Environmental Monitoring and Forecasting Services for Indian Fisheries Possibilities and Prospects

V. Narayana Pillai
Senior Oceanographer, UNDP / FAO Pelagic Fishery Project, Cochin-682 016

INTRODUCTION:

It is estimated that by 1985 it would become necessary to step up the present world fish production of 80 million tonnes to about 145 million tonnes to meet the minimum requirements of fish for the world population. Of late it has been accepted that a reasonable solution to the problem of stock and recruitment, interaction between different species and inherent variability of natural systems will help us to manage the fisheries in a better way rather than basing the entire concept on maximum sustained yield (Gulland, 1977). Considerable amount of data has been gathered on the life histories of various species and also their environmental requirements and behaviour and several attempts have been made in the past to translate the results into practictal applications for the economic benefit of fisheries. This resulted in the recognition of a separate branch of fisheries environmental services with the basic objective of assisting fishermen in better planning for fishing operations and also in searching for fishable concentrations. Such a service will help to minimise the searching time, thereby reducing the running expenses for the craft and the crew. The net result would be a proportionate lowering of prices which in turn would make cheaper fish protein available to low income groups of developing countries.

POSSIBLE RELATIONSHIPS: As in the case of terrestrial animals, the marine fauna including fishes also respond, in variying degrees, to changes in the environmental conditions. The physical parameters such as sea water temperature, density, hydrostatic pressure, horizontal and vertical movements of water masses, the intensity of solar radiation and chemical parameters such as the saltiness of sea water dissolved gases and biological factors such as the availability of food, occurence of predators etc. decide the occurence, distribution, abundance, reproduction and mortality of individual species in space and time. "Perhaps the ultimate objective would be to predict, to a satisfying extent, meaningful relations between:

(1) Fishable fish concentrations and one or more of the easily observable environmental parameters.

(2) Changes occuring in the availability of fish and the respective environmental changes.

(3) Effect of these changes on the reeproductive success and fluctuations in the number of recruits."

(Tomczak, 1977)

Japan was one of the first countries which recognised the importance of synoptic information on oceanagraphic and marine meteorological conditions and also their application for the improvement of fishery efficiency. The valuable compilations prepared by Leavastu and Hela (1970) assume great significance in this context.

In due course the need for similar services has been accepted by several other nations such as Australia, France Republic of South Africa, U. S. A., U. S. S. R., U. K. etc. These services which are established for the benefit of the respective national fisheries provide oceanographic analyses and "stress the need to establish intelligent collaboration between services, research scientists and the end users in such a manner that all of them could considerably profit from such a collaboration. On the one hand this will result in a greater accuracy of environmental analyses and predictions and vice versa the need for better prediction may additionally justify governmental support for basic research and on the other hand fishermen will be more willing to provide the required environmental observations if the scientists conducting these services are in a position to interpret the analyses in terms understandable and usable for them." (Tomczak, 1977)

WORK CARRIED OUT BY THE EXISTING ENVIRONMENTAL SERVICES IN OTHER COUNTRIES:

(1) **Analyses/Short term forecasts:** "Analyses demonstrate the present state of it environmental condions and are taken as a basis to draw conclusions regarding the behaviour of a given fish population, also making limited extrapolations of the environmental conditions for a short time period." (Tomczak, 1977).

(2) **Mid-term and Long-term forecasts:**

These are mostly "based on climatic considerations and corresponding changes in the heat content of oceanic regions. From such environmental forecasts conclusions may be drawn concerning the behaviour of commercial species, eg. reproduction, changes in migration routes" (Tomczak, 1977)

Most of the existing services are mainly working with the first categorv of products. The analyses cover the following oceanographic and marine meteorological parameters:

(1) Temperature (2) Currents (3) Plankton (4) Wheather analyses (5) Sea state.

Satellite observations for environmental analyses and forecasts:

"Besides the direct assistance given to fisheries by visual air spotting of fish schools, remote sensors are used successfully onboard aircraft to assess

environmental conditions and to monitor fish distribution. Techniques have been developed to measure the sea surface temperature with high accuracy and space resolution and, connected with it, the heat flux thermal fronts and the upwelling intensity and variability, the ocean colour (chlorophyll and plankton) and bioluminiscence of plankton. At present remote sensors from space craft observations are available for surface temperature measurements, temperature gradients and anomalies showing upwelling areas and current boundaries (Infra red and micro wave radio meters), for measurements of circulation patterns and eddies of water masses (Colour and multi spectral cameras) and for the dynamics of sea ice. Great success has also been achieved in measuring chlorophyll and plankton." (Tomczak, 1977).

