Fish aggregating devices (FADs)

Prathibha Rohit
Principal Scientist, Pelagic Fisheries Division
CMFRI Research Centre, Mangalore
P.B. 244, Mangalore, Karnataka-575 001

Fish aggregating devices, more commonly called FADs, are anchored or drifting objects that are placed in the ocean to attract fish. They may be a permanent, semi-permanent or temporary structure or device made from any material and used to lure fish. They have been used for thousands of years in various forms. The earliest surface/ midwater FADs were elements from nature such as driftwood and trees. Fishermen from Indonesia and Philippines began building floating rafts of bamboo and other materials to attract fish as early as 1900. Now surface and midwater artificial FADs are systematically used in a large number of countries. Present practices vary considerably, sometimes involving advanced technology.

Traditional FADs, based on long-term fishing experience, are made on-the-spot with local materials and used in shallow coastal waters (depth 50-200 m) by small-scale fishers to catch small pelagic fish and bait, e.g. payaos (Philippines), unjang (Malaysia), rumpon (Indonesia). Modern FADs, the result of imported technology and materials, can be anchored to over 3000 m.

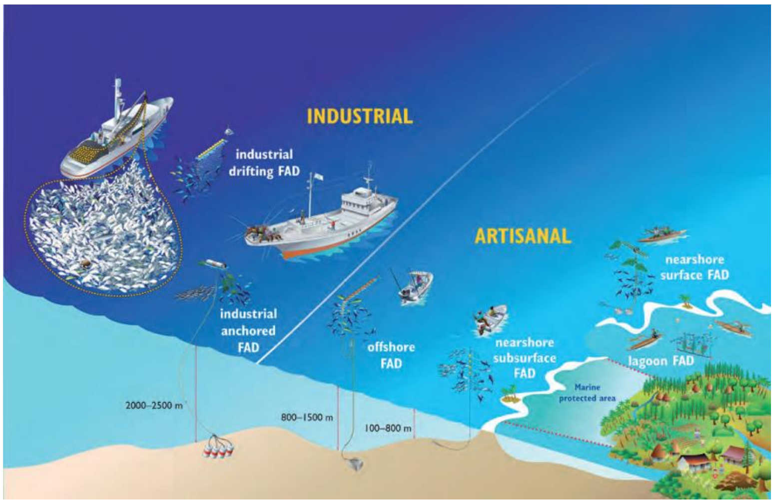
Drifting FADs are not tethered to the bottom and can be natural objects such as logs or man-made. Certain models have large surface dimensions. Moored FADs occupy a fixed location and attach to the sea bottom using a weight such as a concrete block. A rope made of floating synthetics such as polypropylene attaches to the mooring and in turn attaches to a buoy. The buoy can float at the surface (lasting 3–4 years) or lie subsurface (mid water FAD) to avoid detection and surface hazards such as weather and ship traffic. The midwater FADs – where the only surface component is a small marker buoy is less subject to stress from wind and waves and the risk of damage by ships. Subsurface FADs last longer (5–6 years) due to less wear and tear, but can be harder to locate. In some cases the upper section of rope is made from heavier-than-water metal chain so that if the buoy detaches from the rope, the rope sinks and there by avoids damage to passing ships that no longer use the buoy to avoid getting tangled in the rope. *Smart* FADs include sonar and GPS capabilities so that the operator can remotely contact it through satellite to determine the population under the FAD.

FADs can be used in either a single or multiple arrangements. Common practice is to use more than one with enough distance between each. The most suitable distance between each FAD depends on the abundance and type of species targeted; ranging between several hundred and one thousand metres for small pelagic fish in coastal or shallow waters; or 5 to 10 nautical miles for deep-water tuna FADs.

FADs aggregate different fish at different depths. Fish also aggregate under drifting logs and even whales, and rules on fishing around FADs often apply to all objects drifting on or near the sea surface, which attract fish. Various types of FADs in different areas, after a short period, attract and aggregate fish around the structure, irrespective of its design. Fish are fascinated with floating objects. They aggregate in considerable numbers around objects such as drifting flotsam, rafts, jellyfish and floating seaweed. The objects appear to provide a "visual stimulus in an optical void", and offer some protection for juvenile fish from predators. The gathering of juvenile fish, in turn, attracts larger predator fish.

