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Research on the Evaluation Strategy of Production Capacity for Seawater Industrialized Aquaculture

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Abstract: *Currently, seawater factory farming is gradually becoming an important development direction for aquaculture. With the continuous progress of technology and the gradual depletion of resources, seawater factory farming can solve the problems faced by traditional farming, such as pollution, feed scarcity, and ecological damage. This article conducts research on the evaluation strategies for the production capacity of seawater factory farming. After introducing seawater factory farming, the evaluation principles are described, and the main influencing factors such as water intake capacity and seawater treatment capacity are analyzed. The evaluation methods for the production capacity of seawater factory farming are pointed out. Based solely on this article, it serves as a reference for seawater factory aquaculture enterprises, in order to master scientific evaluation methods and lay a decision-making basis for optimizing future aquaculture infrastructure and related technologies.*

Keywords: *seawater factory farming; Capability assessment; Impact factors; Sustainable biomass*

1. Introduction

Industrial mariculture has important economic, social and Environmental Values. From an economic perspective, seawater factory farming can improve marine economic benefits and increase the income of aquaculture owners. At the same time, seawater factory farming has also created employment opportunities and promoted local economic development. From a social perspective, seawater factory farming provides people with a rich and diverse variety of seafood, meeting their demand for healthy food. From an environmental perspective, seawater factory farming can provide opportunities for the protection and restoration of marine ecosystems, improve water quality, reduce the pressure of overfishing, and promote biodiversity conservation. To sum up, industrial mariculture has important economic, social and Environmental Values, and plays an important role in achieving sustainable development. Exploring the strategies for assessing the production capacity of industrial mariculture is an important research behavior to further promote the sustainable development of industrial mariculture in China and give full play to the advantages of this advanced aquaculture method.[1]

2. Overview of seawater industrialized aquaculture

The principle of seawater factory farming is to transform the marine environment into suitable breeding sites through reasonable environmental selection, farm construction, seedling selection, and breeding management, in order to achieve large-scale farming. Firstly, it is necessary to reasonably select suitable sea areas and build breeding facilities such as cages, floating rafts or fixed cabins, seabed nets, etc. to provide a fixed and protected environment for breeding organisms. Secondly, select suitable seedlings and undergo appropriate breeding techniques, such as artificial breeding or marine fishing, to obtain high-quality breeding sources. Once again, implement scientific aquaculture management, including water quality monitoring, feed management, disease prevention, and environmental protection, to ensure the growth and health of aquaculture organisms. Based on the above content, seawater factory farming can effectively utilize marine resources, improve aquaculture yield and efficiency, and achieve the goal of sustainable development.

Compared to traditional farming methods, seawater factory farming has the following advantages. Firstly, seawater factory farming fully utilizes abundant marine resources. The ocean has a vast area and deep water bodies, rich in nutrients and biological resources. Through seawater factory farming,

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these marine resources can be effectively utilized to improve the yield and efficiency of aquaculture. Secondly, seawater factory farming is an environmentally friendly farming method. Due to the fact that the aquaculture farm is located in the ocean, it avoids the waste of land resources and soil pollution. Compared to terrestrial aquaculture, seawater factory farming has less environmental pressure and can avoid common water source pollution and aquaculture waste disposal problems in terrestrial aquaculture.

Thirdly, seawater factory farming can also provide a rich and diverse variety of aquaculture varieties. There are various types of marine resources that can cultivate various marine products, such as fish, shrimp, shellfish, seaweed, etc. The above technologies provide more choices and flexibility for aquaculture enterprises, while also meeting the market's demand for diversified marine products.

3. Evaluation strategy for production capacity of seawater factory aquaculture

3.1. Evaluation principles

The production capacity evaluation of seawater factory aquaculture needs to follow the principles of optimal use, comparison, and a combination of qualitative and quantitative analysis.

Firstly, the principle of optimal use refers to the evaluation of the production capacity of the aquaculture farm based on its resource utilization efficiency and output benefits during the evaluation stage. Through scientific and reasonable resource allocation and technological means, we aim to maximize the utilization of limited resources, improve production efficiency and output, and ensure the maximization of economic benefits.[2]

Secondly, the principle of comparison refers to comparing and referencing the production capacity of seawater factory aquaculture with similar aquaculture projects. By comparing the experience and data of other similar farms, evaluate the production capacity of one's own farm, identify potential for improvement and enhancement, and learn from successful cases to optimize management and production processes.

