Scholar Publishing Group
Water Pollution Prevention and Control Project
https://doi.org/10.38007/WPPCP.2021.020202
ISSN 2790-2730 Vol. 2, Issue 2: 12-21

# *Water Pollution Control Measures Based on Multi-scale Feature Fusion*

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***Keywords:*** Water Pollution, Prevention Measures, Multi-scale Feature Fusion, Water Monitoring

***Abstract:*** With the sustainable development of economy, the ecological environment of water resources has been damaged to varying degrees, and the country is paying more and more attention to the protection of water resources. Water Pollution (WP) control is a very important part of this work and an important part of the national environmental protection and management strategy, and has become a major priority of environmental governance. In the context of effective control of WP, it is necessary to summarize the existing problems and formulate targeted WP control measures according to the actual situation of the region to effectively control WP and ensure good water quality. Therefore, this paper analyzed the enthusiasm and harmfulness of WP prevention and control, then studied the contents and reasons of water monitoring, and finally put forward the strategies of water monitoring and WP prevention and control. Through comparison, it can be seen that the supervision after the optimization of WP control measures was 20.8% higher than that before the optimization of WP control measures, and the control level was 22% higher than that before the optimization of WP control measures. In short, water monitoring is of great significance in WP prevention and control room.

## 1. Introduction

With the accelerated pace of industrialization and the substantial improvement of economic level, economic recovery often takes the cost of destroying the ecological environment. The problem of WP has reached a new peak in the past overall economic development model, and also affirmed the current strategy of sustainable development of the ecological environment. In order to strengthen the control of WP, the national leadership controls the pollution sources and continuously improves the WP technology through various means. However, due to the complexity and scale of

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management, there are still gaps in practice. In this regard, appropriate measures are being taken to improve the monitoring and control of the water environment to ensure the sustainable development of the environment and promote and maintain social stability.

WP has caused irreversible damage to the environment. Tang Yankui outlined the literature on new pollutants, focusing on the emergence of new pollutants, detection methods, environmental conditions and ecotoxicity [1]. Mekonnen Mesfin M estimated the global anthropogenic phosphorus load and the associated gray water footprint, and compared the anthropogenic phosphorus load of each basin with the runoff to assess the WP level related to phosphorus [2]. Haghnazar Hamed believed that the suppressor had a positive impact on reducing WP caused by industrial and traffic pollutants, but the suppressor had a negative impact on the increase of urban garbage and wastewater [3]. Viet Nguyen Duc introduced in detail the current application of AI based tools in membrane process modeling and the application of these models in other fields of membrane treatment of sustainable water and wastewater [4]. Dai Yingjie tried to summarize the latest findings on the nature, source, pollution status and toxicity of tetracycline in the aquatic environment. At the same time, there were many methods to remove tetracycline, which provided a basis for studying the basic nature and removal methods of tetracycline [5]. Guo Qiaozhen took Tianjin Binhai New Area as the research area. Combined with the adaptive dynamic threshold, the surface water extraction method was used to modify the normalized differential water index extraction and detect its changes. The water environment protection in this area should be strengthened [6]. Qu Jiuhui's experience gained through the massive investment in the upgrading of biosolids led to the formulation of four major biosolids management strategies to achieve integrated water or wastewater management due to the scale of sewage treatment [7]. The above studies have described the impact of WP, but there are still some deficiencies in prevention and control measures.

Many scholars have put forward some suggestions on the prevention and control of WP. Pareek Ravi Kant believed that the river was affected by industrial wastewater and domestic wastewater, and all parts were infected by Escherichia coli, which provided key information for river protection and protection, and put forward suggestions on possible treatment of domestic wastewater before it was discharged into the river [8]. Quesada Heloise Beatriz reviewed the existing literature on the use of low-cost adsorbents to remove core active substances from surface water, in order to summarize the pollution of these pollutants to water and evaluate the effectiveness of water and wastewater treatment [9]. Keiser David A estimated the benefits of cleaning up river pollution and lakes below the cost. Although these studies may underestimate the benefits of several potentially important types, the analysis found the investment in drinking water quality [10]. Li Xiang introduced the research progress of magnetic nanomaterials in the field of WP control, including important properties and preparation methods [11]. Inman Alex used psychology, sociology, behavioral economics and other disciplines to more thoroughly understand farmers' attitudes and behaviors towards pollution mitigation, so as to deeply understand why British policy intervention has so far achieved little [12]. The above studies have described the role of WP prevention and control, but have not combined multi-scale feature fusion.

