

5. HARVESTING METHODS

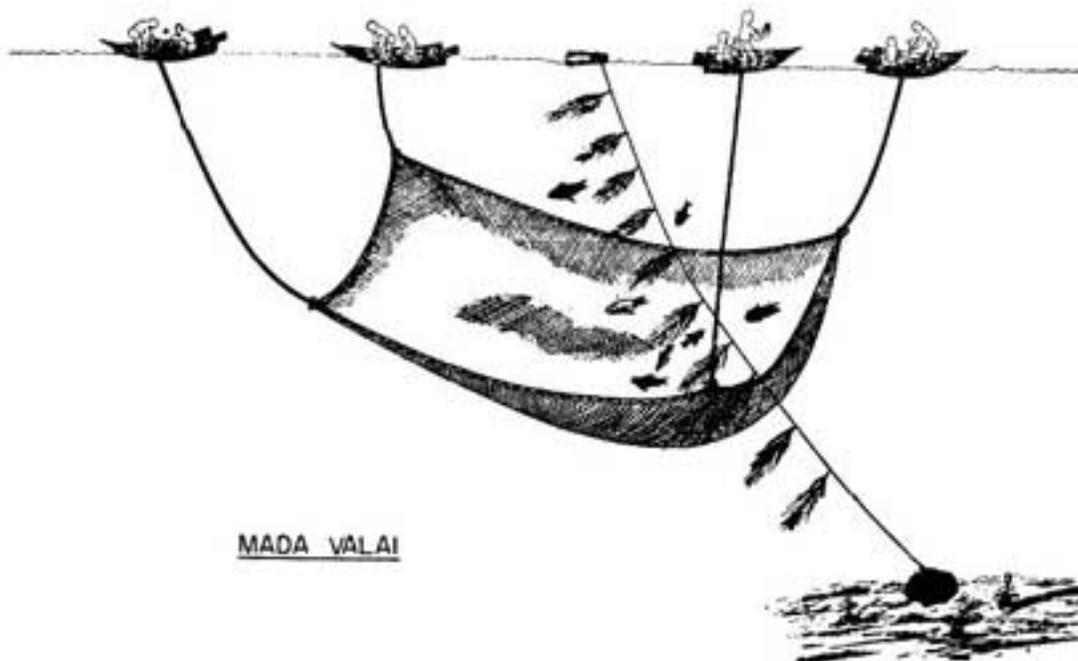
FADs placed on the bottom (bottom FADs): The most common methods to fish around these FADs are gillnetting, handlining and longlining. These methods can be used for FADs without any changes or adaptations in fishing techniques.

FADs anchored or drifting on or near the water surface (surface FADs): The flying-fish fishery along the east coast of South India is a well-known traditional fishery with devices as described on pages 7-8. The harvesting procedure is that when the bundles of branches and leaves are set out, flying fish gather to deposit their spawn on the leaves and branches. Then dip-nets are used to scoop up the fish.

Modern surface FADs are harvested the same way as modern mid-water FADs (described below).

FADs anchored in the water column (mid-water FADs): The traditional FAD design described on page 13 is used along the east coast of India as follows: A Mada Valai or lift-bagnet is operated by four kattumarams, two with two or three crew, one of them the head fisherman, and two with three or four crew. On the down-wind or down-current side and next to the FAD rope, each kattumaram is given one corner of the net. On a signal from the head fisherman, who decides when they are all in proper position, the net is pushed into the water from the kattumaram carrying it and sinks to the bottom. Two kattumarams start paddling as fast as they can against the current, one on each side of the FAD and one sidewise. The fourth one, with the head fisherman, stays stationary. In this way the net is spread, and since the two kattumarams on the lee-side of the FAD will drift away from it, the FAD will be at the centre of the net-covered area. When the net is hauled in, the two kattumarams on the up-wind current side stay close together, reducing the chances of fish escaping. (See Figure 43)

