



Commercial Advantages of Modern Fishery Enhancement Systems: Caribbean-America

Billions of dollars have been spent throughout history to improve the means to pursue, find, and catch elusive stocks of fish in the oceans and inland lakes. Modern boats, electronic fishfinders, and sophisticated fishing gear have improved the pursuit and capture, but few strides until recent years have been made to improve the resource. That is, to enhance desirable species that are either depleted through overharvesting, too widely dispersed for good fishing results, or non-existent because of inhospitable environmental conditions.

The past decade has brought increasing awareness of our natural aquatic resources and the need to find better ways to replenish and manage those resources for both immediate and long-term benefits. Because of this need, a new scientific discipline, called *fishery enhancement technology*, has evolved.

This exciting new field combines biology, engineering, and the quirks of nature to: enhance existing fisheries, guarantee future fish populations, improve accessibility of fish, create new fisheries, manage fishery stocks, resolve conflicts, reduce fuel consumption associated with fish searches, and save travel time to and from fishing grounds. Our expertise in building fishery enhancement devices results from the half-century of combined experience of our well-known fishery enhancement specialists.

Fishery enhancement specialists are well qualified to design, fabricate, and install customized fishery enhancement systems. These include benthic artificial fishing reefs and fish aggregating devices (FADs) that meet the unique needs of the fisheries specialist, resource manager, and sport/commercial fishery industry as well as the fishery to be enhanced.

Benthic artificial reefs attract and host rich concentrations of aquatic life in otherwise barren waters, much as an oasis forms the nucleus of teeming life in a desert. They are usually placed in areas of little abundance to provide substrate upon which thriving ecosystems can evolve. First, encrusting organisms

and other filter feeders settle on the substrate to feed on particulates suspended in the water. They, in turn, attract small crustaceans and fish looking for food and shelter. Larger predatory species and prized game fish quickly move in seeking sustenance, thus creating a viable sport or commercial fishery.

Benthic artificial reefs in US waters have traditionally been constructed from materials regarded as refuse on land, such as discarded automobile tires, broken concrete culvert, and scrapped vehicles. Derelict ships, drydocks, and portions of obsolete offshore oil and gas production platforms have also been sunk to provide substrate for artificial reefs. Recent developments, however, have led to the harmless, cost-effective use of industrial by-products as components of specially designed artificial reef structures. This innovative breakthrough promises a positive impact on environmentally conscious industries.

Once established, man-made reefs provide all the essentials for perpetuity — food, shelter, and nursery grounds for the young. In essence, the carrying capacity of the reef area has been increased to better withstand an increase in both commercial harvesting and sport fishing. However, sound fishery management practices are still required to maintain this renewed resource and prevent damage to the ecological balance.

To further increase the productivity of benthic artificial reefs, fish aggregating devices may be installed in the water column. Although FADs can be used alone, when combined with existing benthic reefs the resulting fish abundance is greatly increased. FADs may be used at surface and/or mid-water depths to attract pelagic species. Experience has shown that the best fishing and most desirable pelagic fish can be found around floating objects in the ocean. Although the attraction of fish to flotsam and jetsam remains a mystery,

this behavior is comparable to flying insects swarming around lights in the night. To encourage this behavioral phenomenon, FADs are strategically placed at selected depths vertically in the water column.

FADs are an excellent means of attracting and hosting a wide variety of commercial and game species, which results in a positive impact on both commercial and recreational fisheries. They are also known to benefit fish populations by serving as spawning and nursery grounds.

Most FADs have three basic components — a float, an attractor, and an anchored mooring. floats have taken on many shapes and forms, ranging from primitive bamboo rafts to sophisticated floats made of modern synthetics and marine alloys. The float helps provide vertical stability for the attractor and simultaneously serves as a secondary attractor. Primitive attractors have been made of palm fronds and discarded nets but long-lasting synthetic-covered fiberglass frames and streamers survive the ocean elements indefinitely. Anchors have been from many objects, including scrap metal, molded concrete, and castaway freight train wheels. The mooring serves a triple function as part of the FAD system. It (1) provides a means for attaching the attractor to the float, (2) it holds the FAD in position, and (3) it sometimes produces low frequency sounds that attract fish.

FADs can be installed in many different configurations, depending on the species sought, harvesting techniques, and environmental conditions. They may be installed singly, in multiples on a deep vertical moor, in clusters, or in multiples in a horizontal array to create a "trolling alley." They have been used successfully on the surface, at mid-water depths, and in combination. However, FADs used as mid-water fish attractors have special advan-

tages over surface-only devices. Their major attribute is their relative stability and longer life because of less strain on the mooring system by waves and currents. Also, as the mid-water FAD is concealed below the water surface, it is less accessible to vandals.

Studies by Federal, state and municipal agencies show that the installation of fishery enhancement systems results in far-reaching, positive impacts other than simply improved aquatic populations. Benefits that have dramatized their value to human populations include: (1) improved commercial fisheries, (2) improved recreational fisheries, and (3) improved socio-economic conditions.

The list of socio-economic benefits derived from enhanced fisheries appears endless when all facets of commercial and sportfishing industries are considered. From fishing gear manufacturers to seafood consumers, the enormity of the benefits are mind-boggling. For example, Florida's sportfishing industry alone spirals upward through five billion dollars annually, according to recent estimates, and a large portion of that amount is a direct result of artificially enhanced fishing areas.

The uses of FADs as fishery management tools have yet to be broadly documented, but it's reasonable to predict they'll find an important niche in future fisheries work. Easily maneuverable and adaptable, FADs can successfully provide renewable resources in a variety of applications. Their intrinsic characteristics make them easy to transport, deploy, and reposition at the discretion of the fishery manager.

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