

UNLEASHING THE POTENTIAL OF DRONES IN AQUACULTURE: ADVANCEMENT, CHALLENGES AND FUTURE PROSPECTS

Durgesh Chavande^{1*} and Sakshi Bagde²

College of Fisheries, Ratnagiri, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

Aquaculture and Aquatic Resource Management, Asian Institute of Technology, Thailand.



INTRODUCTION

The world's expanding population is increasingly concerned about the issues of food security and affordability. Consequently, there has been a growing emphasis on aquaculture as a viable and enduring means of producing food. An obstacle to ensuring the safety of aquaculture farms is the occurrence of theft and human incursions, which can harm profitability and the overall functioning of the farm. This is especially relevant for larger aquaculture sites that have made significant financial expenditures and have more resources at risk. The role of innovation has greatly influenced the feasibility of sustainable aquaculture. The implementation of innovative monitoring equipment is fundamentally transforming the approach we undertake for protecting the oceans and the fish species that dwell inside them.

IMPROVEMENTS IN TECHNOLOGY OF AQUACULTURE FOR PRECISE FARMING

Previously, fishes obtained nutrition from natural food sources derived from the surrounding aquatic environments. As a result of advancements in aquaculture techniques, farmers are currently adopting the practice of artificial fish feeding. Since the implementation of artificial feeding, ensuring the appropriate amount of food has been a significant problem, aiming to avoid both underfeeding and overfeeding. Insufficient feeding negatively impacts both the amount and quality of fish produced, while excessive feeding reduces the profitability of fish farmers by leading to food wastage. Excessive feeding of fish likewise the ecosystem, specifically on water quality and can additionally cause damage to the fishing sector as a whole.



AQUACULTURE ADVANCES WITH DRONE TECHNOLOGY

Drones, also known as unmanned aerial vehicles (UAVs), have been utilized in aquaculture, which involves the farming of aquatic animals such as fish, shellfish, and aquatic plants, for various objectives. Drones have numerous benefits in this sector, such as enhanced productivity, cost efficiency, and data collection capabilities. Here are several applications of drones in aquaculture,

1. Monitoring and surveillance

Increasing the effectiveness of monitoring and surveillance in aquaculture is made possible by the use of drones. Drones, which are outfitted with high-resolution cameras, infrared sensors, and other environmental monitoring equipment, make it possible to identify intrusions in real-time, analyze fish behavior, and evaluate environmental parameters. Monitoring water quality measurements such as temperature, pH, and dissolved oxygen, as well as conducting fish behavior patterns analysis with the purpose of gaining insights into fish health and growth, they patrol aquaculture facilities to identify instances of unwanted access.

2. Feeding Management

In aquaculture, automated drone systems are revolutionizing the feeding process by distributing feed pellets over ponds at regular intervals. This improves feeding efficiency and reduces the amount of physical labor required. Drones that are fitted with hopper systems guarantee regular distribution, which in turn encourages healthy growth while reducing the amount of food that is wasted. In order to improve efficiency, they modify their schedules according on the behavior of the fish and the factors in the environment.

Using this technology, feed consumption is improved, expenses are reduced, and remote monitoring is made possible for data-driven decision making, which ultimately leads to increased production and sustainability in aquaculture.

3. Disease Management

In aquaculture, determining the cause of disease outbreaks promptly is of the utmost importance. Drones that are fitted with thermal imaging cameras have the ability to detect variations in water temperature, which can be an indication of the presence of bacteria or viruses. Through the use of this early warning system, quick intervention



can be carried out, such as modifying the parameters of the water supply or delivering treatments, to reduce the spread of disease and minimize economic losses.

4. Water Sampling

The use of drones in aquaculture helps to streamline the process of water sampling by collecting samples from a variety of locations. This makes it easier to analyze the water quality and nutrient levels. This effective method is especially useful for large-scale enterprises since it provides essential data that can be used to make educated decisions regarding water management and environmental health. The use of drones to collect water samples improves aquaculture operations, which in turn ensures that fish are raised in conducive conditions and that production is sustainable.



CONCLUSION

The implementation of drone technology into aquaculture has resulted in a revolution within the sector. This revolution has been brought about by the enhancement of monitoring and surveillance, the optimization of feeding management, the improvement of disease control, and the streamlining of water sample procedures. Not only do these improvements contribute to the promotion of sustainable practices, but they also significantly contribute to the enhancement of production and profitability in aquaculture operations. When it comes to maintaining fish health, protecting the environment, and guaranteeing food security for a growing global population, the use of drones highlights the vital role that technology plays in all of these areas.