TROPIC NEWS

DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE

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The DFW FAD Program: History and Prospects

In 1981, fisheries biologists watched expectantly as their first FAD (or Fish Aggregating Device) was deployed from a NOAA research vessel stationed south of St. Thomas. Even though the event didn't make the newspaper headlines, and the buoy is long gone, it was a significant step - the beginning of the Division's FAD Program.

Our FAD program has spanned more than 20 years now and it is arguably the most popular enterprise undertaken by DFW. In the interim, many scientific and technical advances have been made. This article reviews why we've been so persistent about putting FADs in USVI waters, where our program is headed now, and what we've learned since that first FAD splashed into the waters off St. Thomas.

FADs as a Fisheries Management Tool

Known by some as "fish buoys", FADs attract and concentrate fish into small areas where fishermen are more likely to catch them (see sidebar on next page). FADs *do* provide better fishing. Especially for pelagic gamefish like dolphin, wahoo, tuna, and marlin - inhabitants of deep open-ocean waters called the pelagic zone. FADs are so effective that they have become a cornerstone of the Division's Fishery Enhancement Project – a project aimed at giving sportfishermen better fishing. The U.S. Fish and Wildlife Service, recognizing the effectiveness of FADs, has provided continuous funding for our program since its inception.

But just how do FADs fit into the larger context of fisheries management in the USVI? In addition to enhancing local sportfishing opportunities, our fish buoys also serve another purpose. "FADs can reduce fishing pressure on inshore waters," says Roger Uwate, Chief of the Bureau of Fisheries at DFW.

Since the early 1980's, signs of overfishing on reefs and associated nearshore habitats of the USVI have been acute. Fewer fish are caught and their average size is smaller now. Groupers and snappers, in particular, have become rare. In short, the reefs need a break. DFW wants to redirect some of this fishing effort away from the reefs and towards offshore waters.

In Uwate's view, FADs are a fisheries management tool - and few other options are comparable. He says "It's not like in the eighties, where we had other resources to develop. These days all the inshore resources (reef fish, lobster, conch) are exploited." But, he says, "the offshore resources aren't yet," referring to pelagic gamefish, as well as to the coastal-pelagics (fish like kingfish, crevalle jack, and barracuda) that prefer waters of moderate depths over the island shelf or shelf edge.

surface FAD off St. Thomas subsurface FAD buoy

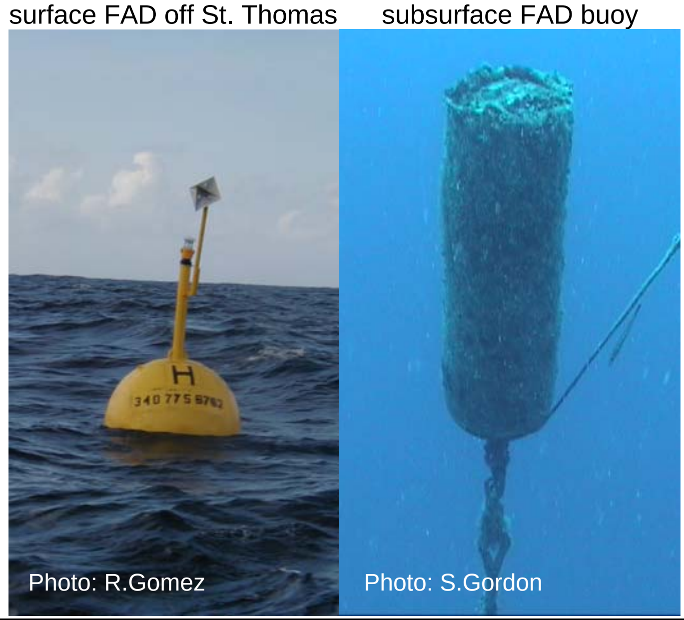


Photo: R.Gomez Photo: S.Gordon

DFW is not alone in its management decision to push for pelagics. Caribbean nations including St. Kitts, St. Lucia, and Jamaica have initiated similar FAD programs, all with the same goal of reducing fishing pressures on inshore reefs by redirecting efforts towards pelagic species.

