Application of Remote Sensing in Marine Management and Biodiversity

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Abstract - *Remote sensing is a holistic method to scrutinize the Marine surroundings. Researchers can now map myriad fundamental components of the marine surroundings from space. The knowledge gathered can be utilized to determine the adaptations within the aquatic conditions due to diverse factors. Remote sensors acquire statistics through sensing electricity contemplated from the earth. These sensors are upon satellites or different carriers. The variety of existence is a vital function of the ecosystem. Depending on the diversity and composition of their organic communities, extraordinary habitats can be taken into consideration as healthy or impaired. With current Climatic changes, there are notifying shifts in the marine habitat. The remote sensing tool has evolved in its functionality and is being used for high-end objectives. In this paper, the advanced applications of remote sensing for alterations in the marine diversity due to numerous environmental changes and human action is described, and the prospect of RS technology in the same field will be drawn.*

***Key Words*: Remote sensing, Marine diversity, climate changes, marine management, remote sensors, satellites**

1. Introduction :

In the past decade, there have been large changes in marine biodiversity. Oceans and coastal life have not been explored much. Despite constituting 71 percent of the Earth's surface, what lies beneath the oceans has remained a mystery to many. Studying the state of the oceans is more important than ever as we are faced with changing biodiversity, climate change and more. However, there is evidence that biodiversity in different habitats is changing as a result of climate change and other human pressures. Comprehending the rationales of biodiversity alteration and monitoring them requires a transformation in the scientific community. Satellite remote sensing is embarking to play a critical role in locating potential fishing zones (PFZ) and administration of fishery resources by furnishing synoptic measurements of oceanic parameters such as sea surface temperature and colour. It is well known that changes in ocean conditions greatly exploit the natural fluctuation of fish stocks. Consequently, knowledge of variations in ocean conditions is mandatory to understand the influence they cause on fish stocks and their distribution. This proficiency will immensely help in proposing promising fishery management and developing fruitful harvesting strategies. The previously established protocols used for point census and study of the marine environment did furnish informative data but were found to be costlier as well as they failed to procure an overall spatial range of data for the locations that were difficult to uncover. Hence, to overcome them, a remote sensing tool is being utilized for data collection from such unknown locations through satellite carriers. [1][2]This paper describes the applications of remote sensing in distinct marine management programs. The focus is on the exceeding technology for modern-day problems encountered by aquatic diversity. The paradigm shift of marine habitat could result in various changes in the environment. To understand and overcome the drawbacks leading to such adverse effects, remote sensing could bring fundamental Optimization in the future.

2. Remote Sensing in marine management

Every physical peculiarity of the location can be assessed from a distance through the radiation emitted from them and apprehended by remote sensors. Remote sensing is categorized into passive remote sensing which depends on the reflected light from the sun or the heat that is radiated. The other category of remote sensing is the active type which analyses the signals from radars, radios and other devices that could be surveyed. Remote Sensing technology has been an asset, not just to human welfare but also to the environment. This technique has been used to analyse the potential fishery zones. The satellite carrier remote sensor helps the fishermen to reduce the scouting time. Knowledge gathered through remote sensing could be used to provide the best possible advice in making fishery management decisions and to generate efficient harvesting strategies for the fishery Resources. It's a tool that could bring about a revolutionary discovery in understanding the habitats of aquatic animals. It could help in generating data to analyse the variation in the oceanic atmosphere.

2.1 Remote sensing for fish management

Large marine ecosystems are basically the habitat of a large biodiverse group of fishes. They also serve the purpose of commercial fishery spots. Remote sensing is the main technique that is used for analysing these large marine ecosystems to understand the potential zones for fishing as well as to know the degradation in the diversity factor. Along with the images provided by the satellite remote sensors there are certain models used to predict the scope (boosted regression

tree model, generalized additive model etc). Satellite remote sensors are being used for broad-spectrum applications. It delivers the spatial overview of the oceans by measuring the electromagnetic radiation reflected or even by actively computing the backscattered radiations. They provide high-resolution images and accurate data which could globally be covered. [3]With the current rise in population there is a high demand for food supply and fish is highly being exploited for its protein source. This demand has to be supplied. The fishermen are improving their techniques for optimizing the fishing zones. The data collected by remote sensors are the biophysical properties that include environmental factors, chlorophyll-a concentrations, the salinity of the water, the sea surface temperature, sea currents and the tides. These characteristics also play a key role in the current climatic situation as well since it's leading to alter in the oceanic condition. This prediction of changes in the environment can help in predetermination of the migration of potential fishery zones.[4]

2.2 Remote sensing for coral reef management

Remote sensors are being used for coral reef management as well as for restoring them. They help in differentiating the various traits of the coral reef which includes its habitat, the most populated location, and other biological elements. Coral reefs are spread throughout the world and with climatic changes and human exploitation they have been going through a degradation phase. The need of the hour is to restore them which would require data that would interpret their true nature to various factors. With the optimum restoration guidelines, the reefs can be revived. Remote Sensing is used to planning out the protocol for improvement by assessing the abiotic constraints that would influence the genotype during altering climatic circumstances. The sensors considered for obtaining the data are usually positioned on the satellites for day-to-day imaging. A multispectral sensor can be used for the identification of the changes in the size of the reef. The remote sensing imaging called the airborne hyper spectral system is used for a comprehensive mapping of benthic territory. This helps in the sampling of the reef and by accessing this database the diversity of reefs can be monitored. Apart from this, the remote sensors equipped on the boats or acoustic sensors could be used to study the effects of other aquatic animals on the reef. This could also in future be helpful to understand certain symbiotic relationships and the potential of other species on the corals.[5]