The following are some of the more important existing fishery environmental services:

(1) The CSIRO Service (Divn. of Fisheries and Oceanagraphy) Australia.

(2) The ISTPM, Nantes, France.

(3) The CNEXO, Brest, France.

(4) The Japan Fisheries fnformation Service Centre (JFIC), Tokyo, Japan.

(5) South-West Fisheries Centre, La Jolla, California, U.S.A.

(6) National Environmental Satellite Servicess, California, U.S.A.

(7) Marine Meteorological Fishery Services, U.S.S.R.

The following are some of the more important proposed fishery environmental services:

(1) Icelandic Herring Search and Information Services.

(2) Analyses and forecasts for North sea - surface temperature (SST) and Bottom water temperature (BWT).

EXISTING FACILITIES IN INDIA:

Two of the major fisheries in India viz. that for Oil sardine and Mackerel show large scale fluctuations in their occurence, distribution and abundance. More or less same is the case with the White bait fishery which also exhibit large scale migrations from one season to another. The above mentioned fluctuations assume great significance especially because of their impact on the total marine fish catches of the country as a whole. The average annual catch (1973-1977 figures) indicate a total catch of 1,45,000 tonnes of Oil Sardine, 57,000 tonnes of Mackerel and 32,000 tonnes of White bait. As regards Oil Sardine, 99% of the catches are landed along the Kerala and Karnataka Coasts. The fishery starts some time in August and continues up to April/May with a peak during October-January. The average potential standing stock of the fish has been estimated to be about 400,000 tonnes (PFP) of which at least 50% could be harvested. The Mackerel fishery is mainly concentrated along the coast of Goa, Karnataka and Kerala during the period August-April May. The estimated average standing stock is about 300,000 tonnes (PFP). The White bait fishery which exhibits large scale seasonal migrations is mainly concentrated between 14°N and 8°N Lat. from October through May and there after in the area between 13° and 10° N Lat. on either side of Cape Comerin during June-August. The stand-

ing stock for White bait has been estimated to be around 400,000 tonnes (PFP).

Realising the importance of proper assessment and rational exploitation of Pelagic fishery resources, particularly Mackerel and Oil Sardine, the Govt. of India organised the Pelagic Fishery Project at Cochin in the year 1971 in collobration with the United Nations Development Programme (UNDP) and Food and Agriculture Organisation (FAO) of the United Nations. The Norwegian Agency for Inernational Development (NORAD) was a collaborator during the first phase of the Project from 1971 to 1975. The Project commenced it's second phase of operation in 1976.

One of the important objectives of the Project was to study the relation between environmental factors and the distribution and migration of pelagic fish in the project area. The project document has emphasized the importance of investigating such factors which might influence the availability of fish to the existing fisheries. With the above objective in mind, the Project has put into operation a relatively extensive programme for environmental monitoring since 1971. The various other institutions currently engaged in marine fisheries research and connected aspects, no doubt, are also working on related problems, but emphasis on field operations have been limited due to various reasons. The Project has two research vessels, one 54' fibre glass boat, R. V. SARDINELLA and one 152' steel stern trawler, R. V. RASTRELLIGER, both equiped with the latest elecronic devices like SONAR, Echo Sounder, Echo Integrator etc. Both the vessels are rigged for purse-seine and trawl operations at varying depths. Regular surveys with the vessels are conducted for resources survey, environmental survey and estimation of fish abundance. The Project mainly used the recently developed acoustic techniques for the surveys and the assessment of the resources. This pioneering effort has brought forth a vast amount of information related to several aspects of the pelagic fish stocks in the area. However the efforts of the Pelagic Fishery Project have been limited to a study of selected resources in a restricted area. A country like India, with about 5000 km of sea coast and large extent of fishable areas on the shelf and beyond, requires a permanent set up to monitor the various parameters connected with fish resources, environmental data governing distribution of these resources and such others which influence the fluctuations in stock sizes. To clarify such situations and to make fairly accurate fishery forecasting, continued surveys and data monitoring are needed.

