

# Coral Reef Fisheries and World Fish Production

The shallow waters of tropical oceans are characterized by the presence of reef-building corals. Only areas with strong upwelling or with massive freshwater inflows lack reef-building corals and the enormously complex and productive communities associated with coral reefs.

## High Productivity

Fisheries production may be quite high from coral reefs and the general rule of thumb that has emerged from analyses of harvests of fish and crustaceans taken per unit area of reef is that heavily fished coralline shelves are able to produce sustained harvests of around 4-6 t/km<sup>2</sup>/year, where such a generalized shelf consists of coral reef and intervening areas of seagrass beds, sand and mud down to a depth of 200 m.

Areas of sand and mud are much less productive than seagrass beds and actively growing reefs, so a potential annual harvest of 5 t/km<sup>2</sup> of coralline shelf is very much a generalization. Detailed studies of fish harvested exclusively from areas almost entirely covered by actively growing corals show that much greater harvests can be taken, for example, in the Philippines, 8.7 t/km<sup>2</sup>/year at Apo Island and 16.5 t/km<sup>2</sup>/year at Sumilon Reef to depths of 60 m. In American Samoa, harvests of fish, gastropods and bivalves total 18 t/km<sup>2</sup>/year down to a depth of only 8 m.

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Coral reefs and associated communities in depths of less than 30 m cover about 600,000 km<sup>2</sup> on a global basis. If the above-mentioned harvests are interpolated in relation to water depth, one can arrive at an estimate of 15 t/km<sup>2</sup>/year as the maximum harvest from coral reef areas to a depth of 30 m.

This estimate suggests a theoretical potential harvest from all coral reefs of 9,000,000 t/year—a very high figure

when compared with the current world fish harvest of around 75,000,000 t/year. Actual harvests from the world's reefs are a mere fraction of the theoretical potential.

The reasons for the relatively limited harvests from reefs are not difficult to find. The basic reason is that because of their complex topography, reefs do not lend themselves to fishing on an industrial scale. Trawls cannot be used in the vicinity of reefs and nets have to be set and hauled individually and with great care lest they become entangled. Large-scale demersal fishing operations are usually not possible and reefs are

*Above:* Coral trout or grouper (*Plectropomus maculatus*) from the Great Barrier Reef. Painting by George Coates. *Below:* Kiribati fishing canoe. Coral reefs are the domain of artisanal fishermen.



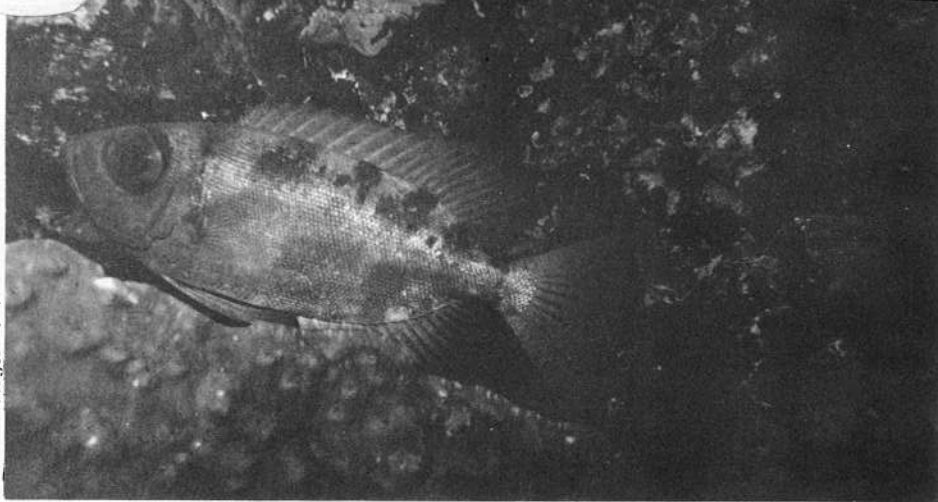
the domain of small-scale artisanal fishermen, often using a variety of indigenous fishing techniques to supply their own needs and those of a local market. Additionally, the huge diversity of shapes, sizes and textures of coral reef fishes limits the degree to which the fisheries can be commercialized as there is seldom any certainty over what a fisherman can supply on any given day.

### Patterns of Reef Use

The situation arises that wherever there are very dense human populations near coral reefs, the reefs are very heavily exploited by the artisanal sectors. Such reefs are very vulnerable to massive over-exploitation caused by high demand, low operating costs and, often, by a lack of alternative employment. This would, for example, describe the situation in the coralline areas of South and Southeast Asia, and the most densely populated islands of the Caribbean. Most of these areas are currently overexploited and yield less than their potential.