Finally, the principle of combining qualitative and quantitative analysis refers to the comprehensive evaluation of the production capacity of aquaculture farms by combining qualitative and quantitative methods. Qualitative analysis can consider non quantitative indicators such as the technical facilities, management level, and environmental factors of the breeding farm, such as equipment status, personnel technical level, and water quality status. Quantitative analysis, on the other hand, quantitatively evaluates indicators such as production yield, growth rate, and feed conversion rate through data statistics and model calculations, in order to more objectively evaluate production capacity.

3.2. Analysis of factors affecting the production capacity of seawater factory aquaculture

3.2.1. Elements of water intake capacity

The water intake capacity refers to the ability of aquaculture farms to obtain seawater from the ocean, which is mainly determined by the operational efficiency of the seawater factory aquaculture production system. As the core module of the seawater factory aquaculture stage, the water intake system usually includes facilities such as water intake pipelines, water intakes, and water pumps. The amount of water intake is mainly determined by the design location of the intake, the size of the intake pipeline, and the number and power parameters of the water pumps during the intake stage. The above factors will directly affect the unit yield and scale of seawater factory aquaculture.

3.2.2. Elements of seawater treatment capacity

The production capacity of seawater factory farming is influenced by multiple factors, one of which is the seawater treatment capacity. The seawater treatment capacity is mainly completed by the seawater treatment system, which mainly reflects the processing capacity of seawater factory aquaculture enterprises for various indicators of seawater.

In the industrial aquaculture production of seawater, the structure of the seawater treatment system usually includes sedimentation tanks, heating facilities, cooling facilities, filtration tanks, storage tanks, and protein separation equipment.

Among them, sedimentation tanks are used to remove suspended particulate matter and waste from seawater, and they are settled to the bottom through gravity sedimentation, thereby improving the

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clarity of seawater. Heating facilities are used to increase the temperature of seawater to meet the water temperature requirements of specific aquaculture species, such as heaters, heat exchangers, and other equipment. Cooling facilities are used to reduce the temperature of seawater to meet the needs of aquaculture species such as coolers, cooling pumps, etc. By removing heat from seawater through cooling media or other means, the cooling effect is achieved. The filter removes particles, suspended solids, and most microorganisms from seawater through physical filtration methods such as filter materials and membranes. The storage tank is used to store treated seawater to meet the water supply needs during the aquaculture process. It can serve as a reserve for water resources and also help balance changes in water quality and supply pressure. Protein separation equipment is used to separate proteins from seawater to obtain high-purity proteins. Common protein separation techniques include centrifugation, filtration, and electrophoresis.

The integrity and operational efficiency of the above-mentioned equipment directly determine the control ability of enterprises over various indicators of seawater, such as water texture, suspended solids, and water flow, which have a direct impact on the production of seawater engineering aquaculture enterprises.

4. Elements of standardization degree of production facilities

Engaging in seawater factory aquaculture, production facilities, as necessary infrastructure, usually include factories, aquaculture pool equipment, aquaculture facilities, etc. The degree of standardization of these facilities directly affects the compatibility between infrastructure and the requirements of seawater factory aquaculture technology. The building structure, air quality, temperature and humidity control of the factory building have a significant impact on aquaculture production. Good factory conditions can provide a stable production environment, which is conducive to the growth and health of breeding species. The design and size of aquaculture ponds are closely related to factors such as water quality circulation system and ventilation. Proper design of aquaculture ponds can provide suitable growth space and water quality environment, promoting the smooth progress of aquaculture production. For example, the configuration of breeding facilities includes breeding systems, water quality treatment equipment, nutrient supply equipment, etc. Reasonable allocation of facilities can improve resource utilization efficiency, save energy, and reduce emissions, thereby improving production capacity.