Redirecting the fishing effort has become a common fisheries management theme in tropical island settings worldwide. In the Caribbean, Pacific and Indian Oceans, agencies with diverse - and often opposing agendas - provide monetary support for FAD programs. It may be obvious why a commercial fishing cooperative would provide financial backing for FADs: their investment more than repays itself with increased harvest of fish. Less obvious, though, is the objective sought by international conservation groups, such as the Nature Conservancy, or international development agencies, like USAID, that also fund FADs. For the latter agencies, fish attractors are a mechanism to redirect fishermen away from fragile reef ecosystems by providing an alternative.

In fact, the redirection of fishing effort has been adopted to such an extent that FADs are now being used as mitigation for fishery closures. For example, when a marine protected area was established on St. Lucia, the displaced fishermen were compensated for closure of their traditional reef fishing grounds by providing them with an offshore array of FADs.

Clearly, in the arena of fisheries management, FADs have broad utility and can serve multiple purposes. The diversity of agencies endorsing FAD programs is a testament to this fact, and FADs will undoubtedly remain an essential tool for fisheries management in the USVI.

The Science of Attracting Fish

Fish that roam the deep open-waters, known as the pelagic zone, have an instinctive tendency to find and stay near drifting objects. Fishermen have known this for centuries - perhaps since before recorded history. This aggregating behavior of predatory fish can be exploited, much to the fishermen's' benefit, with Fish Aggregating Devices, or FADs. But unlike flotsam, FADs are objects that are placed in the ocean *deliberately* to attract fish. FADs may or may not be anchored, although anchored structures are more common.

What draws pelagic fish to a floating object like a FAD? Surprisingly, we still don't have a firm answer. Most scientists favor the explanation that large predatory fish are attracted by food. The object may serve as a physical refuge for smaller "baitfish". In support of this notion is the observation that pelagic predatory fish are interrupted from their chase by the mere presence of a physical object.

Other researchers contend that fishes like tunas use objects as navigational reference points. Consider that these pelagic fish live most of their lives in the deep blue waters far offshore, where physical structures are rare. Seamounts are natural fish aggregation sites and serve as reference for daily movements of tunas. The fish may simply transfer this innate behavior to anchored FADs.

Ultimately, the answer as to why fish aggregate at FADs may depend upon the species of fish in question and the local oceanic setting. Or it just might remain the fish's secret.

Nonetheless, the phenomenon of fish being attracted to FADs is quite real, and beginning in the 1970's, scientists like Kim Holland, a researcher from the University of Hawaii, began to seriously investigate fish behavior at FADs. Using small implanted radio-transmitters, Holland was able to follow movements of yellowfin and bigeye tuna. His studies showed several interesting behaviors:

- schools of yellowfin and bigeye tuna spend daytime hours close to FADs, but make regular nighttime forays away from FADs

- tuna that travel away from FADs generally range less than 5 miles (the FADs' effective radius)

- tuna are capable of learning the locations of FADs and returning to them after much longer journeys

- fish remain closer to the surface when associated with FADs than they would in open waters (especially bigeye tuna)

- tuna tend to cruise the upcurrent side of FADs

- different fish species may aggregate at different depth layers, down to more than 600 feet

FAD Design Evolution

Worldwide, literally hundreds of different FAD designs have been devised. These design variations reflect a great number of factors: depth, local current and weather patterns, targeted fish species, and available materials, to name only a few. Some FADs are simple. In the Philippines, for example, FADs known as Payaos are made from bamboo rafts and palm fronds, attached to a long line with a heavy stone weight. At the other extreme, the commercial fishing cooperative of Okinawa has deployed a very large FAD – at a cost more than $1 million - to aggregate yellowfin tuna.

In general, the FAD "design equation" can be reduced to two basic considerations: maximizing the longevity of the FAD versus the costs of constructing, deploying and maintaining it. A balance must be struck. Payaos are lost after less than a year; the million dollar Okinawan FAD is designed to last over 10 years.

