Deployment of subsurface FADs from small vessels for fishing communities in Choiseul

Introduction

Installing affordable, robust and long-lasting fish aggregating devices (FADs) is a common objective of fisheries officers and other people responsible for FAD programmes. A FAD system requires a floatation device, ropes for the mooring, hardware to connect the various parts of the system, pressure resistant buoyancy to lift the lower part of the mooring rope and avoid abrasion on the seabed, and an anchor system to keep the unit in place. In most cases, FAD materials are ordered offshore while the anchor system is sourced locally. On top of the cost of the FAD itself, the costs of deploying a single FAD may be important and generally cover: the personnel involved, the machinery used for shifting or lifting the anchors (Fig. 1), the deployment vessel or, at least, the fuel used for the deployment vessel.

In looking at the partitioned costs for a full FAD operation, it is interesting to note that the cost of deployment can be more than half the expense; especially in the case of nearshore surface and subsurface FADs where the length and cost of the mooring rope is considerably less than for offshore FADs. The reason for the high cost of deployment is the hiring of heavy lifting machinery, to shift heavy anchors around, and the charges for a deployment vessel. With offshore FADs, deployment vessels have to be of a size that allows for a FAD anchor weighing a tonne or more to be carried safely.

In urban centres, large vessels are not hard to find (in most cases), but they still cost a lot to hire. In rural areas, however, the only boats available are those operated by small-scale fishers and water taxis. Deploying FADs in these areas involves costly charters or meticulous planning to utilise passing inter island cargo ships.

In recent years, the evolution of nearshore surface and subsurface FADs in rural areas compelled a re-thinking of the methods used to deploy FADs that use small vessels such as the open Yamaha banana boats. The use of grapnel, Hall or Danforth anchors and chain for nearshore surface FADs made it safe to use 19–23 foot boats for the deployments. The costs of a 25 kg Danforth anchor and a 500 kg cement block anchor are similar. Safely deploying bulk anchors, however, requires considerable attention.

In March 2011, when reflecting on some of the work carried out by SPC, WorldFish and the University of Queensland (UQ) rigged and deployed seven nearshore

