Progress Report on the Evaluation of Fish Aggregating Devices for the Eastern Caribbean

RALPH M. WILKINS[1]
MELVIN H. GOODWIN[2]

[1]*St. Kitts/Nevis Fisheries Division*
Basseterre, St. Kitts
West Indies

[2]*South Carolina Sea Grant Consortium*
287 Meeting St.
Charleston, SC 29401 USA

INTRODUCTION

Many Eastern Caribbean countries are net importers of seafood. The need for increased local landings of fish is important to local nutrition, the tourist industry, improved income generation, and reduction in loss of foreign exchange. While the current harvest of traditional shallow-water marine resources is close to sustainable levels, pelagic fishes found in deeper waters appear to have significant potential for increased landings to the small island nations of the Eastern Caribbean.

Fish aggregating devices (or FADs) have been used in many parts of the world as an aid to the harvest of pelagic fishes. In 1983, participants from the Eastern Caribbean attending the 36th GCFI recommended that the Institute should assist with the development of FAD technology in the region. In the following year, a grant was secured from the United States Agency for International Development to support a pilot scale FAD project which was launched in St. Kitts. The primary participants in this project were GCFI, the St. Kitts/Nevis Fisheries Division, Environmental Research Projects, South Carolina Sea Grant Consortium, and McIntosh Marine.

The objectives of this project were to evaluate the usefulness of fish aggregating for improvement of artisanal fisheries in the Eastern Caribbean, and to adapt and develop appropriate mooring, deployment, and monitoring techniques to assist local use of FADs in the region.

METHODS

Three types of FADs were used in this project. Commercial units were obtained from McIntosh Marine Inc. These units were assembled on-site by inserting fiberglass support rods into prefabricated vinyl parasols. The ends of the support rods were cemented into a molded nose cone using cyanoacrylic glue. A small float was fitted over the end of one support rod to maintain the parasol in a horizontal position when deployed. A single commercial FAD array consisted of three parasols attached to a 0.25 inch polypropylene line. Plastic tubing was installed on the line to prevent chafing, and small floats were used to separate the individual parasols units. Scrap engine blocks were used as anchors, with 0.25 inch galvanized chain and chain swivels.

A second type of FAD was assembled from discarded fishing nets and scrap automobile tires. Two tires were joined with 0.5 inch diameter polypropylene line, and a 20 foot length of net tied between the tires. Floats were attached to the top of the array and a 0.5 inch mooring line led to an engine block anchor and galvanized tackle as was used for the commercial FAD array.

Both the commercial and tire-net unit were attached to surface marker floats by means of heavy monofilament fishing line. These floats, and perhaps the fishing line, may have been excellent aggregating devices for fishermen. In any case, the markers usually disappeared shortly after deployment.

To correct this problem, a third type of mooring and marker system was devised. Spar buoys were constructed from 10 foot lengths of 4 inch PVC drain pipe. One end of the pipe was sealed with a pipe cap fitted with a U-shaped steel rod. Approximately 20 lb of cement were tamped into the sealed end of the pipe. The opposite end was sealed with a second pipe cap after filling the remaining void filled with closed-cell polyurethane foam. A 20 foot length of 0.25 inch galvanized chain was used to join the buoy to a 0.25 inch polypropylene mooring line and engine block anchor. Several coconut palm fronds were attached to the upper length of chain, and in some cases a single commercial FAD was added to the array. Auxiliary floatation was secured to the lower portion of the spar to provide added buoyancy.

These devices were deployed on three sites off the leeward coast of St. Kitts. One of the primary objectives of this project was to use techniques suited to small vessels typical of Eastern Caribbean artisanal fisheries. A similar deployment technique was used for all FAD arrays. The desired depth was first located using a battery powered recording depth sounder. The upper portion of the FAD was then placed over the side of the boat, and the entire length of mooring line laid out on the water's surface. The depth was then re-checked, and the anchor dropped over the side. This procedure eliminated any danger of entanglement as the engine block dropped to the bottom. All units were deployed in depths between 300 and 600 feet. Mooring lines of the commercial and tire-net FADs were adjusted so that the FAD device was located between 60 and 90 feet below the surface. A single commercial FAD array was deployed in 110 feet of water so that the durability of the anchor and bottom tackle could be determined.

Controlled fishing was carried out periodically on FAD sites as well as control areas without FADs. Additional information was obtained from local artisanal and recreational fishermen. The single commercial array deployed in shallow water was visually inspected by divers at intervals of several months.

RESULTS

Catch rates from fishing on sites with FADs ranged from 0 to 4 strikes per line-hour, while catch rates on sites without FADs ranged from 0 to 0.96. The majority of fish captured in the vicinity of FADs were wahoo and barracuda, while dolphin, kingfish, and wahoo were predominant in catches from other areas.

These data were highly variable, and statistical analyses did not indicate significant differences between sites. However, catch rates in the vicinity of FADs were generally higher than those from other areas, even though the control areas included deepwater sites which local fishermen consider to be the very best locations for fishing. Catch rates and variability found in this project are of a similar magnitude to those reported from FAD studies by Workman *et al.* (1985) and the U.S. Virgin Islands Division of Fish and Wildlife (Clavijo *et* *al.*, 1987), as well as by Matsumoto *et al.* (1981) from FAD studies in the Pacific. These observations confirm evidence from other studies which establish the general effectiveness of FADs.

