CMFRI Diamond Jubilee Publication

Status and Perspectives in Marine Fisheries Research in India

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Indian marine capture fisheries - present trends and future possibilities

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3.1 Introduction

In India, the last few decades' fisheries research together with technological advancement in the harvest and post harvest scenario has accelerated the processes of transformation of a subsistence oriented traditional sector marine capture fisheries into a market oriented multi-crore industrial sector activity with considerable strength and capabilities in essential infrastructures.

With the result, the marine capture fish production has made great leaps through successive stages; first with a change from natural to synthetic fibres in fishing gear fabrication and the concurrent introduction of mechanized trawlers in the fifties followed by the introduction of mass harvesting gear, the purse seine along the southwest coast in the eighties. Motorization of country crafts and subsequent proliferation of innovative fishing gears occurred during the late eighties. The marine capture fish production remained almost static in the nineties possibly waiting for another technological breakthrough for locating and harvesting under exploited/unexploited oceanic and deep water (continental shelf edge and slope) resources. Attempts are also being made to bring down the searching time for locating pelagic fish shoals, which constitute more than 50% of the total fish landings.

Slowly, but gradually, the common property was put to immense fishing pressure which led to over harvest of at least a few easily vulnerable and targeted demersal resources and degradation of some of the fish habitats. The sustainability of the harvest of the many resources from the coastal areas was jeopardized by the incessant fishing pressure coupled with the impact of

pollution and other anthropogenic interventions. The situation is closely similar to the global marine capture fisheries scenario wherein 70% of the fish stocks are either fully exploited, over fished, depleted or slowly recovering.

3.2 Strategic issues

Our total marine capture fisheries production increased from about 0.4 million t during 1947-48 to about 2.7 million t in the year 2000. Studies conducted by CMFRI have clearly indicated that the growth rate since 1981 had been on the decline and during the period 1991-2000, it was only 1.9%. It was also revealed that the increasing pattern of production at all India level for most of the resources may not truly represent the trends in the resources exploited from the different hydro-climatic zones of the country. The overall trends may mask the regional differences in the variations observed on the availability as well as the abundance of presently exploited major resources.

Studies conducted by CMFRI on the quantity and percentage of juveniles of selected commercially important species landed by trawl, purse seine and ring seines landed at Mangalore and Malpe during the year 2005 revealed large scale destruction of juveniles and young ones of both commercial and non-commercial finfishes and shellfishes. Percentage of juveniles in the total landings at these centers varied between 10% and 85% for 24 major species represented in the trawl landings. Two major species landed by the purse seine (58 % for oil sardine and 63% for horse mackerel) and by the ring seine (33 % for oil sardine and 14% for mackerel) indicate the gravity of the situation. Close examination of the landings at the major landing centers located in the other maritime states also may reveal a similar picture. Strict enforcement of mesh size regulation by the respective state governments is necessary for sustenance of commercially important marine fishery resources.

Studies revealed that the low value bycatch landed along the Indian coast is contributed mainly by juveniles of sciaenids, silverbellies, flatfishes, threadfin breams, gobids, *Acetes* sp., squilla, crabs, non penaeid shrimps and molluscan shells. Landings of low value bycatch is mainly due to continued and indiscriminate usage of small codend mesh in the trawl nets operated.

The sharing of the pelagic and demersal common property fishery resources of the continental shelf waters has created in the recent past, considerable tensions, law and order conflicts among various fishing communities in the coastal belt. There is need to find a solution for the sustainable long-term economic utilization of these resources by maintaining the exploited fish stocks through proper regulatory measures.

Pelagic resources dominated the marine capture fish production in India. Most of these stocks are annual crops predominantly belonging to 0-year class. The abundance of these resources depends on the variations in the recruitment. The availability as well as the abundance of pelagic stocks in space and time is dependant on fishery independent factors such as meteorological and oceanographic variables, food availability etc. Among pelagics, oil sardine, mackerel, ribbon fishes, Bombay duck, carangids, white bait and tunas are the major contributors and the variations in the abundance of any one or all of them would affect the total capture fishery production.

The total exploitable potential yield of marine fishery resources of the Indian EEZ is revalidated at 3.93 million t in the year 2000. The total landings have stabilized around 2.7 million t annually. Studies also revealed that fishing effort expended at present in the shelf waters up to 100 m is near optimal and there is little scope for enhanced production. Additional yields could possibly be expected through diversification of the effort to tap the demersal resources of the continental shelf edge, upper continental slope and selected oceanic cephalopod and tuna resources.