In order to study the specific effect of WP prevention and control, this paper analyzes the water quality monitoring effect and control effect of WP prevention and control through multi-scale feature fusion, then analyzes the perfection and control level of the monitoring system through comparative experiments, and finally analyzes the supervision strength and detection data accuracy before and after WP prevention and control. Through experimental analysis, it is found that after the optimization of WP control measures, the supervision of WP and the accuracy of monitoring data have been significantly improved. Compared with other documents, this paper focuses on the comparative analysis of data accuracy of WP prevention and control optimization.

## 2. Impact Evaluation in WP Prevention and Control

### 2.1. Enthusiasm and Harmfulness of WP Prevention and Control

WP is one of the greatest threats to public health [13]. As shown in Figure 1, there are different types of WP hazards that affect industrial and agricultural development. With the continuous development of social economy, the status of industrial and agricultural production in people's life has gradually improved. At the same time, WP has affected the agricultural nature of the country to a certain extent, leading to the decline of agricultural production and serious interference in agricultural production. The second is the harm to human health. Water is the most important part of the human body and also a necessity for human survival. In order to maintain life and obtain energy and elements beneficial to health, people need to drink a lot of healthy water and water resources. Therefore, external pollution would cause serious damage to human health.

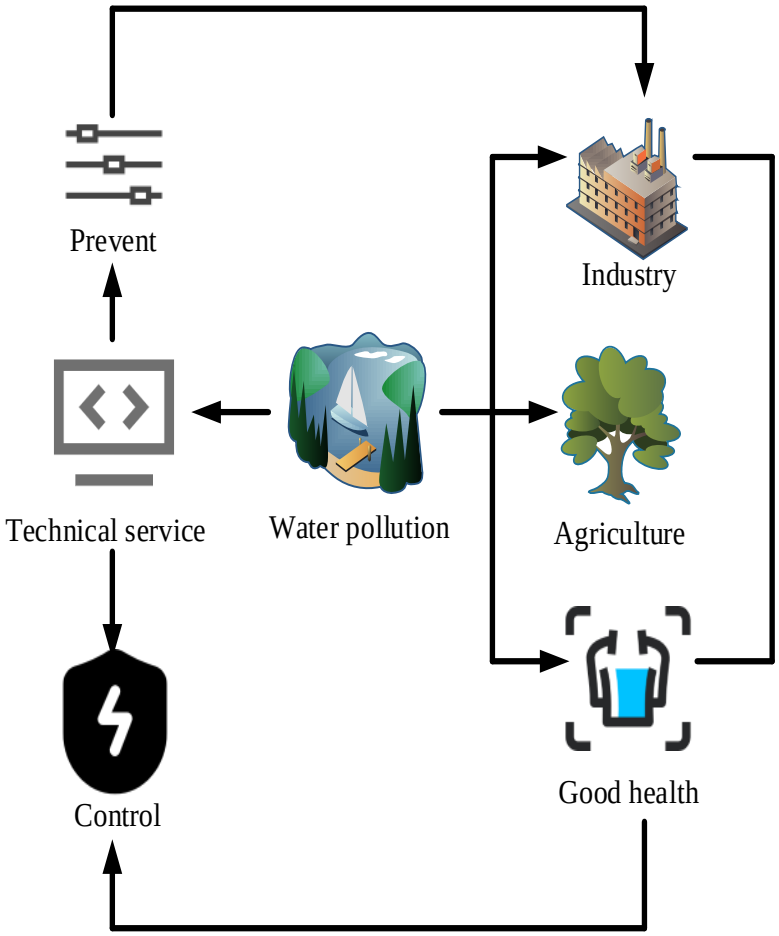



*Figure 1. Enthusiasm and harmfulness of water pollution prevention*

WP control is closely related to people's life and health. In fact, the environmental monitoring station calculates that the amount of wastewater discharged in some areas is very high, which seriously pollutes the ecological water resources. If this situation continues for a long time, economic recession is inevitable. Although people are now in the golden age of industrial development, if people no longer care about sewage discharge, the pollutants in wastewater would exceed a certain amount, which would lead to various domestic water diseases and cause serious

damage to human body. In order to better promote economic development and human health, people must make rational use of various modern technologies, pay more attention to the prevention and control of WP, and solve the problem of WP.