5. Completeness elements of supporting facilities

The capacity of seawater industrial aquaculture production is affected by the Completeness of supporting facilities, including food workshop, laboratory, laboratory and other auxiliary facilities. Firstly, the bait workshop is the place where breeding feed is produced. A fully equipped bait workshop can ensure the production quality, efficiency, and supply stability of feed. High quality bait can provide the nutrients required for breeding species and play an important role in their growth and health. Secondly, in the composition of seawater industrial aquaculture, the laboratory is mainly used to detect and analyze the quality of seawater samples, Bioindicator of cultured species and bait. A fully equipped laboratory can provide accurate and fast detection results, which helps to monitor water quality conditions, feed composition, and the growth status of breeding species, thereby timely adjusting the breeding environment and feed formula. Once again, it is a place for research and innovation during the seawater factory aquaculture stage in the laboratory. Fully equipped laboratories can carry out breeding related research, including breeding technology improvement, disease diagnosis and control, Product development, etc. High level research can promote the development of the aquaculture industry and improve production capacity and level.[3]

To sum up, the Completeness of supporting facilities has an important impact on the capacity of industrial mariculture production. With complete food workshops, laboratories, laboratories and other auxiliary facilities, feed quality can be improved, water quality and Bioindicator can be monitored, research and innovation can be promoted, so as to enhance production capacity and the development of aquaculture.

6. Summary of Elements

The previous article analyzed the influencing factors of seawater factory farming, and the collaboration of multiple systems is an important guarantee for ensuring the productivity of seawater

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factory farming. Therefore, by evaluating the above factors and synthesizing the evaluation results, an effective evaluation of the production capacity of seawater industrial aquaculture can be achieved.

Evaluation method for productivity of seawater factory aquaculture.The evaluation of the productivity of seawater factory aquaculture reflects the recoverable biomass of the enterprise, while the production capacity of the enterprise is an estimation of the recoverable biomass.

6.1. Calculation of sustainable biomass

Equation 1 is the calculation expression for the storage biomass of seawater factory aquaculture enterprises:

$$C = P \times S \tag{1}$$

In equation 1, the storable biomass is represented by C, and P represents the storable biomass per unit area. S represents the production scale of seawater factory aquaculture carried out by enterprises, usually the specific scale of the aquaculture pool, which can be obtained based on on-site calculations. Usually, the scale of aquaculture ponds is mainly calculated based on the volume of the water body, which is the water demand of the aquaculture pond under normal operating conditions (unit: m^3). For some enterprises that carry out industrialized aquaculture of special types of seawater, such as abalone breeding enterprises, their aquaculture scale needs to be calculated based on the plane area of the aquaculture pool, that is, the plane area of the water body under conventional operating conditions (unit: m^3).

6.2. Calculation of sustainable biomass per unit area

Under different evaluation object backgrounds, the evaluation results of unit area cultivable biomass will vary, with a certain variation range, but will not exceed the theoretical upper limit value, which is the limit value of cultivable biomass per unit water body. Usually, based on the confirmation of the change interval, the evaluation stage can confirm the storable biomass per unit area based on the evaluation of production capacity. The specific calculation expression is shown in Equation 2:

$$P = L + (H - L) \times R \tag{2}$$

In equation 2, the biomass that can be stored per unit area is represented by P, and R represents the evaluation coefficient of the production capacity of seawater industrial aquaculture. H represents the highest limit value of sustainable biomass per unit area, and L represents the lowest limit value. The specific values of H and L during the calculation phase can be obtained based on the analysis of the actual production situation of similar types of seawater factory aquaculture enterprises in the surrounding areas of the industry. For special situations where the evaluated variety is a newly developed aquaculture variety, in the absence of reference historical data or case studies, the H and L values can be set based on the theoretical extreme values of the organism.[4]

6.3. Production capacity evaluation coefficient

The production capacity of seawater factory aquaculture enterprises is jointly determined by various influencing factors. The calculation expression is shown in Equation 3:

$$R = \sum Ri (i = 1,2,3,\cdots\cdots) \tag{3}$$

In equation 3, the production capacity evaluation coefficient is represented by R, and Ri represents the evaluation coefficient of the i-th influencing factor. During the calculation phase, the assignment range of Ri is between 0% and 100%.

7. Conclusion

In conclusion, based on the evaluation of each influencing factor one by one, that is, the factors of water intake capacity, seawater treatment capacity, standardization degree of production facilities, and Completeness of supporting facilities, the final evaluation results of productivity of seawater factory aquaculture enterprises can be obtained. Relevant enterprises can learn from the methods studied in this article to evaluate their own productivity, and based on the evaluation results, further optimize and

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transform the seawater treatment and water intake capacity in all dimensions, thereby enhancing enterprise productivity and laying a good technical and environmental foundation for the creation of economic and social benefits.

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