3.3 Future possibilities

It is well known that adaptation of fish to the surrounding marine environment is controlled by selected oceanographic features such as sea water temperature, salinity, dissolved oxygen content, availability of food etc. Many pelagics are known to concentrate at current boundaries especially in areas with sharp horizontal temperature gradients. Monitoring the oceanographic features in space and time is time consuming and prohibitively expensive and a real time picture of any one of the above-mentioned parameters or a combination of the above becomes almost impossible.

However, indirect methods of monitoring selected parameters such as sea surface temperature (SST) and phytoplankton pigments (chlorophyll-*a*) at surface levels from satellites is found very ideal as it provides high repetivity and large spatial coverage.

In India Potential Fishing Zone advisories (short-term fishery forecasts) are generated by the Indian National Center for Ocean Information Services (INCOIS) under the Ministry of Earth Science (MoES), Government of India. INCOIS disseminate PFZ maps along with details to about 225 nodes free of cost for operational use. This is the only short-term marine fishery forecast now available in the country generated for the benefit of artisanal and small mechanized/motorized sector fishermen during the cloud free months between November and May. NOAA-AVHRR derived SST and IRS P-4 derived OCM chlorophyll data are being utilized for generating PFZ. Advisory maps along with details with regard to location (Latitude and Longitude) distance from a particular node situated on the coast, compass direction, depth of the sea where PFZ is located at surface levels, the base data from which the map is prepared (SST or chlorophyll or a combination of both), validity of the forecast in terms of number of days etc are transmitted in the local language by internet, telephone/ FAX or digital display boards installed at selected major fish landing centres.

The feedback data is gathered through project activities funded by INCOIS being operated in the different maritime states (Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh and Orissa) under the able leadership of eminent fishery scientists. Quantification of advantages derived by groups of active fishermen engaged in various types of fishing activities employing different types of craft/gear and targeting a variety of fishery resources, in terms of reduction in searching time for surface shoaling fishes (reduction in total fuel consumption towards improving the economics of fishing operations) is being attempted through the above mentioned project activities. Attempts are also being made to bring out species-specific PFZ advisories on the basis of feedback received through project activities to enable fishermen to carry/utilize the most suitable fishing gear to effectively catch a particular resource. Identical vessels employing more or less same type of fishing gear are being utilized for undertaking fishing operations within

and out side PFZ locations to compare advantages derived. Field oriented time series data on major fishery oceanographic parameters are essential prerequisite for developing fishery predictive models and for validation of PFZ feed back. Application of GIS is found to be promising in understanding issues related to short/long term fishery forecasts.

Periodic monitoring of major meteorological and oceanographic parameters of continental shelf waters relevant to fisheries assume great significance. The usefulness of similar data collected alongwith simultaneous fishing data during the erstwhile Indo-Norwegian Project operation onboard *R. V. Varuna* and FAO/UNDP Pelagic Fisheries Project onboard *R.V. Rastrelliger* and *R.V. Sardinella* (1971-78) and FORV *Sagar Sampada* (since 1984) does not need any emphasis.

Apart from adopting modern techniques for harvesting, storage and processing of under exploited/unexploited resources in the comparatively deeper areas of the shelf and slope and also the oceanic province, necessary steps must be initiated for the periodic monitoring of shelf waters to understand the variations in oceanographic parameters and its influence on breeding/ feeding migrations, recruitment pattern and above all the availability and abundance of individual species in space and time. Satellite derived data is found very ideal as it provide high repetivity and large spatial coverage. But as on today, only two important parameters relevant to fisheries *viz* sea surface temperature and surface chlorophyll can be perceived by satellites. At present monitoring of other parameters such as salinity, dissolved oxygen content etc at surface and sub surface levels and sea water temperature at sub surface levels, qualitative/quantitative estimation of phyto/zooplankton, direction and velocity of currents etc is possible only by engaging research vessels /moored data buoys. This exercise has to continue until such time we develop technologies for retrieving these important parameters through future satellites for possible correlation with occurrence/abundance/dynamics of commercially important marine life. Although only a beginning has been made, the results obtained both within the country and abroad do indicate the possible future applications of satellite derived SST and chlorophyll data for the purpose of directing and controlling fishing effort.