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SPACE-FARING SENTINELS FOR SUSTAINABLE SEAS: USING SATELLITE TECHNOLOGIES TO PROTECT FISHERIES AND COMBAT ILLEGAL FISHING

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OVERVIEW

Illegal, unreported, and unregulated (IUU) fishing is a major threat to our global fisheries. Traditional methods for keeping an eye on the vast expanses of the ocean just aren't cutting it. This article dives into how cutting-edge satellite technologies, like Vessel Monitoring Systems (VMS) and Automatic Identification Systems (AIS), can revolutionize fisheries management and tackle IUU fishing head-on. We'll explore the perks of satellite monitoring, such as greater transparency, better enforcement capabilities, and richer data for stock assessments and habitat monitoring. Plus, we'll look at the challenges, including restricted data access and privacy concerns, and consider the future of satellite-based fisheries monitoring in promoting sustainable fishing practices.

INTRODUCTION

With the world's appetite for seafood growing, our marine ecosystems and fisheries are under more pressure than ever. Illegal, unreported, and unregulated (IUU) fishing makes things worse, threatening the sustainability of fisheries and putting food security and coastal livelihoods at risk. To manage fisheries effectively, we need comprehensive monitoring and enforcement to ensure regulations are followed and overfishing is prevented.

But traditional methods like coast guard patrols and aerial surveillance often fall short, especially in remote ocean areas. Enter satellite-based technologies, which have emerged as powerful tools for enhancing fisheries monitoring and combating IUU fishing. These technologies provide real-time data on fishing vessel locations and activities, giving authorities and stakeholders a better understanding of what's happening on the high seas. This article explores how satellite monitoring can transform fisheries management, examining its benefits, limitations, and future potential.

TECHNOLOGY, SPACE, AND FISHERIES GOVERNANCE

The way we govern marine resources is shifting from state-centric control to a model increasingly influenced by private actors. This change is driven by the advanced technologies that provide and interpret information.

HISTORICAL CONTEXT

The United Nations Convention on the Law of the Sea (UNCLOS) organized the management of straddling and highly migratory fish stocks around dividing rights and responsibilities within political boundaries and forming regional fisheries management organizations (RFMOs). This approach divided the ocean into large, homogenous sections.

EMERGENCE OF MCS TECHNOLOGIES

The development of Monitoring, Control, and Surveillance (MCS) technologies represents a new phase in ocean governance, focusing on the remote collection and control of information. Unlike the broad divisions under UNCLOS, MCS technologies create detailed, non-homogeneous spatial configurations.

SHIFT FROM STATE TO NON-STATE ACTORS

With the advent of MCS technologies, states are no longer the only players in governing fisheries. Private actors, including fishing companies and NGOs, now play key roles in collecting and disseminating information on fishing activities. These technologies allow private actors to establish new spatial territories based on spatially referenced information.

DE-TERRITORIALIZATION OF ENVIRONMENTAL GOVERNANCE

The control of information is shifting away from states, leading to the de-territorialization of environmental governance. States no longer hold a monopoly on monitoring, reporting, and verification within their jurisdictions or shared areas. In fisheries, states must renegotiate access with private actors to understand activities within their waters and on their flagged vessels.

TERRITORIALIZATION AND INFORMATION TECHNOLOGIES

Information and sensing technologies used for fisheries MCS by private actors are creating new geographies of fisheries regulation. This process involves negotiating boundaries defined by new information flows, impacting the inclusion or exclusion of environments and their exploiters, and redefining public and private regulation roles.

OBJECTS, SPACE, SUBJECTS, AND EXPERTISE

The territorialization process involves interactions between objects (targeted biological resources and material objects related to the production process), space (physical or relational boundaries within which objects of concern associate), subjects (actors needing assessment and surveillance by MCS technologies), and expertise (knowledge controlled by experts who define information systems and produce rules). Expertise extends beyond states to include private actors who control technologies.

ANALYSIS FRAMEWORK

Using the framework of objects, space, subjects, and expertise, we analyze how information and sensing technologies make objects of concern visible and create new informational territories controlled by private actors. We focus on three assemblages of information and surveillance technologies: water, air, and space.

WATER, AIR, AND SPACE TECHNOLOGIES

Each technology has a material basis and is being practiced to some extent, although they are in nascent stages. Their current influence is mainly limited to the creation of collective imaginaries, or visions of desirable futures. The distant, offshore, and invisible nature of the marine environment makes the vision of sustainable oceans imagined to the extent they are mediated and formed by technologies and information.

THREE TRANSPARENCY ASSEMBLAGES

Drifting Oceanic Fish Aggregating Devices (d-FADs)

Drifting oceanic Fish Aggregating Devices, or d-FADs, are a marvel of modern fishing technology, used extensively in both

national waters and the high seas to make purse seine fishing more efficient. These devices are more than just floating objects; they're equipped with GPS and acoustic technology that allows fishers to locate schools of fish quickly and gather information about the fish biomass below, including species composition. This data is invaluable for assessing fish stocks and improving fishing practices.

While d-FADs significantly boost fishing efforts and have led to a notable increase in tuna catches, they also pose sustainability challenges. Overfished juvenile bigeye tuna, endangered sharks, and other species are often caught unintentionally, raising concerns among conservationists. The unregulated proliferation of d-FADs worsens this issue, as their numbers continue to grow globally, creating dense artificial habitats that could be altering marine ecosystems in unknown ways.