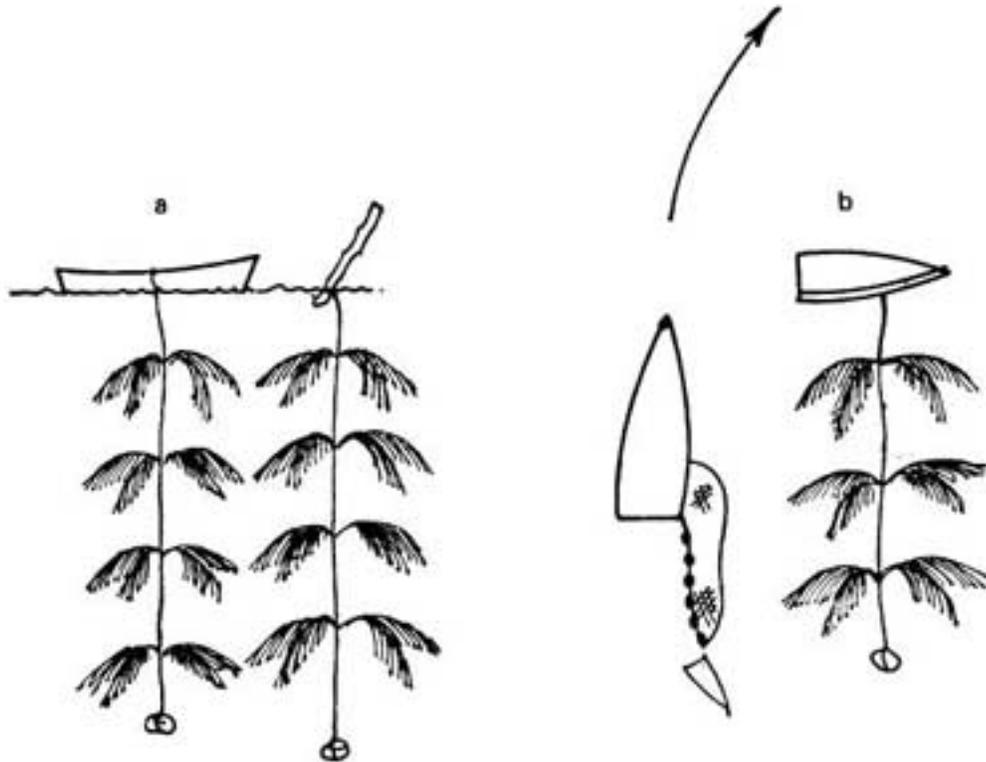
Figure 43



As a curiosity it is interesting to note that this fishery was described in 1924 by J. Hornell. It was then carried out exactly as it is done today. The drawing above is taken from his report (ref. F).

The Indonesian Rumpon: The Rumpon is harvested with ringnet, encircling gillnet, boat-seine or purse seine. (See Figure 44)

Figure 44



Left. Transfer of fish from anchor to mobile lure line. **Right.** shooting the gear.

The Malaysian Unjang: In Malaysia, a few sophisticated traditional methods are used for fishing from the “Unjang”. The original text, together with Figures 45 and 46 taken from ref. 3, describe how the main Unjang is submerged from a canoe, and this Unjang drifts over a net which is then lifted up. This net is called Pukat Tangkul.