Some FADs are permanent structures while others are moveable. The former are set mainly in deep waters and relocation is virtually impossible. Present experience shows that the expected life of a permanent FAD would be 2 to 3 years. The mobile, lighter structures can be moved to attract fish to a particular point. Still others can be removed from the water during certain seasons when the fish are not in the area or when the weather is rough, e.g. monsoon.

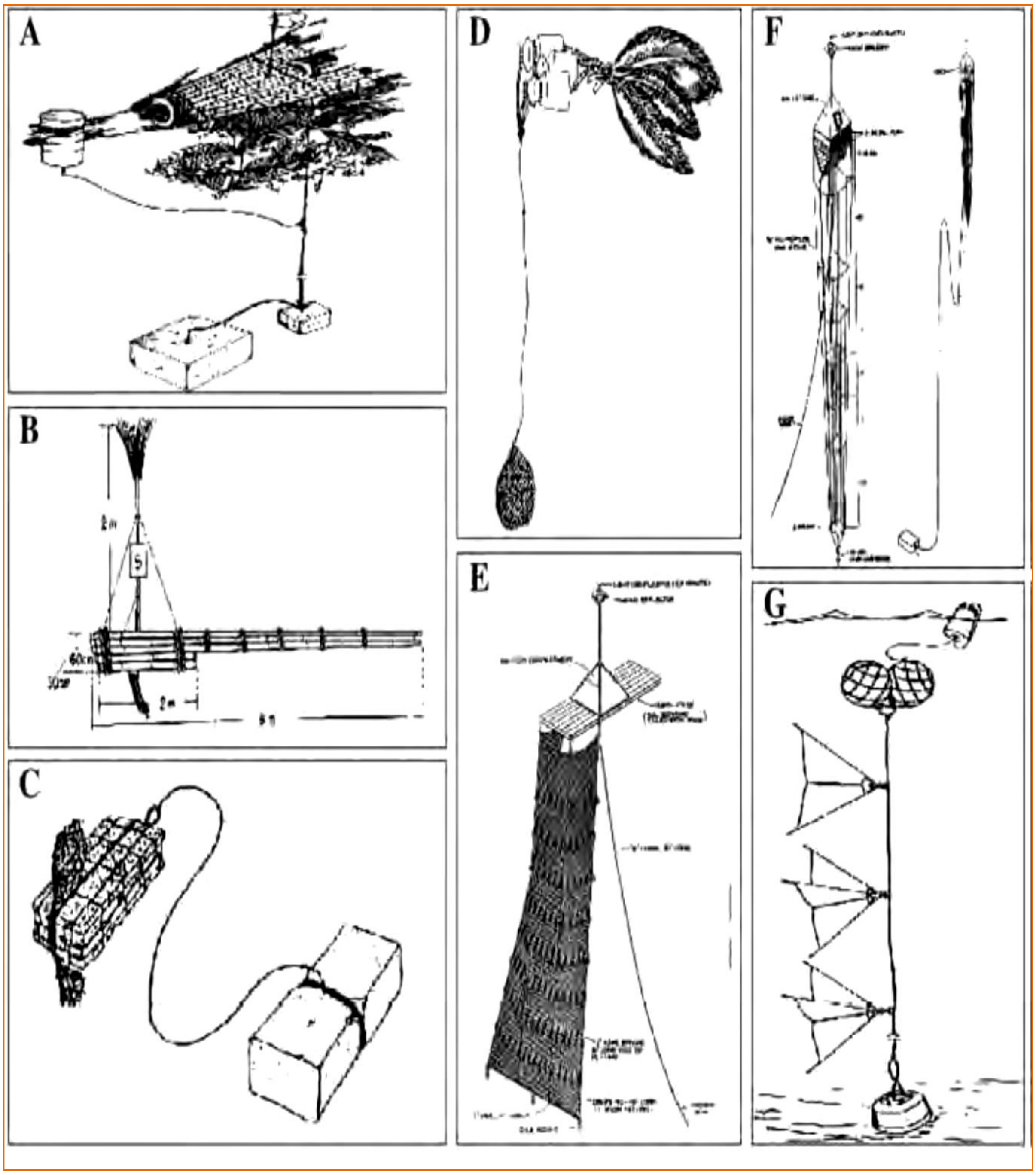
Two major categories of FAD's may be classified into two - Artisanal and Industrial types. Simple or advanced FADs are left drifting in deep waters to help offshore, artisanal and industrial fleets catch big pelagic fish, mainly tuna. Hundreds of simple, traditional types of drifting FADs are used by each large, modern tuna purse seiner operating in certain areas. Before FADs, the commercial purse seiners used to target surface-visible aggregations of birds and dolphins, which were a reliable signal of the presence of tuna schools below. The demand for dolphin-safe tuna was a driving force for FADs. The artisanal FADs are smaller and used by subsistence, artisanal and recreational fishers. These are mostly anchored offshore or near-shore and in lagoon and maybe surface or subsurface. The Industrial FADs are huge structures and may be drifting or anchored. The fishers use purse seine, long line or pole & line type of fishing and cater to fishing companies in support of industrial scale vessels.



