On the one hand, the application of new technologies such as virtual reality, augmented reality, and artificial intelligence provides more diverse display methods and interaction methods for maritime Sci-Pop, which can greatly enhance the fun and attractiveness of Sci-Pop. For example, some bases use VR technology to create virtual navigation experience scenarios, making the audience feel as if they are personally on the scene and experience the charm of navigation [9]. On the other hand, the rapid development of the maritime industry also requires Sci-Pop bases to update Sci-Pop content in a timely manner to reflect the latest dynamics and development trends of the industry. For instance, with the application of emerging technologies such as smart ships and green shipping in the maritime field, Sci-Pop bases need to strengthen the popularization and publicity of knowledge in these aspects to meet the public's demand for new knowledge [10].

4. Current Status and Main Problems of Existing Maritime Sci-Pop Base Evaluation

4.1. Overview of Evaluation Status

Currently, the evaluation work of China's maritime Sci-Pop bases is mainly led by the Chinese Institute of Navigation and relevant competent departments in various regions. The evaluation is mainly based on the Measures for the Administration of Maritime Science Popularization Education Bases of the Chinese Institute of Navigation and supporting management regulations of various regions, adopting a comprehensive evaluation method combining self-assessment, expert review, and on-site random inspection. Each base first conducts a self-assessment based on the evaluation index system, writes a work summary, and completes a self-assessment score. Then, the society or competent department organizes experts to conduct a comprehensive review of the submitted assessment materials. Finally, some bases are randomly selected for on-site verification. The evaluation results are graded as qualified or unqualified. A rectification notice within a time limit is issued to unqualified bases, and those that still fail the rectification acceptance will have their naming qualifications revoked.

The evaluation indicators mainly cover core dimensions such as system and institution construction, Sci-Pop venues and facility construction, communication and publicity platform construction, the development of Sci-Pop activities, and Sci-Pop work effectiveness. In terms of system and institution construction, the focus is on investigating the soundness of management institutions, the improvement of management systems, the rationality of work plans, the construction of full-time and part-time personnel teams, funding guarantees, and personnel training. In terms of Sci-Pop venues and facility construction, attention is paid to the venue area, layout rationality, exhibit display level, and the advancement and maintenance status of facilities and equipment. In terms of communication and publicity platform construction, the construction of external communication channels such as websites, clients, WeChat, and Weibo, as well as media publicity effects are evaluated. In terms of the development of Sci-Pop activities, the frequency of activities, form innovation, public participation, and activity influence are considered. In terms of Sci-Pop work effectiveness, the rewards and commendations received, the assumption of Sci-Pop projects, and the selection into national or industry demonstration cases are mainly evaluated.

4.2. Main Problems

4.2.1. Imperfect Evaluation Index System

Although the current evaluation index system covers various aspects of maritime Sci-Pop bases, there are still deficiencies in the scientific nature, comprehensiveness, and pertinence of the indicators. Some indicators are set too generally and lack clear quantitative standards, leading to strong subjectivity in the evaluation process. For example, when evaluating the quality of Sci-Pop content, it only mentions that "Sci-Pop content is rich and accurate", but there are no specific measurement standards for defining "rich" and "accurate". In addition, some important indicators are not fully reflected in the index system, such as the innovation of Sci-Pop content and the impact on public behavior and concepts. When evaluating the effectiveness of maritime Sci-Pop bases in cultivating public marine awareness, the current index system lacks specific evaluation indicators, making it impossible to accurately measure the work effect of the bases in this regard.

4.2.2. Single Evaluation Method

Currently, the evaluation of maritime Sci-Pop bases mainly relies on material review and on-site inspection, and the evaluation methods are relatively single. This evaluation method is difficult to fully and deeply understand the actual operation status and Sci-Pop effect of the bases. For example, material review mainly relies on written materials provided by the bases, which may have untrue or incomplete information. On-site inspection is limited by time and space and cannot track and evaluate the daily operation of the bases and the long-term effects of Sci-Pop activities. In addition, existing evaluation methods rarely use diversified evaluation means such as big data, questionnaires, and interviews, making it impossible to fully collect the opinions and suggestions of stakeholders such as the public and staff, which affects the objectivity and accuracy of the evaluation results.

4.2.3. Insufficient Application of Evaluation Results

The effective application of evaluation results is an important driving force for promoting the improvement and development of maritime Sci-Pop bases. However, there are

obvious deficiencies in the application of evaluation results. On the one hand, for bases with excellent evaluation results, there is a lack of effective incentive mechanisms, failing to give full play to their demonstrative leading role. For example, after obtaining excellent evaluation results, some bases did not receive obvious inclinations in terms of policy support and fund rewards, affecting their enthusiasm for further improvement. On the other hand, for bases with unqualified evaluation results, although they are required to rectify, the guidance and supervision during the rectification process are not in place, leading to poor rectification effects for some bases and failing to truly achieve improvement and development.