Regulators face a daunting task with d-FADs, as they drift across both national and international waters, making it difficult to manage and control their use effectively. While d-FADs provide an unprecedented view of fishery dynamics, ownership and data sharing remain contentious issues. Fishing companies hold most of the data, and despite some monitoring programs by regional fishery management organizations, comprehensive data on d-FAD deployment is scarce. Ensuring the sustainable use of d-FADs will require greater cooperation between fishers, regulators, and scientists to monitor and manage their impact on marine environments.

Drones in Fishery Surveillance

Drones, or unmanned aerial vehicles, are becoming game-changers in the fight against illegal, unreported, and unregulated (IUU) fishing. These flying machines can monitor vast oceanic spaces, providing near-real-time data on fishing activities. Initially developed for military use, drones now serve various scientific, recreational, and environmental purposes, including monitoring agricultural crops, anti-poaching efforts, and forest management.

In fisheries, drones are still experimental but hold great promise. They can detect unregistered vessels, observe fishing gear, and provide data on environmental conditions that may indicate fishing activity. Countries like Belize have already deployed drones to enhance their monitoring capabilities, and other nations and NGOs are following suit. The stealth and speed of drones make them particularly effective for surveillance, although concerns about privacy and the snapshot nature of drone data remain.

Drones' use in fisheries brings together a diverse community of experts, including state agencies, environmental organizations, and even hobbyists. As drone technology becomes more accessible, it has the potential to democratize fishery surveillance, allowing local communities to monitor marine protected areas and combat illegal fishing. However, integrating drone data into effective management practices will require addressing issues of privacy, data ownership, and the technical expertise needed to operate these advanced systems.

Satellite-Based Vessel Monitoring

Satellite technology, particularly Vessel Monitoring Systems (VMS) and Automatic Identification Systems (AIS), has revolutionized fishery management. These systems track fishing vessels using GPS, providing detailed maps and models that describe fishing effort

and dynamics. VMS is widely used by states and regional organizations, while newer private services offer near-real-time data accessible to anyone with an internet connection.

Platforms like Global Fishing Watch have made significant strides in increasing transparency in the fishing industry by providing open access to vessel tracking data. This allows the public, researchers, and policymakers to monitor fishing activities globally, helping to identify and combat IUU fishing. However, there are still challenges, such as the time delay in data transmission and the ability of vessels to switch off their AIS to avoid detection.

Satellite surveillance brings fishers and governing authorities under scrutiny. Governments are increasingly held accountable for managing legal and illegal fishing practices within their exclusive economic zones. The push for more transparent sharing of VMS data is gaining momentum, with countries like Indonesia and Peru leading by example. The expert community in satellite surveillance includes government agencies, commercial actors, and non-profits, all working together to use this technology for sustainable fishery management.

BENEFITS OF SATELLITE MONITORING FOR FISHERIES MANAGEMENT

Increased Transparency

Satellites provide continuous data on fishing vessel locations, regardless of weather conditions or remoteness. This transparency allows scientists, NGOs, and the public to track fishing activity and hold governments accountable for managing fisheries effectively. Platforms like Global Fishing Watch use satellite data to create global maps of fishing activity, raising public awareness and fostering collaborative efforts to combat IUU fishing.

Improved Enforcement Capabilities

Satellite data can identify potential IUU fishing events by flagging vessels operating in restricted areas, turning off tracking systems, or exhibiting unusual behavior. This targeted approach enables more strategic deployment of limited enforcement resources, such as coast guard patrols, significantly increasing the effectiveness of enforcement efforts.

Enhanced Data Collection

Combining satellite data with other sources like earth observation imagery provides valuable insights into fish stocks and habitat health. Information on oceanographic conditions, chlorophyll concentration, and sea surface temperature can create more accurate models of fish populations and inform catch quotas and regulations.

LIMITATIONS AND CHALLENGES

DATA ACCESS RESTRICTIONS

Access to VMS data is often restricted by national governments, limiting the comprehensiveness of public platforms like Global Fishing Watch. International collaboration and standardized data-sharing protocols are crucial for maximizing the effectiveness of satellite monitoring on a global scale.

ENFORCEMENT CHALLENGES

Satellites primarily provide data on vessel locations and activities. While they can identify suspicious behavior, actual apprehension of IUU offenders still relies on traditional enforcement methods like coast guard patrol.

CONCLUSION

Satellite technologies represent a new frontier in fisheries management and the fight against illegal, unreported, and unregulated (IUU) fishing. By offering unprecedented transparency and real-time data, these advanced tools empower authorities and stakeholders to monitor and protect our oceans more effectively. From drifting Fish Aggregating Devices (d-FADs) to drones and satellite-based Vessel Monitoring Systems (VMS) and Automatic Identification Systems (AIS), the arsenal of tools available for sustainable fisheries management is expanding rapidly. However, challenges remain. Restricted data access, enforcement limitations, and privacy concerns need to be addressed to fully harness the potential of these technologies. Additionally, fostering international collaboration and developing standardized data-sharing protocols are essential steps towards a more comprehensive and effective global fisheries monitoring system. As we move forward, the integration of satellite monitoring with traditional enforcement methods and local community efforts will be key. By leveraging these technologies, we can ensure more sustainable fishing practices, protect marine biodiversity, and secure the livelihoods of millions who depend on healthy, thriving oceans. The future of fisheries management lies in the sky, and with the right policies and cooperation, we can safeguard our seas for generations to come.