The Academic
International Journal of Multidisciplinary Research

An Online Peer Reviewed / Refereed Journal
Volume 3 | Issue 2 | February 2025
ISSN: 2583-973X (Online)
Website: www.theacademic.in

Navigating the Future: Integrating in Fisheries Management Education for A Sustainable Tomorrow

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ARTICLE DETAILS

Research Paper

Accepted: 24-02-2025

Published: 14-03-2025

Keywords:

fisheries management, education technology integration, sustainability, GIS, GPS, Remote sensing , drone

ABSTRACT

Fisheries management education is the process of teaching and training individuals particularly those who are engaged in fishing sector .it provide best practices, principles, and technique for managing and sustaining fishery resources. The integration of technology into fisheries management education represents a transformative shift in how fishery workers are trained and equipped for the future .technology such as Geographic Information System (GIS), Global Positioning System (GPS), remote sensing ,and drones are revolutionising the way fishery data is collected ,analysed and utilized these tools provide invaluable insights into fish stock levels, migration pattern about fish , environmental conditions enabling more informed decision making and resource management. Incorporating these technologies into fisheries management education not only enhances the technical skills of fishery workers but also promotes a culture of sustainability and responsible resource use. This paper aims to explore the role of innovative technologies in fisheries management education. This study employs a Qualitative research design, utilising a data from academic journals, government reports, and interviews with fisher

workers and experts. And it will analyse how these technologies can be integrated into educational programmes to foster a more sustainable and economically viable fishing industry.

DOI : https://doi.org/10.5281/zenodo.15030395

Introduction

Kerala is a maritime state in India. The coastal region of Kerala is spread over 9 districts. The fishing sector is a distinctive group of people geographically located in coastal area and engaged in fishing and allied activities. The sector holds a pivotal role in global food security, economic development and environmental sustainability. Fish is a staple food for most people worldwide, driving a steady global increase in demand for fish and fish products. Therefore, sustainable practices are necessary to promote the fishery ecosystem and ensure the long-term sustainability of fish stocks. The fisheries sector is confronted with a multitude of complex challenges, including overfishing, environmental degradation, regulation issues etc are collectively threaten the long-term sustainability of this critical industry .as a result there is a need for a management and educating technologies that addressing these complex issues in a holistic and integrated manner. Effective fisheries management is important for promoting sustainable practices in the fishing industry. The integration of advanced technologies revolutionising the sector by providing precise data on fish stock levels, and environment conditions etc. The integration of innovative technologies in fisheries management education is crucial for effective resource management and addressing the pressing challenges faced by the fishing community.by empowering fishery workers with the knowledge and skills to leverage modern technologies these challenges can be mitigated, and a more sustainable and economically viable fishing industry can be promoted. The research aims to explore he role of innovative technologies in fisheries management education and informing strategies and policies that support sustainable fishery resource management. Ultimately this study contribute to ensure a resilient future for fishing community and the environment.

Geographical Information System

Geographical Information System that allows for the collection, processing, and visualisation of spatial and geographical data. GIS has important uses in fisheries management, environmental studies and resource management. A GIS involves multiple vital parts to function properly. Spatial data covers

geographical objects, such as their location, shape, and properties. This data is gathered using a variety of ways, including surveys, remote sensing, and secondary data base access. After collection, the data is processed, prepared, and arranged for meaningful analysis with the GIS framework. Finally, it consists of variety of analytic tools that allow users to alter overlay data, expositing patterns and trends that may be used to make decisions. Resource mapping in GIS entails developing maps and spatial data sets to illustrate and examine the allocation of fishery resources. GIS resource mapping consist of fish distribution mapping, habitat mapping, fisheries resource assessment, Marine Protected d Area Mapping, Essential Fish Habitat Mapping, fish spawning ground mapping, fish migration route mapping, fisheries management zone mapping and cadastre mapping. Fish distribution mapping is the process that generate maps displaying the spatial distribution of fish species or population. This form of mapping is crucial for understanding fish ecology and behaviour, as well as for ensuring sustainable fisheries management. Habitat mapping is another one which designing maps that depict the spatial distribution of various habitat such as their locations, sizes, and properties. This process entails gathering data on habitat features, incorporating data from multiple sources, classifying habitat and mapping their spatial layouts. Techniques for habitat mapping comprise remote sensing, GIS modelling, and direct field observation. The utility of habitat mapping spans several areas, such as conservation planning, species management, ecosystem management etc. By analysing habitat maps, can gain insight the connections among habitat, species and environmental conditions enabling the development of effective strategies for natural resource conservation and management. GIS offers important benefits in the field of fishing industry by proving improved decision making and management of spatial data. It allows to investigate and describe complicated spatial phenomena, which improve accuracy and scalability. It is an effective tool for analysing and visualising spatial data and its benefits can be maximised by knowing and overcoming its limitations.