5. Strategies for Improving the Popularization Effectiveness of Modern Maritime Sci-Pop Bases

5.1. Optimizing Management and Operation

5.1.1. Perfecting the Management System

Establishing and improving a scientific and reasonable management system is the key to improving the operation efficiency of maritime Sci-Pop bases. First, it is necessary to clarify the responsibilities and powers of management agencies, build a flat management structure, reduce management hierarchies, and improve the speed of information transmission and decision-making efficiency. For example, establish specialized departments such as Sci-Pop planning, activity organization, and publicity and promotion, with clear division of labor and collaborative cooperation among various departments. Second, improve internal management systems, standardize work processes such as project approval, fund use, and personnel assessment to ensure that all work follows rules. Establish and improve supervision mechanisms, strengthen supervision and inspection of management work, and timely discover and correct problems in the management process to ensure the healthy and orderly development of the bases.

5.1.2. Innovating Operation Models

Actively explore diversified operation models to enhance the self-development capabilities of maritime Sci-Pop bases. On the one hand, strengthen cooperation with social forces, establish cooperative relations with enterprises, social organizations, and foundations to attract social capital investment and jointly carry out Sci-Pop projects and activities. For example, cooperate with maritime-related enterprises to hold maritime science and technology exhibitions, display the latest products and technological achievements of enterprises, and provide a publicity and promotion platform for enterprises to achieve mutual benefit and win-win results. On the other hand, expand service areas and develop diversified Sci-Pop products and services, such as Sci-Pop cultural and creative products, Sci-Pop training courses, and Sci-Pop tourism routes, to increase revenue sources. For example, some maritime Sci-Pop bases have launched navigation-themed cultural and creative products, such as ship models, badges, and books, which are very popular among tourists, both disseminating maritime culture and creating economic benefits.

5.2. Strengthening Talent Team Construction

5.2.1. Talent Training and Introduction

Formulate scientific talent training plans, strengthen

cooperation with universities offering maritime and Sci-Pop majors, and directionally cultivate compound talents with both maritime professional knowledge and Sci-Pop communication capabilities through modes such as joint training and internships. For example, jointly build characteristic maritime Sci-Pop courses or professional directions with universities, select outstanding students to intern and practice at the bases, and establish an "internship-employment" connection mechanism. At the same time, increase efforts in talent introduction, and attract outstanding domestic and foreign maritime Sci-Pop talents by providing competitive remuneration, a high-quality working environment, and development space. Special funds for talent introduction can be established to provide supporting preferential policies such as housing subsidies and scientific research start-up funds for high-level talents.

5.2.2. Improving Incentive Mechanisms

Establish and improve diversified incentive mechanisms to fully mobilize the enthusiasm and creativity of Sci-Pop personnel. In the design of the compensation system, implement a system of "linking performance with compensation" to reflect the distribution principle of more pay for more work and excellent pay for excellent performance. For example, establish special awards for Sci-Pop achievements to give both material and spiritual rewards to personnel who have performed outstandingly in Sci-Pop creation and activity organization. At the career development level, build a clear promotion channel for Sci-Pop personnel, provide regular training opportunities, and encourage them to improve their professional literacy and business capabilities. For example, regularly organize participation in domestic and foreign academic exchanges and professional skills training activities to assist career growth.

5.3. Innovating Sci-Pop Content and Forms

5.3.1. Content Innovation

Closely track the technological frontiers and social hotspots in the maritime field, update Sci-Pop content in a timely manner, and ensure the timeliness and scientific nature of Sci-Pop work. Combine industry development trends such as smart ships, green shipping, and the Maritime Silk Road to develop forward-looking and characteristic Sci-Pop projects. For example, hold special Sci-Pop exhibitions on the technical principles and application prospects of smart ship technology to help the public understand the future direction of maritime development. At the same time, balance the depth and breadth of Sci-Pop content, not only popularizing basic maritime knowledge but also deeply interpreting the underlying scientific principles and technical applications to meet the needs of the public at different knowledge levels. In addition, deeply explore the connotation of maritime culture, integrate maritime historical stories and the maritime spirit into Sci-Pop content, and enhance the cultural heritage and attractiveness of Sci-Pop work.

5.3.2. Form Innovation

Fully utilize modern technological means to innovate Sci-Pop forms and enhance the fun and interactivity of Sci-Pop. Utilize technologies such as Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) to create immersive and interactive Sci-Pop experience scenarios. For example, some bases use VR technology to simulate ship navigation, allowing the audience to experience the fun and challenges of navigating a ship in a virtual environment; AR technology is used to overlay relevant information on exhibits

to provide the audience with richer and more vivid explanations. At the same time, carry out diversified Sci-Pop activities, such as navigation-themed Sci-Pop drama performances, navigation knowledge competitions, and ship model making contests, to increase public participation and interactivity.

