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Drones in Fisheries

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The fisheries sector has recently geared up to automate mechanical processes to perform fisheries-related activities faster and more efficiently. In this regard, Drones are the latest models in fisheries, helping with various activities such as habitat assessment, confirming the presence and distribution of fish species in aquatic ecosystems, real-time monitoring of IUU fishing activities, and providing real-time aerial views and broader spatial coverage. It's also highlighted for use in aquaculture, such as feed distribution, fish transportation, medication supplementation, and pond monitoring. Both the marine ecosystem study and modern pond management drones are proving to be more efficient techniques. As it's an emerging technique, it takes time for it to be accepted and adapted by local farmers.

Introduction

Drones, commonly referred to as Unmanned Aircraft Systems (UASs), are available in a wide variety of shapes and sizes and can be designed according to specific operational requirements. Advances in technology have enabled the development of drones with improved stability, navigation, and data acquisition capabilities. Most commonly used drones are equipped with four motors and four propellers, which allow controlled flight, hovering, and manoeuvrability. Recent progress in drone technology has enabled the programming of UASs to follow predefined flight paths, collect high-quality images, videos, and other data, and return automatically to their point of launch after completing assigned tasks, without requiring continuous operator intervention during the mission (Fishbio, 2019).

In recent years, the application of UASs has expanded rapidly across many scientific disciplines, ranging from applied fields such as agriculture and infrastructure inspection to fundamental research areas including ecology and geology (Harris et al., 2019). Similar to these disciplines, fisheries research stands to benefit significantly from the broader adoption of drone technology; however, its application has progressed more slowly compared to other fields. Drones offer several advantages over conventional fisheries methods, including the ability to access remote or difficult-to-reach areas of water bodies, reduce the need for boats, minimize labor requirements, and enhance operational safety. In fisheries, drones are primarily used for habitat mapping and estimating fish abundance. Additionally, several countries, including Belize, Palau, the United States, and Australia, have adopted drones as surveillance tools to monitor fishing activities and support fisheries management and enforcement (Towers, 2014).

Drone usage in Fisheries

In a broad sense, drones are used in fisheries for multiple purposes, including high-quality habitat evaluation, confirmation of species occurrence in aquatic environments, monitoring of illegal, unreported, and unregulated fishing, and functioning as aerial observation platforms similar to traditional crows' nests. In addition, drones are increasingly explored for assisting fishing operations and fish capture. Furthermore, UASs play a crucial role in identifying and mapping critical aquatic habitats, including tidal wetlands, fish nursery grounds, inlet and channel topography, coastline features, river bathymetry, restoration sites, and other physical habitat characteristics, thereby significantly contributing to fisheries research and management (Harris et al., 2019).

To describe the habitat with a high-quality evaluation

The application of drones for detailed habitat assessment in fisheries is still emerging, and relatively few studies have been reported. However, available research clearly demonstrates their effectiveness. For example, Hardy et al. (2012) used a fixed-wing UAS to survey more than 60 km of river in Texas to identify pool habitats targeted for the removal of non-native Smallmouth Bass (*Micropterus dolomieu*). Similarly, Birdsong et al. (2015) documented cumulative changes in instream habitat conditions affecting the native Guadalupe Bass (*Micropterus treculii*). Kalacska et al. (2018) further enhanced habitat analysis by combining aerial imagery with underwater photography to quantify habitat complexity relevant to fish assemblages. Advanced imaging approaches such as fluid lensing technology have also been applied to generate three-dimensional images of aquatic ecosystems by correcting surface wave distortion, enabling centimeter-scale habitat mapping (Chirayath and Earle, 2016). In addition, the use of thermal imaging has enabled researchers to identify groundwater inflow zones, which serve as critical summer refuges for salmon and steelhead (*Oncorhynchus mykiss*) (Willms and Whitworth, 2016).

Fig: Drones used in habitat assessment (Source: Fishery News Patna, 2024)

To ensure the occurrence of species both in water bodies

Drones have also been increasingly employed to confirm the presence and distribution of fish species in aquatic ecosystems. Most early applications focused on epipelagic megafauna such as whales and sharks; however, recent studies have extended drone-based surveys to freshwater and smaller-bodied fish species. Tyler et al. (2018) explored the feasibility of collecting freshwater fisheries census data using drone surveys of Taimen (*Hucho taimen*) in Mongolia, demonstrating the potential of UASs for species identification and monitoring. In addition, drone-assisted spawning surveys have been successfully conducted for Chum Salmon (*Oncorhynchus keta*) and Sockeye Salmon (*O. nerka*) (Kudo et al., 2012; Whitehead et al., 2014). For schooling fish species, Vanderlaan et al. (2014) introduced a novel approach by integrating acoustic data with UAS aerial imagery to estimate biomass and aggregation behavior of Atlantic Bluefin Tuna (*Thunnus thynnus*), highlighting the usefulness of drones for advanced fisheries assessments.