Global Positioning System

Global Positioning System in fishery refers to the technology that use to track and monitor fishing vessels, fishing gear, and fish population. Fishing industry has revolutionised by the use of GIS technology in the management and monitoring of fish stock. GPS technology generates reliable and up-to-date information on fishing activities and fishing population, allowing fisheries managers to make better choices about sustainable fishing pratices.one of the primary benefits of GPS in fishing sector is improved fisheries management. GPS technology empowers fisheries manager to aware of fishing activities, track fish populations, and enforce fisheries standards because it provides accurate and fast

data on fishing activities and populations. This helps to prevent overfishing, protecting marine environments and ensuring the long-term sustainability of fisheries resources. Enhanced efficiency is another key benefit of GPS. GPS technology allows fishermen to enhance their fishing methods, diminishing bycatch and boosting catch rates, by giving them continuous information on fishing operations. This helps to minimise the expense associated with fishing, boosts profitability and also enhance efficiency of fishing operations. In addition to improved management and increased efficiency, GPS technology has a wide range of several applications in the area of fishing. For example, GPS can be used to track fishing gear, monitor fishing vessel movement, and provide emergency response capabilities in the event of an accident or incident. One of the most promising applications of GPS in fishery is use of Vessel Monitoring System In order to provide real time data on fishing activities and monitor and track the location and movements. VMS send location information to a satellite or a cellular network which is transmitted to a VMS center for monitoring and analysis. This protects them marine environment to ensure safety and security of vessels and their workers, and help to enforce regulations prevent overfishing. GPS technology has the potential to transform the fishing by providing accurate and timely data on fish stocks and its operations. This technology can contribute to the long-term sustainability of fisheries resources by improving fisheries management, increasing efficiency and strengthening food security. As the fishing industry evolves, GPS technology is anticipated to become increasingly crucial in influencing the future of sustainability of fishery. The various applications of GPS in fishery consist of navigation and tracking, fisheries management, safety and emergency response and research and development. Navigating and tracking are crucial component of GPS application in fishery. It allows the fishermen to accurately determined fishing grounds, which reduces search time and boots catch rates. Furthermore, GPS assist fishermen in navigating unknown waterways, avoiding hazards and reducing the likelihood of an accidents. Vessel tracking system, which use GPS to monitor the movement of fishing vessels, help fisheries managers to monitor the activities related to fishing and also prevent illegal, unreported and unregulated fishing. GPS play a crucial role in the fisheries management. Fisheries managers can monitor fishing activities and make well informed judgement and take decision with the light of catch reports that generated with the help of GPS technology. Fisheries managers can modify management strategies and avoid overfishing by using fishing efforts monitoring system provided by GPS. It is also help to track adherence to Marine protected Area (MPA) rules, safeguarding biodiversity and important habitats. Another key application of GPS in fishing industry is safety and emergency response. GPS based Emergency Positioning Indicating Radio Beacon System assist to quickly locate in distress. Additionally, easily search rescue teams to rapidly locating lost crew

and missing crew members. Further GPS is used to tack weather patterns help fishermen to plan safer fishing trips. Subsequently GPS is employed in fisheries research and development. GPS is used by fisheries researchers to investigate population dynamics, habitat utilisation and fish migration pattern. Additionally, it is used to maximise the development of fishing gear, lowering bycatch and increasing catch rate. Also, GPS is utilised to support environmentally friendly methods including minimising waste and preserving marine environment. GPS have a wide range of uses in fishing and essential to the long-term sustainable management of fisheries resources. Fishermen, fishery manager and researchers can make well informed judgement regarding fishing methods, resource management and conservation because GPS provide accurate and trustworthy location data. As the fishing industry continues to evolve, the importance of GPS technology will only continue to grow.

