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Marine Environmental Indicators of Fish Distribution-An overview

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SUMMARY

The productivity of the world's fisheries has been dropping for the past 40 years as a result of pressures from overfishing, habitat loss, pollution, and climate change. The world's fish stocks must be effectively monitored and managed if marine resources are to be used sustainably. Fish schools are more effectively located by fishing fleets thanks to the use of remote sensing techniques, which also aid in maintaining fisheries at sustainable levels. In parts of the ocean where the conditions are favorable to a particular fish species, fish prefer to congregate. Remote sensors on satellites and aircraft may detect and measure some of the key oceanographic factors, such as sea surface temperature, ocean color (productivity), and oceanic fronts, which have a significant impact on the changes of fish stocks naturally. The remotely sensed data are made available in almost real-time to scientists, modelers, and forecasters of fisheries, as well as to fishermen in order to help them conserve fuel and ship time while searching for fish.

INTRODUCTION

The specific environmental parameters most commonly measured from airborne and satellite remote sensors include: surface temperature; surface optical or bio-optical properties (ocean color, diffuse attenuation coefficient, total suspended matter, yellow sub-stance, chlorophyll pigments); salinity; vertical and horizontal circulation, including fronts and gyres; oil pollution; wind and sea state. Information about these environmental/ecological “indicators” helps to forecast fish location, distribution and behavior. Since the complex interactions between the marine environment and its organisms are still poorly understood and difficult to investigate, information is being gathered from various sources and research is conducted to try to relate environmental ocean proper-ties to the distribution and abundance of fish. Fishermen are well aware of how to take advantage of their empirical knowledge about the generally observed correlation of fish distribution with ocean features, especially those related to water temperature. Variations in environmental conditions affect the recruitment, distribution, abundance and availability of fish. Therefore, any use of environmental data for the preparation of oceanographic analyses and forecasts in support of fishery operations will depend on an adequate understanding of the complex linkage between marine environmental and biological processes. Specific conditions and processes affecting fish populations may often be deduced from measurements made by remote sensors. Remote sensors can provide a broad range of indices of ecosystem status, including a compact description of the pelagic ecosystem at a given time and place.

Marine Environmental Indicators

The environmental parameter that is most frequently employed in studies of the interactions between the environment and fish behavior and abundance is water temperature and its variations. Numerous fish species can detect variations in water temperature of as little as 0.1°C, and temperature has a variety of effects on fish. The rate of metabolic processes is impacted by temperature, which influences the intensity of their activity. The temperature of the water has a direct impact on growth, feeding rates, swimming speed, and spawning season. Temperature affects various aspects of fish species' life cycles, including spawning, the growth and survival of eggs and larvae, as well as the distribution, congregating, migrating, and schooling behavior of juveniles and adults. Most open ocean areas are underproductive in terms of primary production and are blue in satellite pictures. The water appears greener in coastal upwelling regions and locations close to river mouths because of the nutrients that are contributed from the sea floor and river runoff, which results in waters with high plankton populations and high primary production. Remote measurements of the concentrations of any dissolved or particulate chemicals can be challenging in coastal and estuarine waters due to large concentrations of suspended sediments and dissolved organics.

Temperature alone cannot account for the observed relationship of some fish species with ocean thermal structures; additional feeding-related behavioral traits must be considered. Since it can be used as an indirect indicator of areas of fish feed concentrations, which are also suitable zones for fish aggregation, sea surface temperature is significant for operational fisheries oceanography. Particularly thermal fronts appear to be linked to significant quantities of fish food. Fish and larvae are drawn to frontal zones and eddy fields, which also provide patchy areas with high phytoplankton concentrations. If prey was scarce, lower temperatures were preferable for growth. Increased food availability at the front enhanced the fish growth rate potential at the front. Whether or if the fish behaviorally picked sites based on temperature, food, or growth rate potential determined the actual growth rates. The findings show that when assessing a fish population's reaction to a front, prey patchiness and the nonlinearities in the relationship between fish development and temperature and prey availability must be taken into account. More recent analyses of fishing grounds using satellite SST and ocean color data revealed that the locations of frontal zones and anticyclonic eddies, where albacore prey was abundant, correspond to the areas of high likelihood (preferred biophysical environmental parameters). Additionally, they discovered that tuna concentrations were concentrated in areas with very large eddy kinetic energy and geostrophic currents, demonstrating that tuna aggregations were linked to anticyclonic eddies.

Five times more sperm whale sightings occurred near thermal fronts on the eastern edge of a Gulf Stream warm core ring than elsewhere in the research area as a whole. Away from frontal limits, no sperm whales were seen in the ring. The high-use area and the rest of the research area have different hydrographic structures, zooplankton densities, and community makeup. This implies that the biological and physical conditions at the mesoscale influence sperm whale habitat use. In emerging and developed countries, coral reef fisheries are significant as a source of food and revenue closer to the coast. For the science and protection of coral reef ecosystems, an understanding of geographical changes in community structures and fish diversity is also essential. The variability and physical complexity of their benthic habitat are related to the diversity, quantity, and dispersion of reef fish.

Advantages of using remote sensing to aid fishing activities as follows

- Saving fuel while searching for pelagic fish schools
- Lower crew expenses as a consequence of spending fewer days at sea
- Lower costs of ship maintenance and improved safety at sea.

CONCLUSIONS

Due to pressures from overfishing, habitat loss, pollution, and climate change, the productivity of the world's fisheries has been dropping during the past forty years. The majority of fish stocks around the world are currently either exhausted or overexploited. Fish stocks and fish habitat must be effectively monitored and managed for the marine resources to be used sustainably. It is challenging to analyze complete ecosystems using conventional methods for sampling the ocean using research vessels since they have fixed time and spatial coverage boundaries. It is now possible to sample the whole ocean on synoptic sizes thanks to the development of satellite remote sensing, particularly remote sensing of ocean color and temperature.

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