Fisheries biologist William Tobias, with more than 20 years experience in the FAD program on St. Croix, has seen DFW FADs go through four distinct evolutionary phases. He was there in 1981. DFW's first FAD was a rather elaborate structure, manufactured by MacIntosh Marine, covered with spidery 20-foot long appendages made of PVC pipe, and interwoven with netting. "The MacIntosh FAD, had to be deployed on a 1:1 scope, which left very little room for error," says Tobias. Too shallow, and the buoy laid down on its side, too deep and well …. bye bye buoy. The design proved to be too unforgiving for use in deep waters of the USVI.

DFW began experiments on a second generation of FADs, this time using a midwater, or subsurface, buoy design. Ruth Gomez, currently the Fisheries Coordinator on St. Thomas, has been involved in the DFW FAD program since the early 1980's. Gomez recalls the efforts of Joe LaPlace, a DFW Master Fisherman. "We put out over l00 FADs, and it was really Joe who made it happen." Fashioned from inexpensive materials, the fish attractors became known as LaPlace FADs in Joe's honor. LaPlace FADs were successful in two respects. They aggregated fish (increased the number and diversity of fish). And they were practical: low-cost units, compact enough to deploy from a small vessel, and with a lifetime of 1 to 2 years. On St. Thomas and St. Croix, DFW continued to experiment with the LaPlace FAD throughout the 1980's.

The LaPlace FADs had a limitation, though. They were designed for use in relatively shallow depths. Anchored in shelf waters (120-200 feet deep), the LaPlace buoys tended to attract coastal-pelagic gamefish like kingfish, cero mackerel, horse-eye jacks and barracuda. Tobias notes that, "We knew FADs had a bigger aggregation potential for pelagics. In the 1970's, the Navy maintained a buoy north of St. Croix in over 10,000 feet of water [a mooring for acoustical tests]. The buoy aggregated yellowfin tuna, making it a very popular site for recreational fishers while supporting a local handline fishery." It was *that* potential which still remained largely untapped in the USVI.

The third generation of DFW FADs were deployed in progressively deeper waters. In the late 80's, an "Overpack" surface FAD was targeted to the shelf break (about 200 feet deep) along the north shore of St. Croix. These FAD – each a string of 10 floats made from Navy packing canisters -

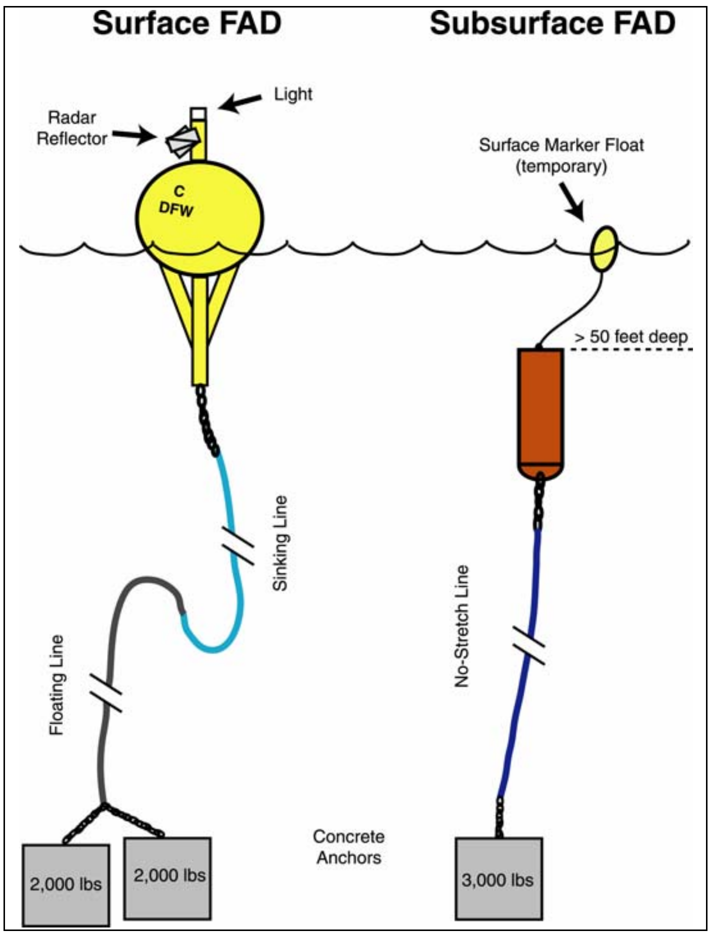
attracted dolphin and blackfin tuna, but were too close to shore to attract yellowfin. A trisphere design (3 buoys welded together) also made a brief appearance.