In contrast, huge areas of reefs and coralline shelves are very lightly exploited or even unexploited because they are in remote areas with small human populations. For example, the more lightly populated areas of Indonesia, most of New Guinea and the Solomon Islands, and many of the remote atolls and reefs of the Pacific Ocean are simply too lightly populated to generate significant local demand for reef fish. At the same time, they are so remote from

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Bigeyes (*Priacanthus*) are nocturnal carnivores of coral reefs.

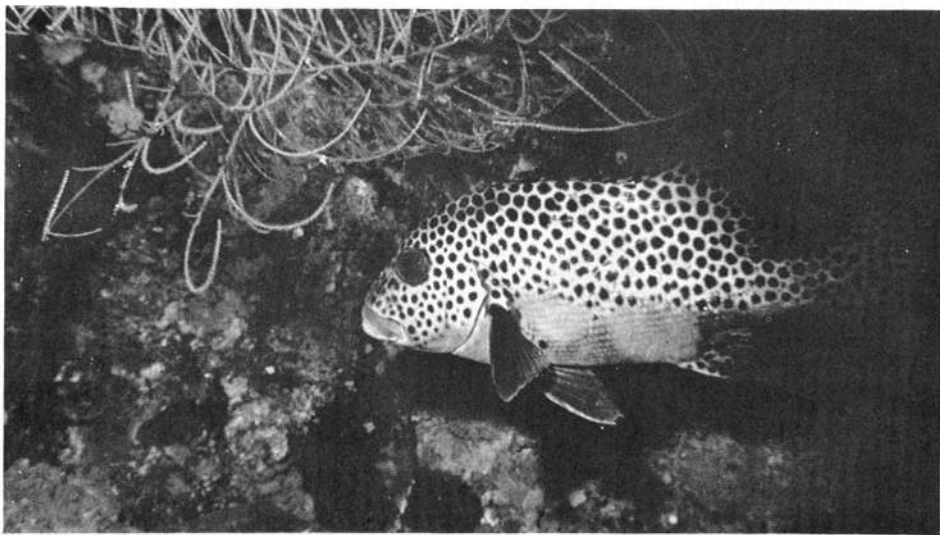
centers of demand that reef fish are uneconomic to harvest from them. This applies also to the Pacific and Atlantic coasts of Central America, the Bahamas and the oceanic banks of the Caribbean, as well as much of the east coast of Africa and the Red Sea. The principal constraint is the cost of transporting the fish to market in a form that will command a satisfactory price. Usually, this eliminates locally dried or smoked fish as a commodity.

A third category of reef areas consists of those where the demand for fish is highly selective and, as a general case, only the apex predators in the reef fish community, such as groupers, grunts and other large reef fishes, are acceptable. The largest coral reef area in the world, the Great Barrier Reef in Australia, falls within this group; much of this area is in any event either wholly protected or reserved for sport fishing activities and is not harvested commercially. Other

reef areas in this group include parts of the south and east coasts of the U.S.A. and, to some degree, Puerto Rico.

There is a fourth reef category, in which the demand for reef fish is constrained by the prevalence of ciguatera poisoning. This problem afflicts many of the eastern Caribbean islands, and many areas in the Pacific. The effects are highly localized and fishes from limited areas may be toxic while those from adjacent areas are not. Local fishermen know these areas but fish buyers are always wary and suspicious about the origins of the fish. As a result, whole groups of fish are eliminated from the commercial markets and the effective harvests from these areas are greatly reduced.

The overall result of all of these factors is that coral reef fish on a worldwide basis are underexploited. Many would respond that this is to be applauded, as nowhere in the biosphere do animal and plant communities reach such an elaborate level of integration and productivity. Fortunately, there are areas throughout the world which have been designated as reef parks and, hopefully, forever preserved. However, reef systems form contiguous units in the Caribbean and the Indo-Pacific, each dependent upon the other to an unknown degree for recruitment of future generations of reef fish. The elimination of whole sections of the global reef system as a result of pollution, degradation of reefs by siltation and destructive activities such as reef mining, poses a threat to the continued existence of reef systems and to the unrealized potential of reefs to produce very large harvests for mankind on a continuing basis.



Sweetlips (*Plectorhynchus*), nocturnal foragers of coral reefs.

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