## 2.2. Specific Contents of Water Monitoring in WP Prevention and Control

Water quality monitoring in WP prevention and control should be carried out from the following aspects, as shown in Figure 2. The first is surface water monitoring. At present, there are two main methods for surface water monitoring. First, the general water elements are comprehensively studied to better understand the distribution and pollution of local water resources. The second is to study the local WP molecules, understand the main sources of pollution, and understand the causes and extent of WP. The monitoring results of surface water generally vary with time and place. Therefore, in order to improve the scientific reliability and accuracy of the monitoring results, it is best to select sunny days, collect surface water samples, and conduct comprehensive analysis with multiple samples to improve the accuracy of the monitoring results.

The second is groundwater monitoring. The quality of groundwater monitoring also affects the overall results of water environment monitoring to a certain extent. With the continuous reduction of water resources, human beings are using groundwater resources, so it is also important to monitor groundwater. In order to develop and protect groundwater resources more effectively, the competent authorities need to monitor groundwater quality scientifically. Like surface water monitoring, groundwater can also be sampled for monitoring. In reality, the monitoring work is still specific. Today, with the rapid development of science and technology, automatic monitoring technology is widely used in groundwater monitoring, greatly promoting the monitoring of water environment.

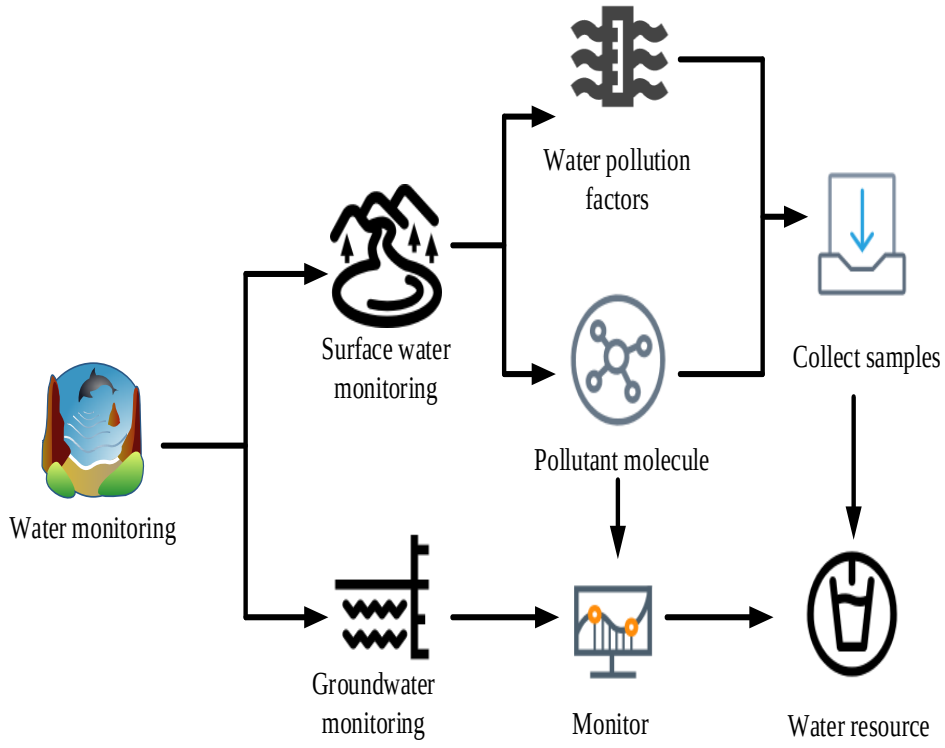



*Figure 2. Specific contents of water monitoring in water pollution prevention and control*

### 2.3. Cause Evaluation of Problems in WP Prevention and Control

There are also many problems encountered in the prevention and control of WP, among which there are several main reasons, as shown in Figure 3. First, the regulatory provisions are not clear. The monitoring department is an important institution in the process of preventing WP, but some relevant departments do not pay enough attention to regional water resources monitoring, ignore global water resources changes, and hinder WP and subsequent management efforts. Second, the experimental data is difficult to observe. WP prevention and control information must be very accurate. However, due to improper selection of facilities or non-compliance with requirements, there is no accurate test data in some regions at present, and it is impossible to effectively report the current WP situation in the region. At the same time, in some areas, the WP level is low, which is difficult to meet the complex data collection needs. Chemical oxygen demand and ammonia and nitrogen emissions are the pollutants that need to be monitored most to control waste WP [14].