ENVIRONMENTAL SERVICE FOR INDIAN FISHERIES:

In a developing country like India with a vast potential of fishery resources, the importance of organising a fishery environmental monitoring, analyses and prediction service need not be emphasised. This assumes greater significance especially in the light of the proposed extension of the economic fishing zone to 200 miles limit. Taking into consideration the existing facilities available in the country for a rational exploitation of these resources and also the limitation by way of the number and location of operating bases, the cruising range for different types of fishing crafts, the wether conditions, availability of suitable fishing gear, width of continental shelf

and bathymetry for trawling purposes, storage / processing facilities both on board and ashore, infra structure for loading of fuel, water and ice, unloading of catches and marketing facilities, and reduction of searching time to the bearest minimum, assume great significance. This is especially the case with the non-machanised boats whose operating ranges are comparatively smaller. Perhaps the first step towards organising a similar service would be to set up a facility for collection of synoptic oceanographic and marine meterological data, the analysis and interpretation of this data and to predict, within reasonable limits, the availability of fishable concentrations in specific areas. Of course, the collection of synoptic data with the co-operation of fishing vessels will, to a large extent, depend on how best one can convince the boat operator the usefulness of the processed information which is supplied in return. The nucleus of a similar facility could be any one of the already existing organisations engaged in fisheries resources survey, fisheries environmental studies and assessment of the stocks. As the work mentioned above is highly field work oriented, special emphasis should be laid on the available facilities with regard to suitable vessels, fishing gear and equipment and above all trained personnel in the respective disciplines.

The Pelagic Fishery Project of the Government of India functioning from 1971 at Cochin has already set up a stage for carrying out the types of programmes envisaged in a fishery forecasting service. The work of this project has already indicated several guidelines for attempting studies in this direction. It has been made clear that the seasonal upwelling in the Indian water would be an important phenomenon to be studied in detail every year. Temperature and current patterns are other physical aspects to be considered equally important. From the biological angle the density and distribution of plankton are likely to throw light on the migratory patterns of the commercial fish populations. Young fish survey, with special reference to the major commercial species, is also to be carried out year after year. Fishery forecasting services in the country may make a start with studies on the above indicated lines particularly with the aim of forecasting the major pelagic fisheries like oil sardine and Mackerel.

The dissemination of processed information as well as the predictions at a level, easily understandable and usuable for the basic operator, require special consideration. Different types of audio-visual media such as Radio broacasts, Radio telephone / Wireless, telegraphy messages, movie filims, notices and news letters could be tried to find out their suitability and effectiveness for different groups whose basic education and capacity to understand and assimilate the information vary within wide ranges. The effectiveness and purposeful functioning of a similar service would greatly depend on the speed with which the predictions can be transfered to reach the appropriate levels.

Field demonstration of the suitability of specific types of fishing gear to harvest the different fisheries also will have to rest with the same organisation. Once the usefulness of the service is established and the fishing community is convinced of the utility of such a service, the organisation

may find it easier to induct some of the commercial fishing boats, by stages, for the collecton of certain primary data with simple instruments. Provision of some of the simple oceanographic and meterological instruments for use on board and necessary training to selected numbers of crew, in the collection, proper recording and quick transmission of such information to the interpretting agency may be necessary for working this system. A similar management has been proved effective in some of the developed countries such as Japan, Australia, U. S. A., U. S. S. R. and U. K.

In order to convince the fishermen of the usefulness of a similar service, short-term forecasts/analyses are found most effective and hence such forecasts are suggested as a first step while initiating fishery environmental monitoring and forecasting service. Later, once the effectiveness of such forecasts are proved, we can consider possibilities of organising mid-term or long-term forecasts. It is worth mentioning in this context that such predictions assume great significance with reference to those of the fishery resources which exhibit large scale seasonal fluctuations, especially the shoaling fishes found in the pelagic waters which are more influenced by the seasonal changes brought about by the variation of some of the meterological parameters and their secondary effect on the sea. The subcontinent, with the Arabian sea on the west and the Bay of Bengal on the east and the northern Indian ocean on the south, is situated in a belt where the monsoon wind system is most effecive both during the summer (SW) and winter (NE) monsoon seasons. The resulting changes in the wind systems, the accompanying current systems and the effect of the associated rain fall and river run off give rise to large scale fluctuations of the various environmental conditions which affect the existing fishery to a varying degree every year.

Let us hope that a much needed fishery forecasting service would be created in the country by continuing, developing and streamlining the existing Pelagic Fishery Project established and operated for the past 8 years with U. N. assistance. Perhaps one of the very objectives of the Project *Viz.*, "to set up a stage to continue the work of monitoring and forecasting the pelagic fish resources on a regular basis" would be achieved by developing such a national service from the already existing nucleus of the Project which is scheduled to complete it's term by the end of the fifth Five Year Plan period.

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