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Primary Productivity and its influence on Marine Fisheries Production

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SUMMARY

The phytoplankton is the basis of food chain and is very efficient and easily detectable indicator of ecological changes in the aquatic environment. All living organisms (plants and animals) must eat some type of food for survival. The most important factor that Influences the fisheries of a region is the nature and extent of plankton production because of the fact that the survival of fish and fish larvae in a locality is dependent on the type and availability of food. Plankton has a major role in the variations occurring in the natural survival of larval and juvenile fish and subsequent recruitment to adult stock. A change in the pattern of feeding as the case with anchovies which usually feed on phytoplankton but at times feeding on zooplankters, can reduce the overall efficiency of transfer of energy from phytoplankton to zooplankton feeders.

INTRODUCTION

The word "plankton" comes from the Greek for "drifter" or "wanderer." An organism is considered plankton if it is carried by tides and currents, and cannot swim well enough to move against these forces. Scientists classify plankton in several ways, including by size, type, and how long they spend drifting. Phytoplankton is of immense value as food, medicine, energy and play an important role in the disposal of sewage and in the natural purification of polluted waters. The phytoplankton is the basis of food chain and is very efficient and easily detectable indicator of ecological changes in the aquatic environment. All living organisms (plants and animals) must eat some type of food for survival. Plants make their own food through a process called photosynthesis. Using the energy from the sun, water and carbon dioxide from the atmosphere and nutrients, they chemically make their own food. Since they make or produce their own food they are called producers.

Plankton

In the marine food web, special producers are found. They are tiny microscopic plants called phytoplankton. Since the water is the home for these special tiny plants; it is also the home for tiny microscopic animals called zooplankton. And of course, zooplankton eat phytoplankton. Sometimes zooplankton and phytoplankton are collectively referred to as plankton. The food chains show the relationships between producers, consumers, and decomposers, showing who eats whom with arrows. The arrows show the movement of energy through the food chain. For example, in the food chain shown below, the small fish gets its energy by eating the plankton and the large fish gets its energy by eating the small fish. Finally, the bacteria eats the fish after it dies, getting its energy from the large fish. The bacteria also returns nutrients back to the environment for use by the phytoplankton.

The most important factor that Influences the fisheries of a region is the nature and extent of plankton production because of the fact that the survival of fish and fish larvae in a locality is dependent on the type and availability of food. The period of successful fishery, especially the plankton feeders such as mackerel and sardine, have been found coinciding with the period of good plankton production, thus the survival-density dependence at larval stages in terms of the amount of feed per organism may play a determinant role. The question to be considered is whether fish larvae are too dilute or not to affect the density of their food organisms. It can be concluded that fish larvae are probably too dilute during the early phases to affect their food but as larvae grow this tendency is reversed and food becomes a limiting factor. However, the production food organisms relative to fish feeding is largely a density independent process. Plankton biomass is considered as an index of productiveness of the oceans/sea. Also they are important as they form the base of the food web upon which larger organisms including fishes ultimately depend. It is the nature of plankton community that determines or controls the fish population of that area.

Thus the effective plankton cum ichthyoplankton abundance can help us to determine

1) spawning areas and seasons,

2) biomass of adult spawners,
3) annual fluctuations in adult biomass,
4) migrations of adults,
5) growth and mortality of larval stages,
6) relation of oceanographic conditions to distribution and abundance of both adults and larvae,
7) trophic relations among fish larvae and zooplankton and
8) species interactions during the larval stage that may subsequently affect stock size.

Plankton has a major role in the variations occurring in the natural survival of larval and juvenile fish and subsequent recruitment to adult stock. Also plankton controls growth of fish. Survival of fish larvae increases with age. Both mortality and growth may vary considerably under natural conditions. The laying of large number of eggs from which only a few adults survive is a typical r-strategy. The success of which will be governed by plankton and its environmental parameters and not by the number of parent stock. At some lower levels of survival, density dependence in terms of the amount of food per organisms may play a determinate role. However, the production of food organisms relative to fish feeding is still a density independent process. Normally spawning areas and seasons were located by examining the gonad condition of fishes caught at various times and places throughout the year. But recent data on ichthyoplankton component based on the actual spawned eggs and larvae collected have given us a true picture of the spawning areas and seasons. Also these data have provided us with the absolute measure of stock size, once fecundity per unit weight and the proportion of females in the stock are known.

Fishery Management

The role of plankton in fisheries management can be as follows:

- The spawning stock size directly estimated from the egg and larval survey data, when compared to catch statistics of particular fisheries can be used to indicate when the level of over-exploitation is being approached.
- The conventional method of estimating stock sizes from commercial fisheries was found inapplicable where fisheries have been prohibited due to depletion of stock.
- Studies on plankton allow us to understand the natural ecosystem in order to answer the question how much fish can be caught from the sea.
- Plankton studies help us to the understand the effect of removing large quantities of fish from the same natural ecosystem.

CONCLUSIONS

Plankton biomass act as an index of fertility of the oceans, giving us an estimate of the total organic production and helping us to chart out the areas of fishery potential. Fish production can change due to changes in the efficiency with which the primary production is converted in to fish rather than changes in the total primary production. The spawning stock size can be estimated directly from the egg and larval survey data. Plankton offer themselves as the principal source of food, the variability in this composition affecting food habits of the fishes. Plankton assemblages indicated the role of plankton as a deciding factor in the spawning of fishes. A fishery survives when a favourable combination of factors prevails adequate food supply and reduced prey density. One of the prime factors deciding the size of the resulting year class is its ability to pass through the larval life without excessive mortality. Zooplankton predation on fish larvae affect subsequent year class strength/fisheries. The percentage of starved larvae can be an indicator of ultimate year class strength. Certain planktonic species act as indicators of fisheries. A multitude of factors control the extent of variations noted in the survival of larval and juvenile fishes.

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