Third, laws and regulations are imperfect. With regard to WP control, there are no standards and requirements for WP control, and the proper allocation of responsibilities is also unreasonable, which cannot provide the basic guarantee for prevention and control. Fourth, the level of WP control is low. In terms of control and control of WP, it is necessary to cooperate with different institutions responsible for different links, strengthen cooperation between various institutions, and improve the response level. In the new situation, the requirements for professionalization and systematization of WP prevention and control are constantly increasing. If people continue to use traditional methods, this would cause certain restrictions on prevention and control and practical application, and the effect is not obvious. Therefore, it is necessary to update prevention and control measures.

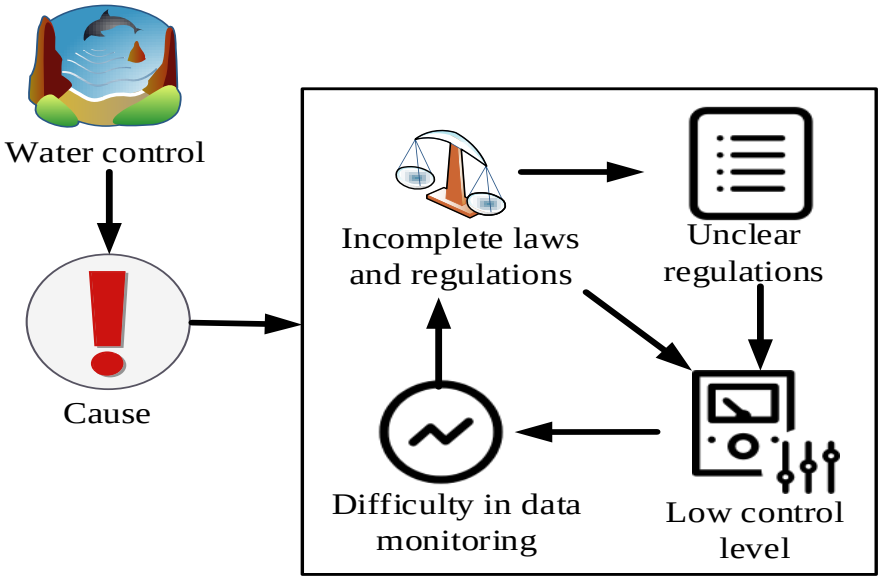



*Figure 3. Cause analysis of problems in water pollution prevention*

## 3. Evaluation of Water Environment Monitoring Strategy and WP Prevention Measures

### 3.1. Strategic Evaluation of Water Environment Monitoring

For the specific situation of WP, it is necessary to monitor the water environment to reduce WP. The first is to stipulate water quality monitoring procedures. During the experiment, the laboratory staff must do a good job in cleaning the laboratory, concentrate on accurate troubleshooting of relevant instruments and equipment, and do sample pretreatment to avoid disturbing the external

environment of the sample during the experiment. After receiving the test results, the water quality in the sampling area is monitored to see if it meets the relevant test standards. In order to make a reasonable assessment, targeted measures should be taken to prevent environmental risks and WP. The second is the standardization of water environment monitoring indicators. It is necessary to strengthen the independent research and development of instruments and equipment related to water environment monitoring and detection, introduce foreign advanced instruments and equipment, and establish a national water environment automatic monitoring system. It is also necessary to continuously adopt new sensor technology and big data technology, establish a reliable water environment monitoring system, automatically monitor and report the environmental risks of water, and minimize the impact of various pollutants on the aquatic environment. The third is to improve the water environment monitoring system. Within the framework of the water environment monitoring system, close communication among all departments is also needed. Therefore, it is also necessary to establish a water environment monitoring information platform to ensure that the work information of all departments flows smoothly on the information platform, and that all departments can easily obtain real-time monitoring data, creating favorable conditions for formulating management plans and implementing follow-up measures.