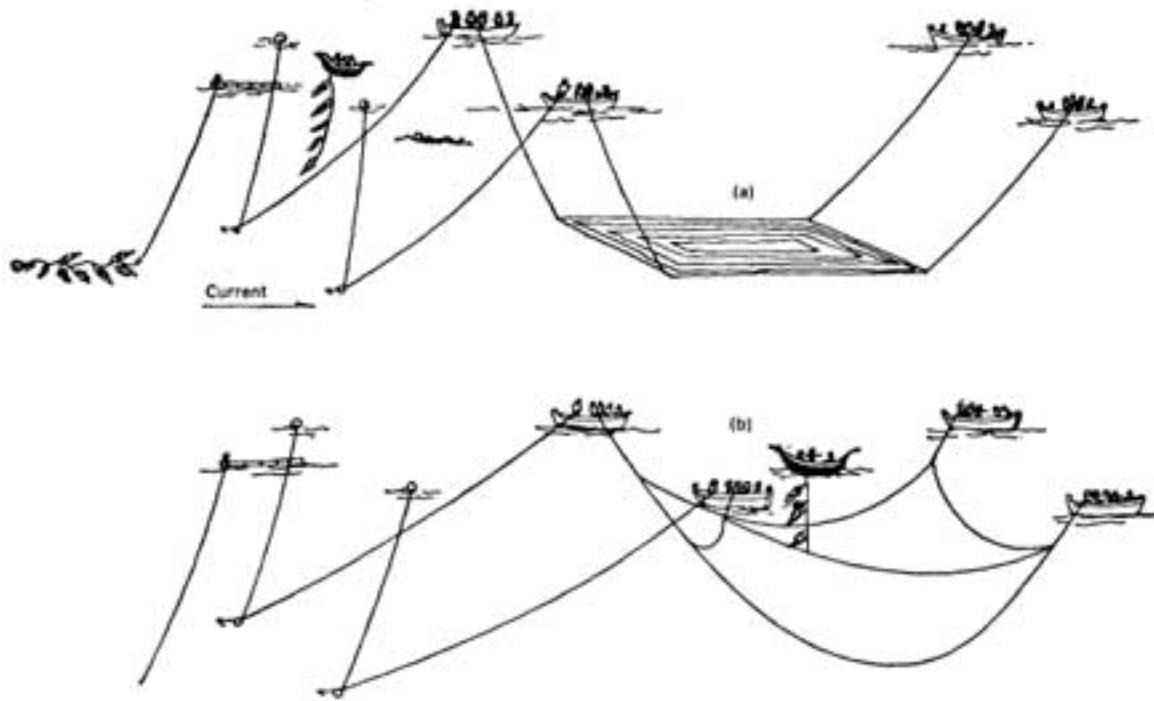
Another net is the bottom-set Pukat Sudu but it is not as common as the Pukat Tangkul. The use of the Pukat Sudu is also described in ref. 3. Similarities can be seen with the Pukat Tangkul, but the net design is like that on Figure 47. It is kept to the bottom until the anchoring stones together with the Unjang are drifted in position above it. Then the Pukat Sudu is also raised quickly, thereby enclosing the fish. For fishing the Pukat Sudu only two boats are needed, plus a canoe for the Unjang. (See Figure 48)

Japanese cuttlefish baskets: They are simply raised fast, or fished with a boat-seine as described on page 15.

Pa yaws of different types and modern-designed rafts and buoys are usually harvested by:

- trolling
- live bait pole-and-line fishing
- purse-seining
- longlining
- gillnets
- scoop nets
- handlining.

Figure 45



Operation of the pu/rat tan gku/.

- a) The net is placed on the bottom and the cinjang besar let down to the bottom. The up-current boats are holding the net out by their anchor ropes. The juru se'am's (head fisherman) boat on the left has lowered the unjang anak the juru se'am is diving to try to hear if the fish are following.
- 6) The net is raised round the unjang anak. having been carried some distance by the current, The up boats on the left have paid out their anchor ropes to keep the net spread but not streamed out. The juru se'am has climbed back into this boat and is directing the hauling. If a/has gone well, the fish are in the bag

Figure 46

PUKAT TANGKUL (LIFT NET)