Industrial FADs improve the catch rate of purse seine and pole & line vessels that target large schools of tuna. These are commonly drifting rafts, with an electronic beacon so the fishing boat can find the FAD and sometimes sonar equipment that shows the amount of fish under it. Anchored buoys are also used. FADs play an important economic role for industrial fishing fleets and their use has increased greatly in recent years. Most fishing is by purse seine is non-selective and catches all the fish around the FAD. Fish tend to move around FADs in varying orbits, rather than remaining stationary below the buoys. They mostly target tuna schools. Shoals of juvenile bigeye tuna and yellowfin tuna aggregated closest to the devices, 10 to 50m. Further out, 50 to 150m, was a less dense group of larger yellowfin and albacore tuna. Yet further out, to 500m, was a dispersed group of various large adult tuna. The distribution and density of these groups was variable and overlapped. The FADs are also used by other fish, and generally the aggregations disperse when it was dark.

FAD type	Advantages	Disadvantages
Artisanal	• Food security • Vessel efficiency • Coastal resource management • Climate change adaptation • Tourism • Safety at Sea	• Short lifespan • User Conflicts • Budget constraints
Industrial	• Food security • Efficiency • Domestic development • Distribution of effort and license revenue	• Increased catch of big eye tuna though not targeted • Catch of small sized tunas • By-catch (mostly silky sharks and turtles)

The deployment and proliferation of FADs in an extensive way has influenced harvesting practices and become the concern of fisheries managers. The use of FADs by purse seine vessels has come under increased criticism for its impact on tuna stocks and its potential threats to biodiversity, specifically the by-catch of sharks and other marine life. Tropical tuna show a natural behavioural tendency to aggregate around floating objects and the fishermen exploit this behavior using FAD. Technological advances in FAD design have increased fishing efficiency and FADs have contributed to increasing tuna catches especially skipjack and yellowfin tuna.



Diagrams of types of fish aggregating devices used in different parts of the world: **A**. Raft called "payao" used by tuna fishermen off certain islands of the Philippines (by de Sylva, 1982). **B**. Bamboo raft called "tsukegi" used in Japan to fish dolphin fish (by Kojima, 1956). **C**. Fish aggregating device called "capcer" used off the Balearic Islands (the East Mediterranean Sea) (by Massut´ı & Reñones, 1994). **D**. "Cannizzi" made with plastic bottles and palm leaves used by fishermen of Sicily (Italy) (by Potoschi, 1996). **E**. and **F**. Anchored fish aggregating devices used in Hawaiian waters. Raft made of wooden planks filled with polyurethane foam and a nylon net drape hanging from its rear (**E**), and a FAD made with gallon steel oil drums filled with polyurethane foam in a frame of iron and a drape made of polypropylene (**F**). Both FADs have a radar reflector and a navigational warning light (by Matsumoto et al.,1981). Manufactured FAD McIntosh Sea-kites fishing system (by McIntosh Marine, Inc. 621 Idlewyld Drive, Fl, USA).

Studies on FAD fishing showed that the vulnerability to FAD fishing varies with species size and age and FAD contribute sustainability to overfishing risks and as suggested earlier the FAD fishing takes significant levels by by-catch. On the positive side, FADs may trap tunas in unproductive regions. Management of FAD associated fishing is becoming a concern for policy makers. Time-area closures are the predominant method used to limit impacts of fishing on FAD fisheries has been suggested but the effectiveness of time – area closures is uncertain. Management of FAD-based fisheries will need to be assessed on a regional basis. Further, the degree of local impact is uncertain due to uncertainties over stock structure. In general, FADs are not inherently bad; however, these floating objects require additional attention from the scientific and fishing communities. If used correctly, FADs can reduce fuel costs and carbon footprints without jeopardizing the ecosystem or the survival of the target species. And, like all fishing methods, FADs need to be monitored and managed.