

CORAL REEFS - ECOLOGY AND FISHERIES

M.V.M. Wafar

Introduction:

You will be wondering how the coral reefs have become so important with respect to commercial fisheries so as to warrant a separate lecture. There exist already so many fisheries - coastal, estuarine and oceanic - that have become so well established, viable economically, and what is even more important, almost predictable with models developed to quantify optimum yields, and even forecast the success or failure of a fishery for years to come. Compared to these, and with an almost negligible area the coral reefs occupy in the world oceans, what sets apart reef fisheries as unique? In this lecture, I deal precisely with this point, and to develop this, a brief account of the reef ecology is warranted first.

Ecology:

By definition a coral is a coelenterate capable of secreting a massive calcareous skeleton around it. Growth of several species of corals at a localised site along with other calcareous organisms forms a reef. By definition a reef is " a ridge or mound of limestone, the upper surface of which lies, or lay at the time of its formation, near the level of the sea, and is predominantly composed of calcium

carbonate secreted by organisms, of which the most important are corals". Reef-building is an interaction between biological and geological processes, the former represented by primary and secondary reef framework growth, and the latter by sedimentation and early cementation. The destructive processes operating on a reef are mechanical and biological erosions.

Corals are also specific in their requirements for environmental conditions. They require a water temperature of >20 degrees Celsius, a salinity $>30\%$, and survive well in waters low in suspended load i.e. a greater water clarity. They also require a hard substratum on which to settle and grow. These environmental requirements sets their limits of latitudinal distribution to essentially the tropics, and occasionally extending into sub-tropics.

The coral reefs of the world cover an estimated area of 0.6 million square kilometers, equivalent to 0.17% of the world ocean area. Over half of this (54%) lies in the Asiatic mediterranean and Indian Ocean. Of the remaining, Pacific reefs account for 25%, Atlantic reefs for 6%, Caribbean reefs for 9%, Red Sea reefs for 4%, and Persian Gulf reefs for 2%. Majority of the reefs are concentrated in the western parts of the three oceans.

What specifically sets the coral reefs apart from the other tropical marine ecosystems is the high productivity

they sustain. Reefs, with the exception of certain upwelling systems, have the highest primary production rates (8-12 gC per sq.m. per day), derived from a variety of autotrophs ranging from periphyton through symbiotic zooxanthellae to macroalgae. By energetic considerations alone, such a high productivity must translate into proportionally higher yields of tertiary biomass i.e. higher trophic organisms which include edible ones such as fishes and others.

Fish yield:

a) Food fishes:

Fish production from coral reefs is quite high, upto 20 tonnes per sq. km. per year, and heavily fished coralline shelves produce sustained harvests of 4-6 tonnes per sq. km. per year. The estimated potential fish yield from all world reefs varies from 6 to 9 million tonnes per year, or 10-15 tonnes per sq. km. per year, equivalent to 9-12% of all oceanic fish caught. These yields are comparable with intensively fished shelf areas in the world.

Fishing in Indian reefs is generally for sustenance, hence underexploited and the catches remain unrecorded. However, extrapolating fish yields from other reef areas to Indian reefs, and calculating potential fish yield from all Indian reef areas, gives a yield of about 0.2 million tonnes per year, which is equivalent to about 10% of the total

marine fish production in India.

The question one would then ask is this: If reefs are so productive, why then they do not sustain commercial fisheries? The answer is simple. The topography of a reef does not permit the use of any gear that is designed for a large-scale catch. Employment of such gears will inevitably damage the gear, or, if the gear is sturdy enough, the habitat so that the productivity decreases rapidly. Fishing methods normally employed in a reef, on the other hand, are trap-setting, fish poisoning, harpooning, dynamiting etc. These are labour-intensive and have low yields. These are the reasons because of which the reef fisheries still exists at sustenance level in most reef areas.

a) Aquarium fishes:

There is, however, yet another fishery that compensates largely for the difficulties of harvesting the food fishes and cost-effective even if the fishing effort is high. These include the aquarium fishes, which are more often called ornamental fishes. These are the most prominent residents in any reef, and occur in a multitude of shapes, sizes and brilliantly colours. A host of genera comprise these, but more often they are known by their common names. Some such groups are: squirrelfishes, seahorses, cardinalfishes, remoras, goatfishes, batfishes, butterflyfishes, angelfishes, anemonefishes, damselfishes, wrasses, hawkfishes,

surgeonfishes, blennies, lionfishes, filefishes, triggerfishes, boxfishes, puffers, porcupinefishes and anglerfishes.

These ornamental fishes are in great demand for salt-water aquaria all over the world, and especially in Europe and U.S.A., and commercial exploitation of these fishes has steadily been gaining momentum in the recent years. Several Asian countries, notably the Philippines and Sri Lanka, have organized trade in this product, and have been steadily increasing their foreign exchange earnings. Our Indian reefs also sustain an abundant variety of aquarium fishes, but as of now no organized effort is being made to exploit these resources: we do not even know how many species of aquarium fishes exist, nor their biology and potential yield.

3. Other resources:

Because of the high biological diversity of the ecosystem, the tertiary yield is not restricted to fishes alone, but include a variety of other forms. These include the corals themselves which are used in cement and lime industries, and also in the trade in ornamental corals. Besides this, a variety of molluscan shells such as trochus, pearl oysters, chanks, cowrieshells, helmetshells etc are regularly harvested from many reef areas for industrial uses and trade in ornamental shells. Present level of world trade in ornamental shells and corals alone amounts to several

million U.S.D.

Constraints in sustainability:

As with any other ecosystem, sustainability of the resource harvest from the coral reefs depends on the ecosystem remaining free from natural and man-made changes. These come in various forms. These include hurricanes, predation, parasitism, erosion, sealevel changes, pollution, mining, overharvesting, use of unacceptable fishing methods and gears etc. Sustainability of the yield from reefs is contingent on these constraints being taken care of and controlled, if not totally prevented.