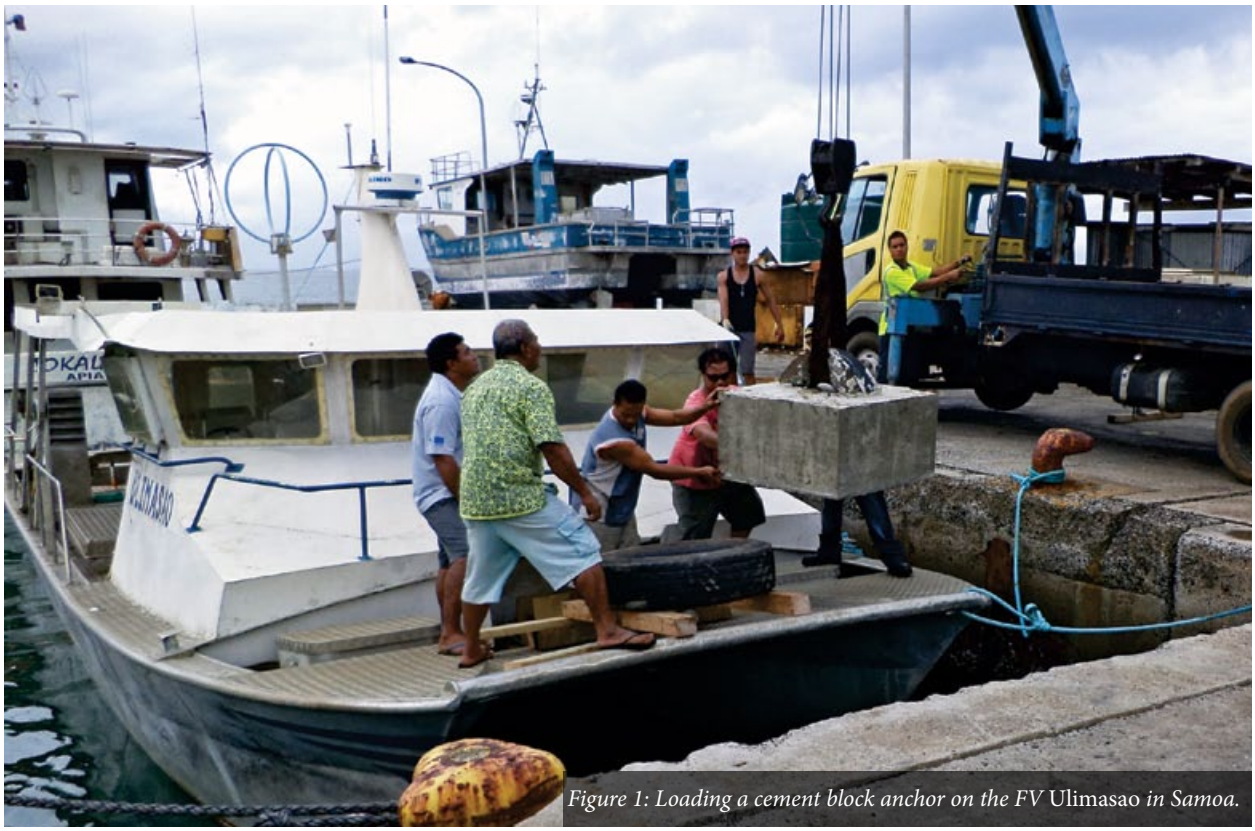

Figure 1: Loading a cement block anchor on the FV Ulimasao *in Samoa.*

surface FADs in the Western Province of the Solomon Islands by using 23 ft open Yamaha banana boats. Three different mooring systems were used: grapnel anchor and chain; drum cement anchor with the rope connected directly to the block, and a heavy single engine part and chain. All the FADs were of the Indian Ocean type – with the exception of the rope in the middle mooring and anchor systems – with a string of floats on the surface.

Deploying the FADs with grapnel anchors was easy as they could be lifted by two men only (Fig. 2).

To deploy the heavy bulk anchors, careful planning and additional safety measures had to be implemented to avoid accidents. The anchor weight was suspended by sacrificial ropes beneath a raft and was towed to the deployment site where it was released by cutting the holding rope (Figs. 3 and 4). In later deployments, WorldFish did not use a raft to tow the bulk anchor but suspended it beneath the deployment vessel itself. However, in both cases, even if the task was carried out by using small vessels, it proved to be very time and fuel consuming because of the drag caused by the un-streamlined weight being towed underwater.

Using a new technique to deploy FADs in Choiseul, Solomon Islands

In April 2015, a FAD workshop was carried out at Taro in Choiseul, Solomon Islands. This was a collaborative effort between SPC, *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ), Solomon Islands Fisheries Division and WorldFish, in order to train staff from the respective organisations on how to rig and deploy subsurface FADs using a 23 ft open Yamaha banana boat for the fishing communities of Subesube, Vurango, Voruvoru, Pangoe, Nuatabu and Posarae.

FADs were standard SPC subsurface units (Fig. 5), with a mooring made of two cement blocks linked to a Danforth anchor to prevent them from sliding along the sea bottom slope.

Figure 2. Deploying a nearshore surface FAD from a 23 ft open Yamaha banana boat using a grapnel for anchor.

Figure 3. Using two boats to tow a bulk anchor to the deployment site.

Figure 4. Preparing to cut the rope to release a ½ drum cement anchor.

A subsurface FAD with 100 kg buoyancy (lifting power) needs an anchor weight of at least 300 kg in seawater. Therefore, 25 kg Danforth or Hall anchors alone would not be sufficient to hold a FAD down. A cement anchor block weighing 300 kg in seawater weighs around 550 kg in air; a weight that can be carried by a 23 ft open Yamaha boat. A metal weight (discarded engine block, etc.) that weighs 300 kg in seawater weighs around 350 kg in air.

For the FAD work in Choiseul, it would have been extremely difficult to lift a single 550 kg anchor block without machinery. Consequently, this weight had to be broken down into two weights that could be physically carried. The six Choiseul communities were requested to each construct two cement anchor blocks of 55 cm x 55 cm x 38 cm. These blocks weighed around 260 kg each in air so the combined weight of each pair was 520 kg. Although these blocks fell short of the recommended 550 kg combined weight, the weight of the 5 m anchor chain and the Danforth anchor made up for the difference. Eight men were needed to lift the blocks by using a long and solid wood log (Fig. 6).

For previous deployments done by SPC or WorldFish in the Solomon Islands, the bulk anchors were suspended under large floats or under the deployment vessel and released by cutting the holding ropes. For these deployments in Choiseul, the cement block

Figure 5. A subsurface FAD unit ready for loading.

Figure 6. Loading a cement block on to the deployment vessel.

anchors were loaded on to a platform that was fitted on a 23 ft open Yamaha banana boat. This platform was constructed with several specific features, as detailed in Figure 7.

Two boats were used to deploy the subsurface FADs; one used as a barge – with the engine removed – carrying the complete FAD (Fig. 8) and the other used to tow the 'barge'. The use of two boats was a safety measure that was undertaken to maintain a minimal number of people close to the deploying platform. In retrospect, only one 23 ft boat is needed for the whole operation, provided it is powered by a 40 horsepower outboard engine or less. The weight of an engine of more than 40 hp would add to the weight of the FAD, and would overload the boat and compromise safety.

All the deployments were carried out in good weather (Fig. 9), efficiently, with ease, and most importantly: safely.

