Water quality prediction and control of recirculating aquaculture system based on hybrid neural network

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Introduction

Aquaculture, often referred to as fish farming, has emerged as one of the fastest-growing sectors in the global food industry. As the world grapples with the challenges of feeding a growing population and conserving our natural resources, aquaculture systems offer a promising solution. This article explores the various aspects of aquaculture systems, including their importance, types, environmental impact, and innovations that are shaping the future of sustainable seafood production. The global demand for seafood has risen dramatically over the years, driven by factors such as population growth, rising incomes, and a greater awareness of the health benefits of seafood. Traditional wild fisheries, however, are facing significant challenges. Overfishing, habitat destruction, and the depletion of wild fish stocks have put immense pressure on marine ecosystems. Aquaculture systems have emerged as a viable alternative to meet the growing demand for seafood while reducing the strain on our oceans. Aquaculture allows for controlled and sustainable seafood production. It can provide a consistent source of high-quality protein without depleting natural fish stocks. As aquaculture production increases, the need for overfishing declines, easing the pressure on fish populations in the wild. Aquaculture provides economic opportunities for coastal communities and nations [1-3]. It creates jobs and supports local economies.

Description

By producing seafood closer to consumer markets, aquaculture can enhance food security and reduce the reliance on long-distance seafood transportation. Pond systems are one of the oldest forms of aquaculture. They are used for the production of species such as tilapia, catfish, and shrimp. Pond aquaculture allows for control over water quality and temperature. Cage systems involve confining fish in underwater cages or net pens. This method is often used for salmon and trout farming. It allows for rearing fish in their natural habitat while still providing some level of control. RAS is a closed-loop system where water is continuously recycled and treated. This method minimizes water usage and helps control disease outbreaks. It is often used for high-value fish species. Raceway systems are long, rectangular tanks that allow water to flow continuously. They are suitable for fast-swimming species like rainbow trout. IMTA combines the cultivation of multiple species, such as fish, seaweeds, and shellfish, in a single system. This approach maximizes resource use and minimizes waste. Offshore aquaculture involves raising fish in deep waters [4,5]. It has the potential to reduce conflicts with other marine activities and alleviate some of the environmental concerns associated with nearshore aquaculture.

Conclusion

While aquaculture offers numerous benefits, it is not without its environmental challenges. Responsible and sustainable aquaculture practices are essential to mitigate the industry's impact on ecosystems. Proper management of water quality is vital. Monitoring and maintaining water parameters such as dissolved oxygen, temperature, and pH are crucial for the health of the farmed species and the surrounding environment. The sourcing and composition of aquaculture feed play a significant role in sustainability. Reducing the reliance on wild-caught fish for feed and adopting alternative protein sources is an ongoing challenge. Aquaculture operations generate waste, including uneaten feed and faeces. Effective waste management and recycling systems are necessary to prevent water pollution.

Acknowledgement

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Conflict of Interest

The author declares there is no conflict of interest in publishing this article.

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