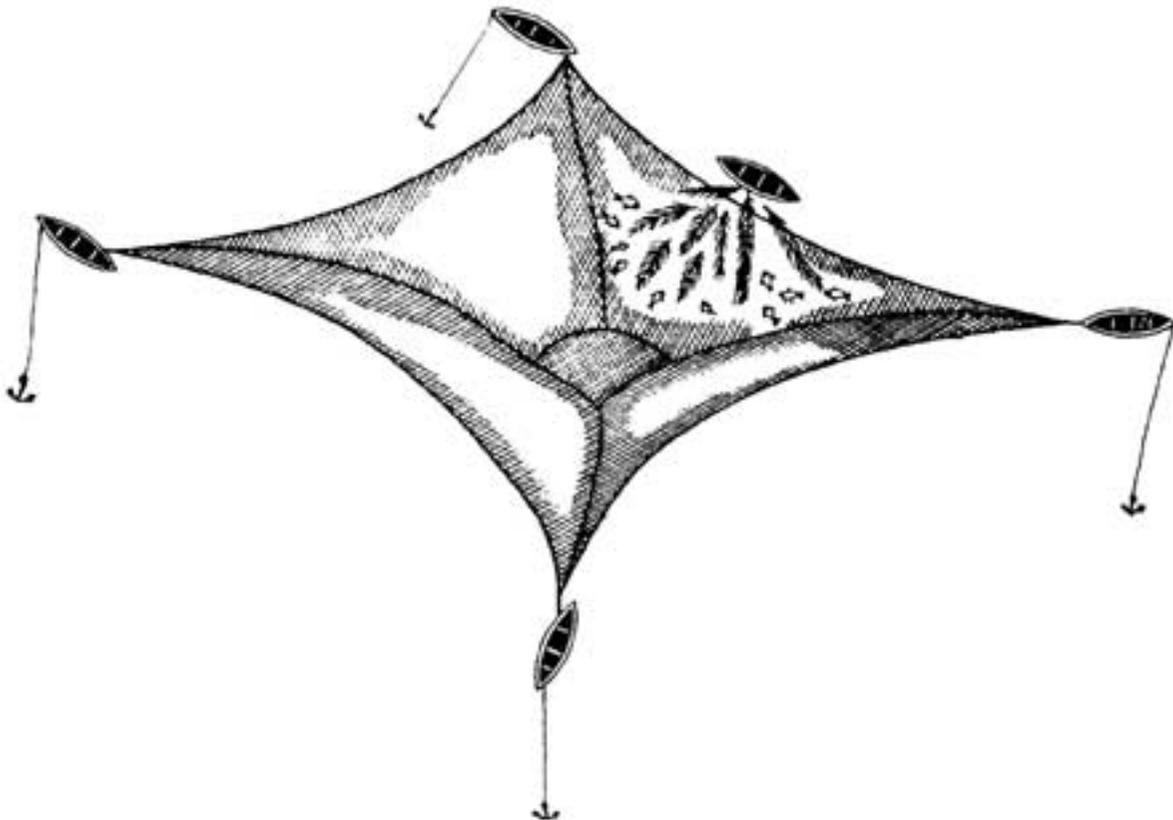


Figure 47

PUKAT SUDU (BOTTOM NET)



Fishing near FADs by these methods can usually be done in the normal manner. In the Hawaiian pilot programme, for example—as described on pages 28-30 it was found that at least three different fisheries benefited greatly; the trolling and the pole-and-line fisheries, plus the local speciality “dropstone” fishery (also described on page 30).

Also, purse-seining is a highly efficient method to harvest FADs. The purse-seining around FADs is a sophisticated version of the traditional methods described earlier, used since long in South Asia. For such harvesting the FAD must be designed so that the appendage can easily be detached before the operation and attached again after it. As the fishing vessel nears the raft, the appendage is carefully detached and temporarily fixed to another buoy which the fishing vessel has brought with it. Or, if the FAD is furnished with a side buoy, the whole raft is detached and no extra buoy is needed. This unit is then left to drift away from the anchoring line, taking with it the fish aggregated in the appendage. After a while the appendage has drifted far enough and the purse-seine is set out in the normal manner. After closing the net and while hauling it in, the buoy and the appendage are lifted aboard the vessel. The appendage is attached again to the anchoring line after the catch is recovered.

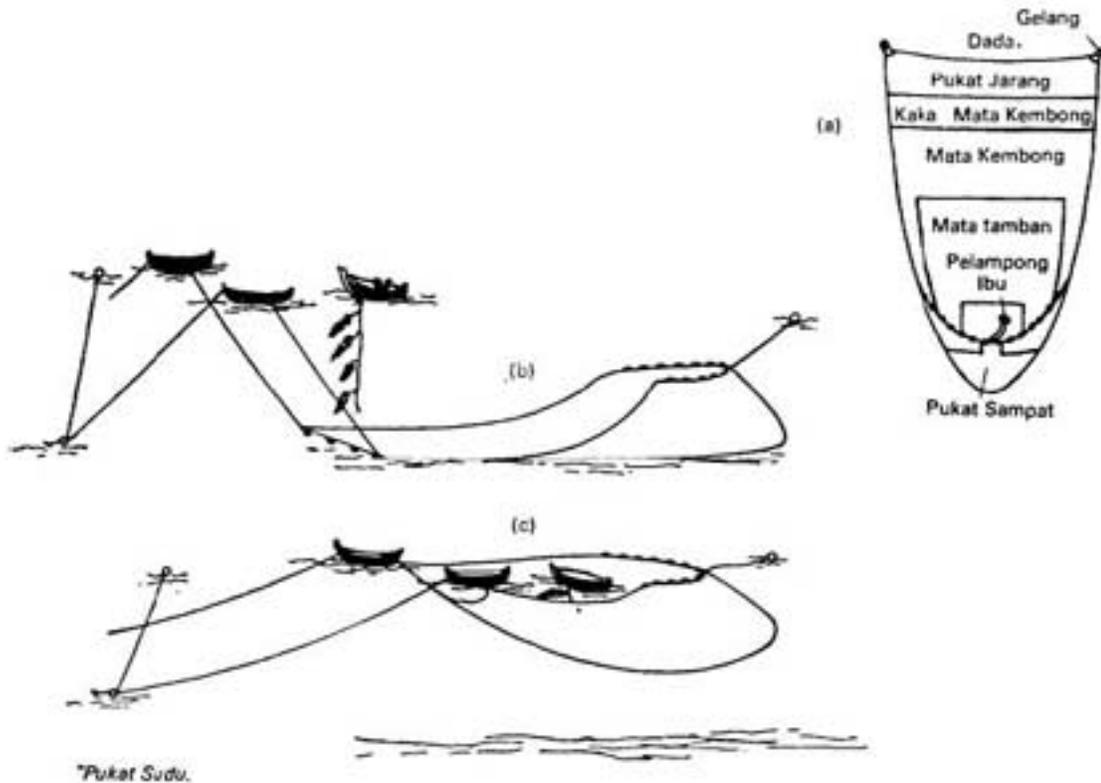
Experience has shown that a raft needs about a month free from fishing, after intensive purse-seining around it, to rebuild considerable aggregates of fish. Because of this, commercial purse-seiners operating on rafts are now trying to maintain at least 30 rafts per vessel.

