An Artificial Reef for Artisanal Fisheries Enhancement in Costa Rica

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Costa Rica is a tropical country where commercial landings on the Pacific coast account for 98% of the total fisheries production. The finfish fleet concentrates in relatively shallow waters near the littoral zone where among others, croakers, snappers and snook are abundant and diverse. Penaeids and other shrimp species are also abundant in these grounds where shrimp trawlers operate most of the year and capture a substantial amount of finfish (see Newsletter April 1985, p. 14).

The concentration of effort in these artisanal waters leads to a combined fishing pressure on the same resources. Evidence from interviewed fishermen indicates that resource abundance has declined, especially on the eastern shore of the Gulf of Nicoya—a preferred shrimp ground. Artisanal fishermen believe that trawlers are responsible for the reduction in catch. Their primary concern is the increase in the cost of fishing due to travel expenses to farther grounds. This artisanal-industrial fishermen conflict is a rather complex issue which calls for political and economic actions, and the short-term possibilities to regulate shrimp fishing by controlling effort, modifying trawl net mesh size or other strategies are remote.

With these considerations in mind we concentrated on finding biological options not related to the management of the fishery per se, which would permit some recuperation of the ecological system severely disturbed by fishing.

A literature review indicated that artificial reefs seemed promising as refuges for fauna and to increase fish productivity. We studied this alternative and after several months of preparatory arrangements a small reef was built between June and April 1984 at a depth of 10 m using approximately 400 scrap tires. In June 1985 we added 1,500 tires.

Top: Fish sheltering in the artificial reef. *Below:* Materials for a Costa Rican reef. Photos by Héctor Guzmán.

For a year, monthly visual counts by scuba divers were made of the fish populations present at the tire reef and at a natural rocky reef near the study area.

The artificial reef supported a larger biomass and most important, the number of commercially valuable species was greater than the natural, rocky reef. Overall, the tire reef was approximately ten times more productive, in terms of biomass, than the natural one. *Lutjanus guttatus, L. argentiventris, Haemulon scudderi* and *H. steindachneri* were the most abundant species.

The average length of black spot snapper *(L. guttatus)* in commercial landings was 43 cm. At the tire reef they averaged 15 cm and individuals taken by hook and line (averaging 19 cm) were found to be mainly immature. We believe these fish are not yet recruited to the commercial stocks. Small individuals of other commercially important species like *L. argentiventris* (yellowtail snapper), *Hoplopagrus guntheri* (rock snapper) and haemulids (grunts) were present in abundance.

Considering the limited time dedicated to this study and the small size of the artificial reef we cannot yet make any definite statement. However, if the fish there survived through a crucial stage of development, the natural sequence of events indicates that recruitment of this species should improve.

In a tropical multi-species fisheries system like the Gulf of Nicoya, there is a large diversity of commercially important species whose survival in juvenile stages could be augmented by building artificial reefs in the proper geographical areas. A small-scale National Artificial Reef program backed up by fisheries extension programs in adjacent littoral communities holds promise as a stock rebuilding strategy for the conservation of marine resources and for the continuous socioeconomic benefit to the fisheries communities.

We have recently added a further 1,500 tires to the reef and 500 more will be added soon. Monthly visits to estimate fish biomass will be renewed for comparative purposes. ●