5.4. Strengthening Policy Support and Funding Guarantees

5.4.1. Seeking Policy Support

Actively communicate and coordinate with relevant government departments to seek more policy support. On the one hand, appeal to the government to introduce special support policies for maritime Sci-Pop bases, such as preferential treatment in land use, tax reduction and exemption, and talent introduction. For example, for the construction projects of maritime Sci-Pop bases, priority guarantee is given in land approval, and relevant land use taxes and fees are reduced or exempted; high-level Sci-Pop talents introduced enjoy local talent preferential policies. On the other hand, promote the inclusion of maritime Sci-Pop work into the performance appraisal system of local governments to increase the attention of local governments to the construction and development of maritime Sci-Pop bases and promote the implementation and execution of various policies.

5.4.2. Broadening Funding Channels

In addition to seeking government fiscal appropriations, actively expand diversified funding channels to provide stable funding guarantees for the development of the bases. Encourage the participation of social forces in donations, attract enterprises, social organizations, and individuals to donate funds and materials to the bases by establishing special donation funds and carrying out public welfare publicity. For example, cooperate with public welfare foundations to carry out maritime Sci-Pop donation projects to raise funds for facility upgrades and activity development. At the same time, explore market-oriented operation models to increase income through services such as venue leasing and advertising investment. For example, lease part of the venue to relevant enterprises to hold product exhibitions and industry conferences, achieving the dual goals of efficient resource utilization and income supplementation.

5.5. Enhancing Social Cooperation and Public Participation

5.5.1. Strengthening Cooperation and Exchange

Strengthen cooperation and exchange with schools, communities, and scientific research institutions to form a synergy for Sci-Pop. Cooperate with schools to carry out activities such as "Maritime Sci-Pop Entering Campus", incorporate maritime Sci-Pop courses into the extracurricular practical activity system of schools, and provide regular Sci-Pop services for students. For example, sign cooperation agreements with primary and secondary schools, regularly organize students to visit and study at the bases, and carry out maritime Sci-Pop lectures and practical activities. Cooperate with communities to carry out activities such as "Maritime Sci-Pop Entering Communities", and bring maritime Sci-Pop knowledge to residents through forms such as holding Sci-Pop exhibitions, Sci-Pop lectures, and cultural performances. Cooperate with scientific research institutions to jointly carry out maritime Sci-Pop research projects, transform scientific

research achievements into Sci-Pop resources, and improve the scientific nature and advancement of Sci-Pop content.

5.5.2. Enhancing Public Participation

Establish and improve a public participation mechanism to encourage the public to actively participate in the construction and development of maritime Sci-Pop bases. Set up public suggestion boxes and open online message platforms to extensively collect public opinions and suggestions on the base's Sci-Pop work and continuously improve work according to public needs. For example, set up an opinion feedback column on the base's official website and WeChat public account to promptly reply to public messages and suggestions. Carry out volunteer recruitment activities to attract people from all walks of life to become volunteers of the base and participate in work such as Sci-Pop explanation, activity organization, and exhibit maintenance. For example, through social publicity and campus recruitment, build a high-quality volunteer team to provide strong support for the base's Sci-Pop work.

6. Conclusion

As important platforms for disseminating maritime knowledge, promoting maritime culture, and showcasing maritime scientific and technological achievements, modern maritime Sci-Pop bases play an important role in enhancing national marine awareness and promoting the development of the maritime industry. However, current maritime Sci-Pop bases still face many problems in the development process, such as imperfect evaluation index systems, single evaluation methods, insufficient application of evaluation results, as well as defects in the bases themselves in terms of management and operation, talent team construction, and innovation in Sci-Pop content and forms.

To improve the popularization effectiveness of modern maritime Sci-Pop bases, it is necessary to adopt a series of targeted strategies. In terms of management and operation, the management system should be improved and operation models should be innovated to improve the operation efficiency and self-development capabilities of the bases. In terms of talent team construction, it is necessary to strengthen talent training and introduction, improve incentive mechanisms, and build a high-quality Sci-Pop talent team. In terms of innovation in Sci-Pop content and forms, it is necessary to closely track the technological frontiers and social hotspots in the maritime field, continuously update Sci-Pop content, and fully utilize modern technological means to innovate Sci-Pop forms and enhance the fun and attractiveness of Sci-Pop. In terms of policy support and funding guarantees, active efforts should be made to seek policy support and broaden funding channels to provide strong guarantees for the development of the bases. In terms of social cooperation and public participation, it is necessary to strengthen cooperation and exchange with various parties

and enhance public participation to form a good atmosphere where the whole society participates in the maritime Sci-Pop cause.

Through the implementation of these strategies, it is expected to solve the current problems existing in maritime Sci-Pop bases and improve their popularization effectiveness, enabling maritime Sci-Pop bases to better play their role in disseminating maritime knowledge, promoting maritime culture, and cultivating maritime talents, and make greater contributions to the sustainable development of China's maritime industry. At the same time, in the future, it is necessary to further improve the evaluation system of maritime Sci-Pop bases, strengthen the application of evaluation results, and promote the continuous optimization and development of maritime Sci-Pop bases to adapt to the needs of the times.

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