To report illegal, unreported, and unregulated fishing

Illegal, unreported, and unregulated (IUU) fishing poses a significant threat to global fisheries sustainability. It is estimated that nearly 20% of the world's fish catch is obtained illegally through activities such as fishing in restricted areas, violating seasonal closures, and using prohibited fishing gear. To address this issue, many countries have adopted drones as cost-effective surveillance tools for real-time monitoring of fishing activities. The use of UASs enhances enforcement efficiency by improving detection of illegal operations and supporting regulatory authorities in both marine and inland waters (The Fish Web Page, 2020).

Drones as a Crow nest

Traditionally, sailing vessels relied on a crow's nest as an elevated observation point to identify land, hazards, other vessels, and surface fish schools long before the development of radar technology. In modern fisheries, drones serve as an effective alternative to the crow's nest by providing real-time aerial views and broader spatial coverage. This aerial perspective enhances the ability of fishers and researchers to detect surface schools, assess environmental conditions, and improve navigational awareness, thereby supporting both fishing operations and safety at sea (National Fisherman Web Page, 2020).

Advantages and other uses of drones in fisheries

Drones offer several advantages and additional applications in fisheries, particularly with recent advancements in drone design and functionality. Specialized waterproof fishing drones have been developed that can carry relatively heavy payloads, such as bait and fishing lines, and deploy them accurately at targeted locations. These drones significantly enhance fishers' ability to access remote areas of lakes, rivers, and coastal waters that are otherwise difficult or time-consuming to reach using conventional methods. By enabling the aerial deployment of fishing gear, drones assist in transporting baits and equipment without the need for boats, thereby reducing operational costs and physical effort.

The use of drones also improves safety by minimizing or eliminating the risks associated with boat-based fishing, especially in rough waters or hazardous environments. Their ease of operation and user-friendly controls make them accessible to both professional and recreational fishers. Additionally, drones facilitate the capture of highly valued game fish by enabling precise bait placement in deeper or less disturbed waters. For recreational fishers, drones provide a novel and efficient way to scout for fish schools from above and accurately cast lines, enhancing the overall fishing experience. Increasingly, anglers are adopting drones to assist in hooking and hauling fish, reflecting a shift toward technology-assisted fishing practices. Additionally, drones also aid in fishermen's emergency situations by dispensing life jackets for rescue operations (The statesman, 2026)

At the farmer culture level, these drones are used to supplement feed, administer medication, transport fish, and monitor the pond and fish behaviour. In Andhra Pradesh, some companies were evaluated for manufacturing and modifying drones based on their suitability for fisheries activities.

Fig. 02: Drone used in Fish Transportation (The statesman, 2026)

Fig. 03: Drones used for dispensing life jackets (Press Information Bureau India, 2024)

Fig. 04: Drones used for feed distribution in an aquaculture farm

Impacts of using drones in fisheries

Despite their benefits, the increasing use of drones in fisheries has raised several concerns related to environmental, ethical, and management issues. The noise generated by drones can disrupt the natural surroundings and disrupt the quiet, peaceful atmosphere traditionally associated with fishing activities. This disturbance has led to mixed reactions among anglers, with some questioning the fairness and ethical implications of using robotic assistance to capture fish. Such concerns have been reflected in public discourse, where some users have described drones as "oversized mosquitoes" because of their persistent buzzing.

Another significant concern is the potential misuse of drones to target protected or endangered species. Without adequate regulation and monitoring, fishers may use drones to locate and capture species that are legally protected, such as certain shark species, including the dusky shark in South Africa. Furthermore, the ease with which drones can deploy fishing lines in deeper waters may increase fishing pressure on deep-sea ecosystems, potentially affecting vulnerable deep-sea fish populations. These impacts underscore the need for effective guidelines and regulatory frameworks to ensure the sustainable and environmentally responsible use of drones in the fisheries sector.

Conclusion

Drones are prominent in fisheries and in remarkable marine and freshwater ecosystems. Advancing drone techniques definitely helps develop sustainable fisheries and improve pond management, thereby increasing production and profits by reducing input costs.

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