But offshore waters imposed new constraints on FAD design. Rougher seas and stronger currents translated into a bigger strain on tackle (shackles, line splices etc). Surface buoys had to be streamlined, and all tackle had to be "overengineered" says Tobias. And there was vessel traffic to contend with in offshore waters. "We were losing buoys and recovering them with propellor scars," says Gomez.

The fourth (and present) generation of DFW FADs began when Tobias started corresponding with researchers in Hawaii, where the state had successfully developed a large-scale FAD program. By simplifying their FAD to a single buoy, Hawaii had overcome many of the same obstacles that we were encountering here in the USVI. DFW adopted their approach.

Presently, DFW utilizes two differing and complimentary FAD systems: a single surface buoy or a subsurface design. The subsurface buoys are ideally suited for areas with large vessel traffic – as occurs south of St. Thomas and south of St. Croix. Life expectancy of the FADs has been extended. Some of our surface buoys have been in the water for more than 3 years. Our subsurface buoys, although still in the testing phase, may have a life expectancy of up to 5 years.

FAD maintenance is essential. DFW makes semi-annual inspections of FADs, to change zincs and to document tackle condition by video. Early detection and repair of problems by divers should extend FAD longevity. Nonetheless, all buoys have a finite lifetime and will periodically need to be replaced after loss.



Prospects for the FAD Program

In retrospect, we can consider the first 10 years of the FAD program as a period of intensive research and development. Basic variables of design were tested and some discarded. Scientific aspects of fish aggregation in response to FADs were investigated. This period was followed by a phase of refinement.

So what does the future hold for the DFW FAD program? With enough funding and staffing, DFW would implement FADs on a larger scale. Tobias says, "I'd like to see it expanded considerably. Based upon the effective radius of each FAD [about 5 miles], and the topography of the island's underwater shelf, St. Croix could have a network of at least 10 FADs." Gomez sees similar possibilities for the waters of St. Thomas and St. John, suggesting the optimum number is 12 FADs. The success of Hawaii's FAD programs, where approximately 60 buoys have been maintained since the 90's, suggests that a FAD network in the USVI is a tangible goal.

Gomez also notes that managing the FAD program across two dissimilar islands (St. Croix vs. St. Thomas) will require flexibility. Nowadays, "we all work closely with user groups… their opinions and specific knowledge play a much greater role in selecting sites for FADs." The fishermen of St. Thomas may have different priorities than those of St. Croix.

What gamefish are caught at FADs?

Depending upon FAD location, season, and your fishing method, you might catch any of the following fish at FADs:

Pelagics	Coastal-Pelagics
dolphin	little tunny
wahoo	crevalle jack
yellowfin tuna	great barracuda
skipjack tuna	bar jack
blackfin tuna	kingfish
bigeye tuna	cero mackerel
blue marlin	rainbow runner
white marlin	blue runner (hardnose)
sailfish	tripletail
swordfish	

As our network of FADs grows in the USVI, the program emphasis will shift into its final phase – accurate monitoring of fishing at FADs. Both Tobias and Gomez agree that there is ample room to improve catch statistics from FADs. We need this information for several reasons. As fisheries managers, we need to track changes in fish populations and catch records give us some valuable insights. We must also show success to the Federal funding agencies who support the project.

