CHAPTER 1

INTRODUCTION

This chapter gives the introduction to remote sensing of fishery resources and the problem, importance of satellite remote sensing, objectives, scope of the works and the flow of the thesis.

CHAPTER – 1: INTRODUCTION

1.1. Background

Satellite remote sensing can be effective and powerful tool in fisheries oceanography and related research on marine ecosystem supporting the living marine resources. The promise of satellite remote sensing technology for marine research and management has been recognized since, late 1960's when the first visible and infrared images of Earth's surface were obtained from orbit. However, it has been mostly in the recent decade the significant studies, progress and expansion have been made in the utilization of satellite remote sensing for meeting the needs of fisheries researchers for measuring and monitoring the ocean conditions. This has come preliminary because of (1) increases in the availability and improvements in the access to satellite data, (2) the development of easy to use satellite data processing and display software combined with low cost computer hardware systems and (3) the increasing awareness of the successes in demonstrating the application of technology to marine fisheries related problems. Variations in the marine environmental conditions affect the distribution, abundance and availability of marine fish populations. Similar information and understanding of marine environmental variability are essential to ensure the recovery and viability of populations of protected species.

Information on the changing ocean is required rather than an average or mean ocean condition in order (1) to understand, model and predict the effects of ocean conditions on marine fish populations, (2) to effective harvest of marine stock and (3) to ultimately rationally manage many marine fisheries. Satellite

remote sensing is notably suitable for measuring and monitoring the changing ocean. It provides the combined benefits of the large-scale synopticity, high spatial resolution and frequent repeatability of coverage. The primary disadvantages are that the satellite measurements are mostly limited to cloud-free areas. However, these drawbacks are not always serious. In many oceanic regions conditions at the surface have been found to be representative of those in the upper 100-250 meters. The cloudiness problem can often be largely overcome by combining infrared or visible images the same area acquired over several days, resulting in temporally averaged images, which often contain sufficient cloud-free area.

The capabilities of evolving satellite remote sensing technology, combined with conventional data collection techniques provides a powerful tool for the efficient and coast effective management of living marine resources. A wealth of satellite remote sensing systems exists today. For the most part, satellite remote sensing applications in fisheries have concentrated on the measurements of ocean temperature, color and computation of ocean transport based on satellite measured wind stress. Chlorophyll concentration is considered as an index of bio-mass availability in the marine food web. The variability of phytoplankton in space and time is thought to hold a key to understand the relative importance of physical and biological factors in structuring the marine food web. The successful modeling of phtoplankton dynamics and predictive linkage of pytoplankton production to higher trophic levels has been limited by lack of synoptic and by limited sampling strategies. This calls for synoptic and repetitive observations of dynamic medium.

Temperature is an important physical parameter that control bio-chemical processes and distribution of marine resources. This is also an indicator of circulation pattern. Exploration of fishery resources using satellite data helps in reducing search time, saving fuel and fisheries management.

The colour of the ocean is determined by the interactions of incident light with substances or particulate present in the water. The most significant constituents are Phytoplanktons, inorganic particulate matter and their derivatives. Remote sensing reflectance is important for characterising the coastal and oceanic optical environment. The oceanic and coastal processes rapidly alter the optical properties of waters and these effects get manifested in the colour of the water. Remote sensing provides an extremely valuable tool for rapidly assessing the spatial variability of coastal and oceanic water reflectance patterns. Phytoplanktons contain chlorophyll, which absorbs light at blue and red wavelengths and transmits in the green. This enables to estimate chlorophyll concentration from satellite ocean colour sensors using bio-optical algorithm derived from the sea truth data.

For a cloud-free atmosphere, infrared radiation emitted from the ocean surface can propagate relatively unattenuated through the atmosphere at wavelengths for which gaseous absorption is small. The variability in attenuation at a given wavelength is primarily due to water vapor. Atmospheric transmission can be ~90% for a dry atmosphere at 3.5-4.o μm and 10-12 μm spectral channels. The transmittence depends on the vertical distribution of water vapor as well as

total vapor amount. The simplest approach for atmospheric correction is to measure radiation from a given field of view at two or more window frequencies having different atmospheric absorption. The difference in the radiance in measurement made at two different channels is proposnal to the signal attenuated due to the water vapor absorption (McClain *et al.* 1985). Using this approach atmospheric contribution in the total signal can be corrected / removed. Once the radiance correction is done, the surface temperature can be determined from the knowledge of the surface emissivity and the form of the Plank's function.

Natural variations in fish stocks are caused by complex interactions of oceanic physical, chemical and biological processes. The prediction of marine ecosystem structures and functions depends on a thorough understanding of the physical and biological processes which govern the abundance, distribution and productivity of the organisms on a wide range of time and space scales. Commercially important fishery resources available in north West Coast of India are promfrets, ribbon fish, bombay duck, seer fish, squids, prawns, sciendies, Sardines etc. There is need to understand the behavioral mechanisms of fishes for selection of habitat and to identify as well as understand the importance of the space-based parameters on their distribution.

1.2. Objective of the study

The purpose of the study is to understand the satellite derive events/processes, fishery resources distribution with reference to the satellite

derived parameters, to relate them with reference to their habitat perticularly, food and feeding habitats based on the in-situ observation through direct fishing operations. Satellite derived features and their relevance to fishery resources for the identifying potential fishing zones in marine environment.

1.3. Scope of present investigations

The thesis is mainly concern with the biological aspect of remote sensing of fishery resources. The study provides background information on the sensor requirement for remote sensing of fishery resources and remote sensing of SST and ocean colour. The methodologies for the retrieval of SST and ocean colour have been discussed. Image interpretation keys to identify Potential Fishing Zone (PFZs) based on remotely sensed data have been discussed. The fish habitat with specific reference to fish food resources and environment has been discussed. The description of investigation on the patterns of season variability of fishery resources would be available based of the catch contribution in the PFZs area. Patterns and persistence of oceanographic features and its relevance to fishery resources have been discussed in detail. The investigations on species distribution in remote sensed forecast and their percent contribution would be very useful in future for utility of specific gears in PFZs areas. The secondary production modeling approach using satellite derived chlorophyll concentration and sea surface temperature have been discussed briefly and initial results have been included in the thesis.

1.4. Theses flow

The thesis is written in five chapters on scientific/technical discussion. Chapter 1 includes brief introduction to remote sensing of fishery resources, the objective, introduction to the problem, scope of the study. The literature survey related to the problem, methodology and work carried out by the scientific community in different organizations in this field have been reviewed in chapter 2. Over all methodology including detail of satellite sensors, parameter retrieval, fishery resources habitat, details of study area have been discussed in chapter 3. Results and discussion on the experiments, analysis, interpretations and observations have been discussed in chapter 4. Conclusions of scientific investigations have been included chapter 5.