Ref. 14 describes how a purse-seiner fishes from a payaw (design on page 18) in Philippine waters. Two hauls are described in this report—the first one yielding 36.3 tonne, and the second haul at another payaw yielding 3.6 tonne.

Another payaw type used by Japanese fishing vessels, and its catches, are described on page 23. The method used so far is purse-seining in the vicinity of the raft.

The Philippine payaw combines modern fishing methods with traditional; as the waters around the Philippine islands are very deep, the rafts do not have to be anchored very far off-shore. Thus even smaller units can reach the payaw for handlining, etc. They do not compete for the fish with the purse-seiners, since the purse-seiners fish more near-surface than the smaller craft that engage in handlining. Commercial pole-and-line companies, however, must nowadays make their rafts non-perishable and non-detachable to avoid their rafts being used by purse-seiners also. This action on the other hand proves the superiority of fishing from FADs over other methods.

Figure 48



- "Pukat Sudu.
- a diagram of the net, showing the arrangement of the different parts as net would appear from above when spread out to dry,
 - the operation of the net: the two up-current boats hold the net spread out while the /uru se/am sampan drifts over the net with (he unjang.
 - the two up-current boats start hauling and the net begins to come tip. Once the stones on the dada are off the bottom, the current no longer tends to hold the whole net down,"

6. OTHER GENERAL CONSIDERATIONS

Biological: FADs will clearly make the fish easier to catch, so the enormous advantages of FADs for fishing lightly exploited stocks are obvious. But as and when a fish stock becomes heavily exploited, one has to assess whether FADs in a certain area actually increase the total yield or merely relocate and concentrate catches to fewer fishing units. One should also examine whether FADs aggregate and yield a greater proportion of young fish than other fishing methods, and the impact of this on total catch. Some fears have been expressed on this score (ref. '12, 14, and 37, quoted on page 19).

Maintenance, ownership and access rights are other matters that need highly individual solutions. In India, the villages often have their traditional FADs so close that they can be seen from the shore: this automatically prevents poaching. The people who operate the nets used with these FADs sometimes together invest the little money and work needed to produce such FADs.

The few off-shore structures already in commercial use are usually paid for either by a private fishing company or by the state. Enforcement of some kind of restricted access to off-shore structures will probably prove extremely difficult. In the Philippines, special caretakers sometimes visit payaws. Poaching by purse-seiners, however, involves catches of such high value that arms on board are becoming common.

Legal aspects and hindrance for vessels: The owner(s) of an FAD might keep its position a secret to avoid theft of construction or aggregated fish. This can endanger ships and fishing vessels, particularly at night if the buoy/raft is not properly marked with a radar reflector and light. Who has to pay if an accident occurs is not clear. Only one incident with FADs is recorded; in July 1977, an experimental fish buoy broke loose, causing the buoyant polypropylene rope to surface. A local charter vessel got entangled in the rope and its propeller was damaged. The institution concerned with the experiments paid for repairs to the damaged vessel.

Economy: There is very little published about such factors as the investment, cost of operation, energy consumption, catch values and catch volumes, or earnings, in relation to FADs. It is therefore difficult to quantify the benefits from FADs or their exact value for different fishing methods. Only in general terms, as in the two examples here, are FADs said to lessen expenditures.