FADs may also contribute to the local economy. At present, the value of catch at FADs is difficult to estimate, but it is likely to be quite high. Larry Aubain, a DFW employee and an avid angler, suggests that fishermen are taking anywhere from 100 to 150 lbs of fish per FAD per day. Some thumbnail arithmetic would put the annual commercial value of these fish at around $200,000 per FAD. But "the value of the recreational catch…" says Tobias "is definitely higher.

You’ve got to consider the associated expenses on fishing tackle, charterboats, hotels, etc.” In other words, multipliers.

But perhaps the most important reason for monitoring FAD fishing is to know if FADs are actually reducing the fishing pressures on inshore waters? If so, by how much? And if not, can the program be adapted to better attain this goal?

Conservation

The Division of Fish and Wildlife receives strong public support for the FAD program. “Our FAD program may be one of the most popular projects that Fish & Wildlife has undertaken,” says Tobias. Sport fishermen like FADs. For example Jason Pruns, captain of a private sportfishing vessel says, “those FADs work! When are you putting more out?”

Inevitably, though, we must return to the question of conservation. What impact will a FAD-based fishery have on pelagic and coastal pelagic species? In principle, aggregating fish for harvest can contribute to overfishing. However, “catch of pelagics by islands residents is trivial compared to the international commercial fleet,” says Tobias, referring to a highly mechanized industrialized commercial fishing fleets working international waters. For pelagic fish that range widely throughout the Caribbean and Atlantic (wahoo and dolphin) or that migrate each year (yellowfin tuna, blue marlin) their populations are most impacted by fisheries occurring hundreds of miles from the Virgin Islands.

Nonetheless, it is up to individuals to practice conservation at FADs. “Ideally, each fish should be able to reach a size that would allow them to reproduce at least once,” says Tobias, showing with his hands a minimum length that he personally observes. Larry Aubain put it more simply “Don’t keep the little fish. Let them go.”

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Article contributed by Wes Toller
Donna M. Griffin – Editor
William Coles, Chief of Environmental Education

Location of FADs in the USVI
(as of May 2003)

St. Thomas / St. John

FAD E 18º11.051’N, 64º55.871’W; water depth 1,465 feet
[submerged buoy] 10 nm S of Charlotte Amalie Harbor

FAD F 18º 35.367’ N, 65º 03.386’W; water depth 1,360 feet
[surface buoy] located 9.8 nm N of Cricket Rock

FAD G 18º 10.179’N, 64º 45.149’W; water depth 1,781 feet
[submerged double buoy] 9 nm S of Dittlif Point, St. John

FAD H 18º 38.346’N, 64º 58.772’W; water depth 1,610 feet
[surface buoy] 16.5 nm N of Outer Brass (1 nm W of BVI)

FAD I 18º 27.041’N, 64º 59.437’W; water depth 174 feet
[surface buoy] 3 nm N of Outer Brass

FAD J 18º 27.715’ N, 64º 54.242’ W; water depth 174 feet
[submerged buoy] 3 nm N of Little Hans Lollick

FAD K 18º 36.406’ N, 64º 58.438’ W; water depth 240 feet
[submerged buoy] 13 nm N of Little Hans Lollick

St. Croix

FAD A 17º 49.686’N, 64º 40.039’W; water depth 4,000 feet
[surface buoy] 5.5 nm NE of Christiansted

FAD C 17º 58.875’N, 64º 30.260’W; water depth 5,400 feet
[surface buoy] 19.0 nm NE of Christiansted

FAD U 17º 44.04’ N, 64º 54.55’ W; water depth 2,000 feet
[submerged buoy] 2 nm W of Sprat Hole
(donated by U.S. Navy)

GOVERNMENT OF THE VIRGIN ISLANDS
OF THE UNITED STATES
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Department of Planning and Natural Resources
Division of Fish and Wildlife
6291 Estate Nazareth
St. Thomas, USVI 00802-1104
(340)775-6762 [ST.T.], (340)772-1955 [ST.X]

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