### 3.2. Evaluation of WP Protection Measures

In the prevention and control of WP, the following aspects should be improved to improve the quality of water quality. The first is to strengthen WP control. It is necessary to establish a good partnership, support scientific research institutions, introduce existing monitoring technologies, and understand the water environment of the region in real time. It is also necessary to protect advanced technologies, take effective prevention and control measures, and provide an important guarantee for the lives of residents in the region. Appropriate protection mechanisms should be established for groups and individuals affected by pollution to ensure the effective protection of the interests of those affected and gradually encourage the public to participate in environmental protection. The second is to improve the enterprise management system. In order to further improve the effect of WP prevention and control, all departments should strengthen cooperation, actively build a WP prevention and control management system, and reasonably prevent water-related environmental hazards. It is necessary to solve the problem of WP and ensure that human water use does not affect the water ecosystem [15]. WP control must be at the same level as monitoring water environment and water resource management to promote the coordinated management of regional water ecosystem. The third is to optimize control technology. In order to obtain efficient wastewater monitoring results, it is necessary not only to prepare the monitoring process, but also to collect and process data. In order to accurately record the data in the monitoring process and comprehensively analyze the data recorded after the monitoring process, it is recommended to use charts and text to record the data, so as to visualize the monitoring results.

## 4. Application of Multi-scale Feature Fusion in WP Prevention

In order to study the specific implementation effect of WP prevention and control measures, this paper analyzes the water quality monitoring boundary function of WP prevention and control through multi-scale feature fusion, then analyzes the final water quality of WP prevention and control, and finally obtains the specific effect of WP prevention and control. Firstly, this paper analyzes the boundary function of water quality monitoring for WP prevention and control as follows:

$$H_k[S(a,b)] = \mu \bullet S'(a*,b*) + \lambda \bullet S'(a,b) \tag{1}$$

Among them, $\mu,\lambda$ are the water quality monitoring threshold for WP prevention and control; $(a,b)$ is the original water quality monitoring boundary; $(a*,b*)$ is the monitoring boundary after multi-scale feature fusion. Next, the final water quality of WP prevention and control is analyzed as follows:

$$H_k[S_i(a,b)]=\frac{1}{n}\sum_i(H(a,b)) \tag{2}$$

Among them, n is the type of pollutant in water quality monitoring. Finally, the prevention and control effects of WP prevention and control are analyzed as follows:

$$R=\frac{2\bullet H_k[S_i(a,b)]}{H_k[S_i(a,b)]+H_k[S(a,b)]} \tag{3}$$

## 5. Experimental Evaluation of WP Prevention Measures

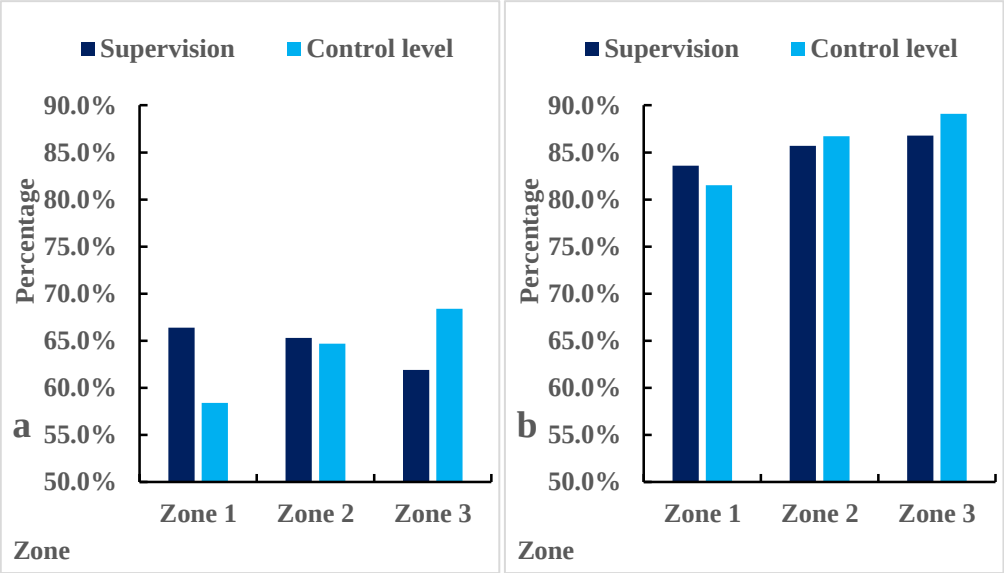
In order to study the specific prevention and control effect of WP prevention and control measures, this paper analyzed the perfection of the monitoring system and the accuracy of the detection data, and finally analyzed the supervision strength and prevention level before and after the WP prevention and control. First of all, the completeness of the monitoring system and the accuracy of monitoring data in the three regions before and after the optimization of WP control measures were investigated. The specific survey results are shown in Table 1.