2.3 Remote sensing for oil spills

The oil spills occurring in the oceans are due to various factors like unexpected catastrophes, combustion from the ships, pipeline leakage. They vary from crude oils, diesel, kerosene and other various types that are found. The estimation of the spill by optical remote sensing depends on the refractive index of the oil as well as the size of the droplet. Therefore, the measurement depends on the oil-water refraction in the visible-near-infrared-shortwave infrared wavelength. The database compiled from optical remote sensing is also based on the ocean atmosphere. The main characteristic that assists in analysing the spill is the property of oil having an elevated scattering coefficient that leads to the formation of emulsions. This is significant in comprehending the type of oil spill. Optical remote sensing in case of spectral bands that come under the visible-near infrared-shortwave infrared wavelength will benefit in deducing the presence of an oil spill, the category oil and quantifying the concentration of oil volume.[6]

2.4 Remote sensing for plastic litter

The recent scenario doesn't favour a healthy environment. Oceans are being highly degraded by plastic waste. It is a heightening factor that needs to be controlled. Remote Sensing assists in a global lookout for plastics in the Marines. Although this technology is in the starting phase, the visible to short wave infrared spectrum is used for the analysis. The model is based on the reflectance of the macro plastic based on its spectral and optical index. The data of the outline of the plastic, colour, reflective index can be found. The reflected light from the plastic object can be the downwelling light directly from it, it can be the backscattered light or the upwelling subsurface light. Remote sensing can help with the increasing effect of plastic on the habitat surrounding the water body and aquatic life. The potential of remote sensor data can be so immaculate to the existing system.[7]

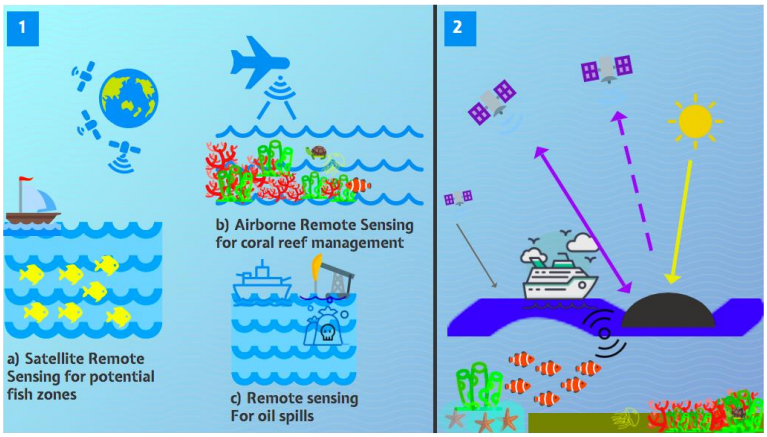

Figure 1. Remote sensing applications for monitoring various impact factors (part1) and different remote sensing techniques for collecting data by reflected, backscattered or other rays from the matter of concern.

3. Remote sensing for Marine Biodiversity

In recent times, there have been many alterations. There has been a rise in temperature due to global warming, rapid shift in the environment due to climatic conditions as well as human exploitation. This has caused a shift in biodiversity as well as there has been a degradation. Especially the marine biodiversity has seen a massive change. Overfishing has led to a decrease in a diverse population, waste disposal has led to a loss of habitat and many other human activities are a threat to the water body and the life within it. Apart from this, there has been an adaptation in habitat and migration. Many species are endangered due to a changing climate leading to acidification, melting ice, increasing salinity. Hence, to understand these changes many countries have come together to put a database for analysing the shifts. Organizations like UNESCO have an Intergovernmental Oceanographic Commission that has proposed to assemble an overview of the essential ocean variables. This ocean essential variable includes biological variables and biogeochemical variables that assist in comprehending the ecosystem of marine life. This helps in acquiring global data collected by satellite remote sensing. The database helps in understanding and predetermining the consequences on aquatic biodiversity.[8][9]The changes observed include the heat that's absorbed by the upper layer of the ocean surface, nutrients availability, an increase in water melted from the Glaciers, the loss in oxygen concentration and other negative impacts. Now satellite remote sensing tool can determine the sea surface temperature, chlorophyll-a concentration and the currents of the ocean data which can be correlated with other factors to study the pattern of shift in the biodiversity Hotspots. These along with other biological factors can be used to analyse the response of the aquatic species.[10]

4. Conclusion

The application of remote sensing is gaining more attention day by day due to the rise in concern for changing environment due to numerous circumstances. The current climatic conditions have increased concerns in the scientific community. Researchers are finding modern strategies to optimize the use of remote sensing tool for the absolute outcome. We need global data to be available for the comprehensive investigation of the pattern in the surging changes. Global remote sensing will offer a better overview of the subject of matter. The scope for the application of remote sensing is of high potential, and we need to focus more on this area for the betterment of our marine environment that has given so much to the mankind and protecting it is also our responsibility.

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