No consistent difference was observed in the effectiveness of commercial and alternative FAD designs. Visual inspections by divers found little deterioration of mooring components after 15 months, though the FAD arrays were heavily fouled by a variety of organisms. Fish were not visually observed in the vicinity of FADs except around palm fronds, which attracted large numbers of small jacks and baitfish within a few days of deployment.

The primary problem encountered in this project was loss of surface buoys marking the location of FAD arrays, almost certainly as a result of theft. Even though the arrays could be easily located with cross bearings along a known depth contour, the absence of surface markers was a strong deterrent to concentrated effort by recreational and artisanal fishermen. On the other hand, local fishermen were quick to begin regular fishing in the vicinity of the spar buoy. Encouraged by catch rates around this FAD, artisanal fishermen are maintaining the unit and have added additional palm fronds to the initial installation.

DISCUSSION

We suggest that FADs have three major potential benefits to Eastern Caribbean fisheries:

1. Increased local landings of pelagic fish species.
2. Increased economy of fishing operations by aggregating pelagic fish into known areas, thus reducing fuel and man-hours spent searching for fish.
3. Reduced pressure on overexploited stocks such as coral reef species through provision of an alternative to traditional fishing areas.

These potentials may be of greatest significance to small-scale fisheries. While the absolute magnitude of the actual benefits is small on a global scale, these benefits can have major impact in small-island nations.

Our results do not suggest that large scale fisheries can be supported in the Eastern Caribbean. The potential impact of FADs on fisheries management is directly related to the scale of fishing activity. Even with FADs, the impact of artisanal fishermen on migratory pelagic stocks is likely to be negligible compared to the effect of the industrial fishing fleets which also target these stocks. On the other hand, use of FADs in a highly mechanized fishing industry would only add to an already-substantial capacity for overexploitation, and could not be justified as having positive development potential. In the Eastern Caribbean, FADs can be a valuable part of a fisheries development strategy to optimize economic benefits by matching the harvest capability of local fleets with the production capacity of available fishery resources. In addition, FADs may play a useful role in the development of recreational fisheries which appear to have considerable potential for the Eastern Caribbean.

Based upon the results of this study, we suggest that the project be expanded to include other interested Eastern Caribbean countries. The primary recommendations resulting from this project are:

1. A secure and visible surface float should be provided. A variety of suitable buoys can be constructed on site, but in many cases small commercially manufactured buoys will be more cost-effective. Such

buoys should include a radar reflector and lighting system to minimize collisions with ship traffic.

2. An inverse catenary mooring system (Boy and Smith, 1984) should be used for all but the shallowest FADs. This system is suited to deep water conditions, and does not require precise depth determination during deployment.
3. Low-cost locally available materials should be used for shallow-water FADs. Biodegradable materials such as palm fronds may be used when fishermen can be relied upon to maintain the FADs, otherwise more durable materials such as PVC pipe and vinyl streamers should be used. Commercial parasol FADs were found to be quite durable and would be useful on portions of the mooring too deep for periodic servicing by divers.
4. FADs should be deployed in the vicinity of traditional pelagic fishing grounds as well as sites intermediate to landing areas.

A final comment is in order concerning costs and benefits. Using St. Kitts as an example, we estimate that a single FAD array deployed at a 2,000 foot depth would cost approximately $900. We proposed to deploy 20 such arrays in the vicinity of St. Kitts, and estimate that deployment will cost an additional $5,000. The total cost of deployment is therefore $23,000.

Annual landings of pelagic fish in St. Kitts are estimated at 60,000 lb, with a minimum landed value of $1.30 per lb. The total value of the catch is thus $78,000. A 30% increase in catch would cover the cost of FAD installation in a single year, and such an increase appears reasonable on the basis of results obtained in this project and elsewhere.

The bottom line is the FADs have once again been associated with improved catch rates, and this has value to artisanal and recreational fisheries including income generation, improved availability of fish, and an added attraction for the tourist industry.

A full report on this project has been completed. Anyone desiring copies of this report should contact Dr. Goodwin or myself.

BIBLIOGRAPHY

Boy, R. L. and B.R. Smith. 1984. FAD mooring systems for moderate to shallow depths. South Pacific Commission, Noumea, New Caledonia.

Clavijo, I. E., J. LaPlace and W. Tobias. 1987. Construction and evaluation of a midwater FAD design in the U.S. Virgin Islands. *Proc. Gulf and Carib. Fish. Inst.* 38:714-722.

Matsumoto, W.M., T. Kazama and D.C. Aasted. 1981. Anchored fish aggregating devices in Hawaiian waters. *Mar. Fish. Rev.* 43:1-13.

Workman, I.K., A.M. Landry, Jr., J.W. Watson, Jr. and J.W. Blackwell. 1985. A midwater fish attraction device study conducted from Hydrolab. *Bull. Mar. Sci.* 37:377-386.