Remote Sensing

In fisheries remote sensing is the technique of collecting information about fish populations and marine ecosystem without making direct physical contact by means of satellite photography, aircraft surveys and other technologies. Remote sensing technology make a revolution in the field of fishing industry by delivering useful information and insights for sustainable fisheries management, marine conservation and climate change research. Remote sensing involves the use of sensors and imaging technologies to collect data about the ocean, fish production, and fishing activities from a distance typically using satellite or airborne platforms. This becomes an important tool for fisheries managers, researchers and policy makers to monitor and manage fisheries resource, protect marine ecosystems and mitigate the impacts of climate change. Fisheries management is one of the key applications for remote sensing by fishery. Data through remote sensing remote sensing is used to track fishing effort, and enforce fisheries regulations. For example, satellite imagery can be used to detect and track fishing vessel, monitor fishing gear deployment, and identify the areas of high fishing activities. Habitat mapping, which includes producing intricate maps of underwater environments including coral reef, estuaries, and coastal wetlands. These maps are essential for understanding the distribution and abundance of fish populations, as well as the impacts of human activities on marine ecosystem. For example, remote sensing data can be used to identify areas of high conservation value, such as coral reefs or sea grass beds, and to monitor the impacts of coastal development or fishing activities on the habitats. Ocean

currents and circulation pattern are also important aspects of remote sensing technique used in fishing sector. Remote sensing data are used to investigate ocean currents, circulation pattern and ocean atmosphere interactions. This data is critical for understanding the location and quantity of fish population.as well as the effects of climate change on marine ecosystems. For example, remote sensing data can be used to study the effects of ocean currents on fish migratory pattern or to monitor changes in ocean circulation pattern due to climate change. Another significant use of remote sensing in fishing is monitoring of water quality. Remote sensing data are used to monitor water quality parameters, such as ocean colour, turbidity and algal blooms. Understanding the distribution and abundance of fish populations as well as the effects of human activities on marine ecosystems requires knowledge of this population. Data from remote sensing for instance, can be used to identify early warning indicators of algal blooms or track the effects of sewage or agricultural runoff on water quality. Research on climate change is also a vital part of fishing remote sensing. The effects of climate change on fisheries, ocean ecosystems, and coastal populations are investigated using data from remote sensing. Understanding the location and abundance of fish population and abundance of fish populations, as well as the effects of climate change on marine ecosystems, requires knowledge of this information. Climate change research is also an important part of remote sensing in fisheries. Remote sensing data are used to investigate the effects of climate change on fisheries, ocean ecosystem and coastal communities. This information is essential for understanding how climate change affects marine ecosystem, as well as the location and abundance of fish populations. For example, remote sensing data can be used to investigate the effects of sea level rise on coastal ecosystem, as well as to monitor changes in ocean circulation pattern due to climate change. An additional important application of remote sensing in fishing is marine conservation. Remote sensing data are used to identify and protect marine protected area such as marine reserves. This. Information is needed for understand the impacts of human activities on marine ecosystem. For example, remote sensing data can be used to identify the areas of high conservation value such as coral reefs or sea grass beds and to monitor the impacts of human activities on these habitats. Fisheries enforcement is also a crucial competent of remote sensing in fishery. Remote sensing data are used to find and detect illegal, unreported and unregulated fishing activities. This information is important for the understand the distribution and abundance of fish populations as well as the effects of illegal, unreported and unregulated data related to fishing on marine ecosystems. For example, remote sensing used to detect and track fishing vessels, monitor fishing gear deployment and identify areas of high fishing activity. Remote sensing technology has emerged as a crucial instrument for studying climate change, marine conservation, and sustainable fisheries management. The distribution and quantity of

fish population, the effects of human activities on marine ecosystem, and the effects of climate changes on fisheries and ocean ecosystems are all better understood through the use of data from remote sensing. Remote sensing technology will become more crucial in guaranteeing the long-term sustainability of fisheries resources as the demand of fishing resources.

Drone

Drone is one of emerged as a valuable tool in fishery offering a wide range of applications that enhance the efficiency, sustainability and profitability of fisheries management .it is also called unmanned aerial Vehicle, drone can be used for fisheries monitoring, fish population tracking and illegal fish detection. Due to sophisticated sensors, cameras, and GPS technology. This make it possible to enforce fisheries laws more successfully it can also be used to monitor water quality, map habitat and identify places of high conservation importance all of which help fishery managers make well informed decisions regarding their resources. Furthermore, drones can assist in aquaculture operations, monitoring water quality detecting disease outbreaks and optimising feeding strategies, leading improved fish health and productivity. Overall, the integration of drones in fishery has the potential to revolutionise the industry, promoting sustainable fisheries management. Reducing environmental impacts and enhance the livelihood of fishing communities.

Conclusion

The integration of technologies such as GIS, GPS, Remote Sensing and Drones has revolutionised the field of fishing fisheries management incorporated of these technologies in this sector results more effective, profitable and sustainable. Decision making and the efficient management of fisheries resources have been informed by the precise and fast data collecting on fish populations, habitats and ecosystem made possible by these technologies. As these technologies continue to develop, they will probably become more and more crucial in maintaining the long term viability of global fisheries resources, encouraging standardisation, and education among fishing communities and driving innovation in sustainable fisheries management.

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