Additional buoyancy could have been used to stabilise the deployment vessel, although this was not tried during the project. This could include having large floats lashed tightly to the sides or by tying a second vessel of alongside the deployment vessel. This would be a good safety measure to consider for future operations.

Conclusion

The FAD deployments carried out in Choiseul established several important factors:

- ✓ Using small boats can drastically reduce the cost of nearshore FAD deployments.
- ✓ By using small boats, it is possible to deploy nearshore FADs with the cement block anchors carried on-board rather than suspended beneath the boat or towed beneath floats. For obvious safety reasons, the carrying capacity of the boat must never be exceeded, while ensuring that the anchor weight is sufficient to hold the FAD in place.

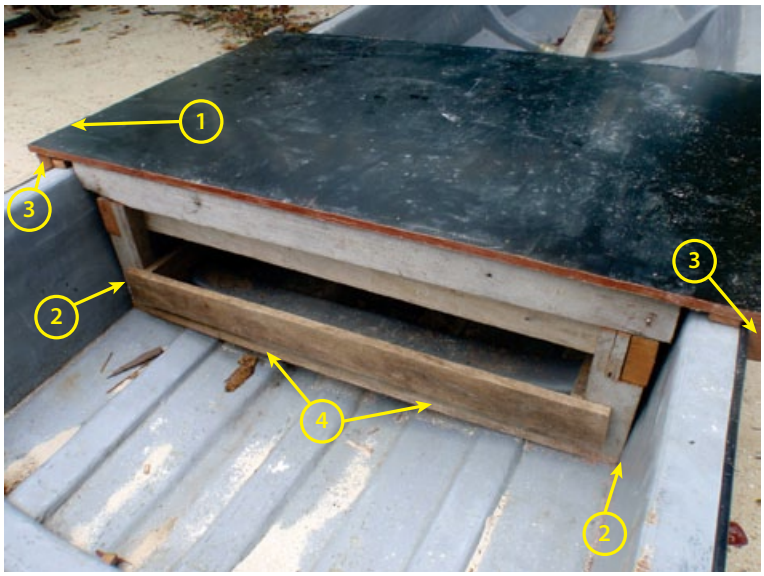

Figure 7. Deployment platform:

1. *The table-top overlaps the gunwale by 8 cm on each side of the vessel. This allows the cement anchors to safely clear the boat sides when deployed.*
2. *The inboard platform structure is constructed as close as possible to the insides of the bulwark.*
3. *Longitudinal wood battens are placed along the outside of the gunwale to lock the table in place.*
4. *The vertical supports rest on transverse and longitudinal base planks to spread the load.*

Note: The whole platform is lashed to the boat's transverse structure (not visible on picture) to prevent it from shifting.

Figure 8. FAD system loaded and ready for deployment.

Figure 9. Cement block anchor about to be deployed.

- ✓ Several countries in the region have already successfully ventured into addressing the use of small boats in FAD deployments:
  - French Polynesia constructed a small barge on which the anchor can easily be carried and towed. Deployment using this method is efficient and safe (Fig. 10).
  - Vanuatu developed the innovative *Vatuika* FAD design (see article on page ...) for which 12 to 16 bags filled with sand are used for anchors with each bag weighing approximately 60 kg; thereby, a 12-bag system weighs 720 kg and a 16-bag system weighs 960 kg. This design requires a single boat for the FAD deployment and eliminates the cost of constructing cement block anchors, which results in a great reduction in the overall FAD expenditure.
- ✓ Subsurface FADs require heavier anchor systems than surface FADs.
- ✓ The anchor system during the Choiseul trial included 2 x 260 kg cement blocks, 5 m of chain and a 25 kg Danforth anchor. In retrospect, this is considered excessive. Combining a cement block that weighs around 200–300 kg, 10 m of chain and a 25 kg Danforth anchor should be sufficient to moor a subsurface FAD with 100 kg buoyancy. This would make the system lighter to carry and easier to deploy.

The Choiseul experiments gave very positive results, but the quest for affordable, robust and long-lasting fish aggregating devices is not over. SPC's Nearshore Fisheries Development Section will keep collaborating with fisheries departments and other partners involved in FAD development, such as WorldFish, to ameliorate FAD systems and to develop affordable and safe ways to deploy them.

Figure 10. Barge used in Tahiti to carry the cement block anchor.

One step in the collaboration will be an SPC/WorldFish regional expert consultation on nearshore FADs, which is to be held in June 2016. It will be an opportunity for nearshore FAD experts in the region to share their experiences and develop best practice principles to guide nearshore FAD deployments in the future. More details about this consultation will be given in the next issues of this newsletter.

For more information:

William Sokimi
Fisheries Development Officer (Fishery Technology), SPC
WilliamS@spc.int

All pictures in this article by William Skimi, except for Figure 10 picture by Mainui Tanetoa.