*Table 1. Monitoring system perfection and monitoring data accuracy before and after water pollution control measures optimization*

| | Monitoring system perfection | | Monitoring data accuracy | |
|---|---|---|---|---|
| | Before optimization | After optimization | Before optimization | After optimization |
| Zone 1 | 60% | 87% | 71% | 81% |
| Zone 2 | 56% | 85% | 66% | 88% |
| Zone 3 | 59% | 81% | 70% | 85% |

According to the data described in Table 1, before the optimization of WP control measures, the monitoring system in Region 1 was 60% complete and the monitoring data accuracy was 71%; the completeness of the monitoring system in Region 2 was 56%, and the accuracy of monitoring data was 66%; the completeness of the monitoring system in Region 3 was 59%, and the accuracy of monitoring data was 70%. After the optimization of WP prevention and control measures, the monitoring system in Region 1 was 87% complete and the monitoring data accuracy was 81%; the completeness of the monitoring system in Region 2 was 85%, and the accuracy of monitoring data was 88%; the completeness of the monitoring system in Region 3 was 81%, and the accuracy of monitoring data was 85%. On the whole, the perfection of the monitoring system before the optimization of WP control measures was 58%, and the accuracy of monitoring data was 69%. After the optimization of WP control measures, the monitoring system was 84% complete and the monitoring data accuracy was 85%. Through comparison, it can be seen that the perfection of the monitoring system after the optimization of WP control measures was 26% higher than that before the optimization of WP control measures, and the accuracy of monitoring data was 16% higher than that before the optimization of WP control measures. After the WP prevention and control measures are optimized, the supervision would be more powerful, and the pollution discharge situation in each region would be better planned.

Finally, to analyze the supervision and control level before and after the optimization of WP control measures, a total of three regions were investigated, and the specific comparison results were shown in Figure 4.




*a. Before optimization of water pollution control measures*

*b. After optimization of water pollution control measures*

*Figure 4. Supervision and control level before and after optimization of water pollution control measures*

Figure 4a shows the WP control measures before optimization, and Figure 4b shows the WP control measures after optimization. It can be seen from Figure 4a that before the optimization of WP control measures, the supervision level and control level of Region 1 were 66.4% and 58.4% respectively; the supervision level and prevention level of Region 2 were 65.3% and 64.7% respectively; the level of supervision and control in Region 3 was 61.9% and 68.4% respectively. It can be seen from Figure 4b that after the optimization of WP control measures, the supervision intensity of Region 1 was 83.6%, and the control level was 81.5%; the supervision level and control level of Region 2 were 85.7% and 86.7% respectively; the level of supervision and control in Region 3 was 86.8% and 89.1% respectively. On the whole, the supervision before the optimization of WP control measures was 64.5%, and the control level was 63.8%. After the optimization of WP control measures, the supervision was 85.4%, and the control level was 85.8%.

Through comparison, it can be seen that the supervision after the optimization of WP control measures was 20.8% higher than that before the optimization of WP control measures, and the control level was 22% higher than that before the optimization of WP control measures.

## 6. Conclusion

Transportation, testing and collection of water samples are very important tasks in water environment monitoring, which can help inspectors intuitively understand the water quality of selected waters. WP control is mainly based on water environment monitoring. In order to further prevent and control WP and environmental pollution, people should continue to strengthen monitoring and effectively eliminate interference to life and production. People should also establish a high degree of sanctions and incentive system to encourage all people to actively

participate in environmental activities. In order to further improve the efficiency of water resources and environmental management, it is necessary to control pollution, strengthen technology research and development, adopt appropriate management technologies, and realize the automation of water environment monitoring. It is also necessary to predict environmental risks in advance and take effective measures to prevent environmental risks from having adverse effects on the aquatic environment, so as to minimize the risk of WP.

## Funding

This article is not supported by any foundation.

## 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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