FADs obviously reduce scouting time for any fishing method. The "improved payaw" and its performance described on pages 23 & 26 is a good example of one very successful application. Here it seems that a few catches will cover the cost of the raft. As referred to on page 30, the Hawaiian State FAD project, covering three or four fishing methods, reportedly recorded an overall cost/benefit ratio between 1 : 3 and 1: 6.

Regarding traditional FADs, the system monitored in south India by BOBP staff (palm leaves) yielded fish worth around Rs. 2 per man-hour of fishing. (See page 13) This figure does not consider the fact that the owners of nets and kattumarams get a larger share, thereby reducing the share for the others to maybe Rs. 1.25—1.50 per man-hour.

Employment. As concluded earlier, fishing FADs can reduce operational costs. If the stocks thus fished are only lightly exploited then new fishing opportunities may be created. But if the stocks are already exploited to their optimum sustainable yield, an extensive use of FADs may hit employment by restricting the catch to fewer units who will on the other hand increase their profits. (Regulation, a licensing system or fishing quotas may be necessary.)

Design of appendage: The importance of the design, material, size and vertical and horizontal extension of the appendage for the aggregating ability of a raft FAD has not been analysed. Nor have used and tried appendage designs been compared from that point of view. Also, the biological/fish behavioural factors that determine the efficiency of an appendage of specific design are not well known.

Ways to decrease the maximum stress in rough weather on an expensive anchoring system should be considered. One option may be to deliberately let the raft and its appendage break loose from the anchoring device, thereby reducing the stress imposed by wind, waves and current working on the raft. This would be especially preferable in areas where the quality of maintenance is low for different reasons, or where investment capacity is low, or where supply of material is irregular and because of these factors, cheap rafts are preferred. The technique for this could be to design the raft's attachment to the anchorline as the weakest point in the system. With less resistance from only a marker buoy left, the anchoring line may manage through a storm and only the raft plus the appendage need to be replaced. It would be worthwhile to assess how much the maximum stress on the anchoring system can be reduced in this way.

Cost-benefit ratio. It is not always true that construction costs for an FAD should be minimised. To use materials in dimensions that are expected to be only just sufficient but with little safety margin, for the purpose of saving money, is not very wise. Any miscalculation of the strength of the system or unexpected stress on it can then lead to a complete loss of the investment. The value of the catches that would have been taken, if the FAD had been built stronger and remained in place, would also be lost.

The design, size and deployment of anchors: Many losses of FADs can be prevented if the anchors are deployed without inducing twists or unlay of ropes and/or kinks on wires. Ensuring correct design and size of anchors to prevent dragging can also reduce FAD loss.

Chafing: It is important to make the anchoring line stay clear of all bottom material to avoid the chafing which eventually leads to the breaking loose of the FAD. The use of steel rods instead of a chain between anchor and rope may be tried — the steel rods kept upright by small floats or simply by the buoyancy of the rope.

Corrosion: The problem of corrosion will come up if FADs' lifespans are considerably extended through improvements. It has been shown (ref. G) that corrosion rates in chains can be considerably reduced by fitting sacrificial anodes. Mooring chains, however, represent a particular problem since the "earth effect" of the chain depends on contact between adjacent links which may or may not be in contact. A programme including experimental anode installations was carried out between 1974 and 1978 and is described in ref. G. These long-term experiments "showed very clearly that two corrosion zones existed, one at the mud line and the other at intermediate areas along the length of the chain. The experiments also showed that prevention of corrosion was possible by the application of sacrificial anode techniques, and that on chain lengths and swivels previously subject to rapid corrosion, the corrosion rate dropped virtually to zero following the application of cathodic protection."

The small-scale FAD has not so far been given much attention by development efforts. This is probably because it does not yield as much profit as the larger-scale off-shore FAD. Nevertheless the smaller FADs may benefit some coastal fisheries in developing countries where a decrease in fuel consumption is vitally important to improve small-scale fisheries. Numerous experiments as well as the use of simple traditional FADs show that smaller FADs in shallower waters are also successful. The low investment cost here could make a modern "package" available for another category of fishermen. This is something to which planners and development programmes should pay attention.

Some of the experimental designs described here are worth considering for indicative fishing trials. As reviewed in this paper, the FAD as a modern fishing aid offers a variety of ways to produce and use an improved fishing ground. There is still plenty of room for innovations and new ideas.