

INTRODUCTION TO FISHERIES OCEANOGRAPHY

Sumitra-Vijayaraghavan

Fisheries of the high seas have become highly competitive and economically risky business. Hence, there is a desire to achieve a maximum catch for efforts. Increase in catch can be accomplished by different ways - improve fishing vessels; improve fishing gears and direct fishing vessels to profitable grounds. In order to realise improved catch, the behaviour of fish (migration and aggregation) in relation to environmental conditions must be known. Fisheries Oceanography deals with those aspects of oceanography which can be applied to fisheries ecology, fisheries management and practical fishing.

Physico-chemical parameters of the environment (temperature, currents, waves, light, oxygen and salinity) have profound effect on fish. Fish and shell-fish are cold-blooded animals. Their body temperature is not internally regulated but remains more or less close to the surroundings. Heat has profound influence on chemical reactions - environmental temperature affects the life processes, growth, development and swimming speed of fishes. Rate of feeding, metabolic activity and growth are not only affected by the availability of food but also by the water temperature. Temperature anomalies during spawning can delay or hasten spawning and cause displacement of spawning grounds.

Fluctuations in temperature or rapid increase may cause mass mortalities.

Current is an important factor which causes local changes in the environmental properties of the sea. Current affect fishing in many ways (i) transports pelagic fish eggs and larvae from spawning areas to nursery grounds; from nursery grounds to feeding grounds. Any anomaly in ordinary transport can cause variations in survival of brood. (ii) migratory routes of adult fish may change (iii) the diurnal behaviour might be affected by tidal currents (iv) current boundaries affects distribution of adult fish and (v) current might affect properties of the natural environment and indirectly affect the abundance of the species and its distribution.

Oxygen minimum layer in the tropics and in upwelling areas can cause mass mortalities. In coastal areas, mass mortalities is caused by "red tides".

Light is an important factor in the lives of fish. Light affects fish directly through vision. Fishes rely on sight for capturing food, receiving signals, locating shelter, avoidance of predator and orientation. Light stimuli affect the diurnal migration and shoaling behaviour of many species. Thermocline and wave action are also known to influence the depth distribution of fish. Trawl catches

vary diurnally. Vertical migration of demersal fish near the bottom can occur in tidal rhythms.

Salinity preference and tolerances vary with life history and stages in marine organisms. Salinity is important for success of reproduction and distribution of different life history stages. Salinity gradients may function in orientation during migration of some species.

The nature of food taken by fish varies by age of the species, by location, by season and is mostly determined by the availability of food. The food in the sea can be classified as pelagic and benthic. The temperature of the environment can affect the food requirement of a given species. Nutrients in the sea triggers the food chain. The production and availability of pelagic and benthic food resources of fish affects the fish biomass.

Shoaling of fish is mainly to minimise predation and for enhancement of spawning. Shoaling is affected by light (seasonally & diurnally). The swimming speed of fish is although a function of size is also affected by temperature.

Knowledge of water depth in a given location is of importance in fisheries. The nature of the bottom is important for the fishermen for trawling purposes. The fish food in the bottom (benthos) varies considerably from one type of bottom to another. The depth of water and

hydrographical conditions near the bottom are significant to the benthic community. Hence, bathymetry and submarine geology are important for fisheries.

Ocean analyses and forecasts can be used in fisheries as guidance for (i) estimation of the probable abundance and distribution of fish (ii) indication of anomalies in migration, aggregation, dispersal and behaviour and (iii) estimation of anomalies of spawning conditions and spawning grounds. Sea surface temperature and wave predictions are the common oceanographic analyses proposed by meteorologists. Remote sensing techniques plays a vital role in fisheries oceanography.

The total biomass of fish in a given region varies little over time. However, the stocks of individual species can vary considerably - some species decreasing, the others increasing in abundance. Fishing usually results in different quantitative composition of ecosystem, where not only the target species is affected by fishing but also non-target species are influenced. Thus, the function of the ecosystem is dependent on the physico-chemical parameter of the environment and the biota. The management regime has to determine which of the resulting state of the ecosystem is acceptable from socio-economic and conservation point of view.

General principles of fisheries management are: (i) maintenance of sufficient reproductive potential to account for possible natural fluctuations (ii) maintenance of particular commercial species at economically harvestable levels and (iii) minimisation of adverse effects on potential harvestable resources.

Fishery oceanography relies upon the basic sciences - physics, chemistry and pure biology as well as composite sciences such as ecology and marine geology. One of the main purpose of this course is to show ways of applying oceanography and marine biology to benefit fisheries.

References

1. Hela, I. and Laevastu, T. 1961. Fisheries Hydrography, Fishing News (Book) Ltd., London, pp. 137.
2. Hela, I and Laevastu, T. 1970. Fisheries Oceanography, Fishing News (Biology) Ltd., London, pp. 238.
3. Laevastu, T. and Hayes, M.L., 1981. Fisheries Oceanography and Ecology, Fishing News (Biology) Ltd., London pp. 199.