Nearshore fish aggregating devices for food security in Solomon Islands[1]

Background

Coastal fisheries are central to the lives of rural Solomon Island villagers, supplying daily food and serving as one of the few sources of income. Yet, it is predicted that coastal fisheries in Solomon Islands, as in many countries in the Pacific region, will not be able to provide enough fish to meet peoples' needs by 2030. Given that there will be localised differences across the country, this assessment implies that some communities will face hardship from declining reef fish supply over the next few decades. Proposed strategies to prevent this scenario include improving the management of coastal fisheries and diversifying the sources of fish by enhancing access to other fish, either through aquaculture or the use of fish aggregating devices.

Fish aggregating devices, known as FADs or 'rafters', are fishing devices that concentrate pelagic fish (e.g. tuna) in one location to make them easier to catch. Nearshore FADs (sometime referred to as inshore FADs) are anchored to the sea floor, close to the coast, to allow fishers from coastal communities to access them, including by paddle canoe.

Solomon Islands was among the first countries in the Pacific region to adopt offshore FADs in the industrial fishing sector, yet nearshore FADs remain a relatively new intervention for most coastal communities. To enable a strong case to be made by Solomon Island communities or by provincial and national governments for recurrent budgets to support long-term nearshore FAD programmes, we need to better understand nearshore FAD effectiveness from both a catch-efficiency and a social perspective.

A strategic priority of the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR) is to improve the health of inshore fisheries and marine resources to support the nation's rural communities. The Mekem Strong Solomon Island Fisheries programme funded by New Zealand is part of this effort. It has provided funding to WorldFish to work in partnership with MFMR to develop a Solomon Island National Inshore FAD programme (2010–2013). Through a larger collaboration of MFMR, the Secretariat of the Pacific Community, the University of Queensland and WorldFish, 21 nearshore FADs, using four different FAD designs, were deployed at various locations across Solomon Islands in order to assess the designs and evaluate the FADs' contribution to food security. For this purpose, fish catch rates (at FAD and non-FAD fishing areas) and socio-economic data were collected in locations where FADs were deployed. This programme brief draws on data collected from four of the FAD locations, where FADs were in the water long enough (i.e. three months) to allow adequate data collection.

Towing the FAD raft out to sea, Langalanga, Solomon Islands (Image: G. Orirana, WorldFish)

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Attributes of a sustainable national FAD programme in Solomon Islands

This research has provided evidence that nearshore FADs can increase access to fish by coastal fishers and can play a role in future food security for coastal Solomon Island communities. Key attributes of a sustainable national nearshore FAD programme for Solomon Islands identified through this research are outlined below.

Consider site-specific FAD designs to improve longevity

The length of time that FADs last in the water is one of the greatest risks to the viability of a long-term national FAD programme. Twenty-one FADs (testing three designs) were deployed between March 2011 and October 2012 at 13 locations across Solomon Islands. Longevity ranged from 6 days to 3.5 years (six of the 21 FADs were still in the water as of June 2014). Three main factors were found to influence longevity: vandalism, rough seas and technical design. Understanding the reasons for loss has provided us with a number of lessons for future nearshore FAD programmes.

Three important characteristics have been used to recommend nearshore FAD designs for Solomon Islands: ability to deal with rough seas; low cost; and accounting for high canoe traffic. (Table 1 and Figure 1).

Surface FAD (Image: Simon Albert)

Subsurface FADs are becoming increasingly popular in the Pacific region, due to the reduced opportunity for sabotage and less wear and tear from wave action. To date, only two nearshore subsurface FADs have been deployed in Solomon Islands, and their efficacy and degree of fisher acceptance remain under research. Early results suggest that subsurface FADs require a surface buoy (as a visual marker for fishers) and surface attractants (e.g. coconut leaves) to increase fish aggregation potential.

Subsurface FADs are more difficult to deploy than surface FADs as the anchor system is heavier and more difficult to handle, and accurate deployment locations are required (to ensure that the floatation device remains at 20 m under the water surface). Care must be taken to ensure accurate rope length calculations (accounting for rope stretch) are carried out and sufficient anchor weight is used to counterbalance the floatation device so that it remains stationary on the sea floor.

Subsurface FAD (Image: Joelle Albert)

Use local fishers knowledge to optimise FAD location

Establishing criteria for the distance to deploy nearshore FADs from shore and appropriate distances between FADs is difficult, as information from Solomon Islands and the wider Pacific is sparse and largely dependent on

Table 1. Recommended nearshore FAD designs for the three selected characteristics (rough seas/strong current, low cost and high local canoe traffic).

		Characteristics		
		Rough sea/strong current	**Low cost**	**High canoe traffic**
FAD design	**Poly*/nylon rope**	4 pressure and 13 purse seine floats with 18–20 mm combined poly/nylon rope. Combined anchor (2 x ½ cement drum/ engine block with grapnel) with 2 x 2-eye pressure float above anchor. Use Samson rope connectors for additional strength and plastic strapping for longer lasting attractants.		
	Bush materials		Bamboo (or other floating timber) for floatation, 2 pressure floats (one at 20 m depth) and 18–20 mm poly rope. Use engine block or cement drum anchor,** Use old shredded rope for attractants	Bamboo (or other floating timber) for floatation, 1 old/used pressure float (for surface float), 1 pressure float (at 20 m depth) and combined poly/nylon rope. Engine block or drum anchor.* Use old shredded rope for attractants
	Subsurface	18–20 mm poly rope with 5 pressure floats and combination (4 x ½ cement drum/engine block with grapnel) anchor. 1 old/used pressure float (for surface float). Use Samson rope connectors for additional strength and plastic strapping for longer lasting attractants.	18–20 mm poly rope with 4 pressure floats and 4 x ½ cement drum/engine block anchor.* Use an old/used pressure float (for surface float). Use old shredded rope for attractants.	Poly rope with 4 pressure floats and cement drum/engine block anchor. Use an old/used pressure float (for surface float). Use old shredded rope for attractants or plastic strapping for longer lasting attractants.

* Poly = polypropylene
** On sloping sites, anchor design should include a grapnel along with a cement drum/engine anchor.
Note: Nearshore FAD designs are constantly evolving and further advice should be sought from SPC.

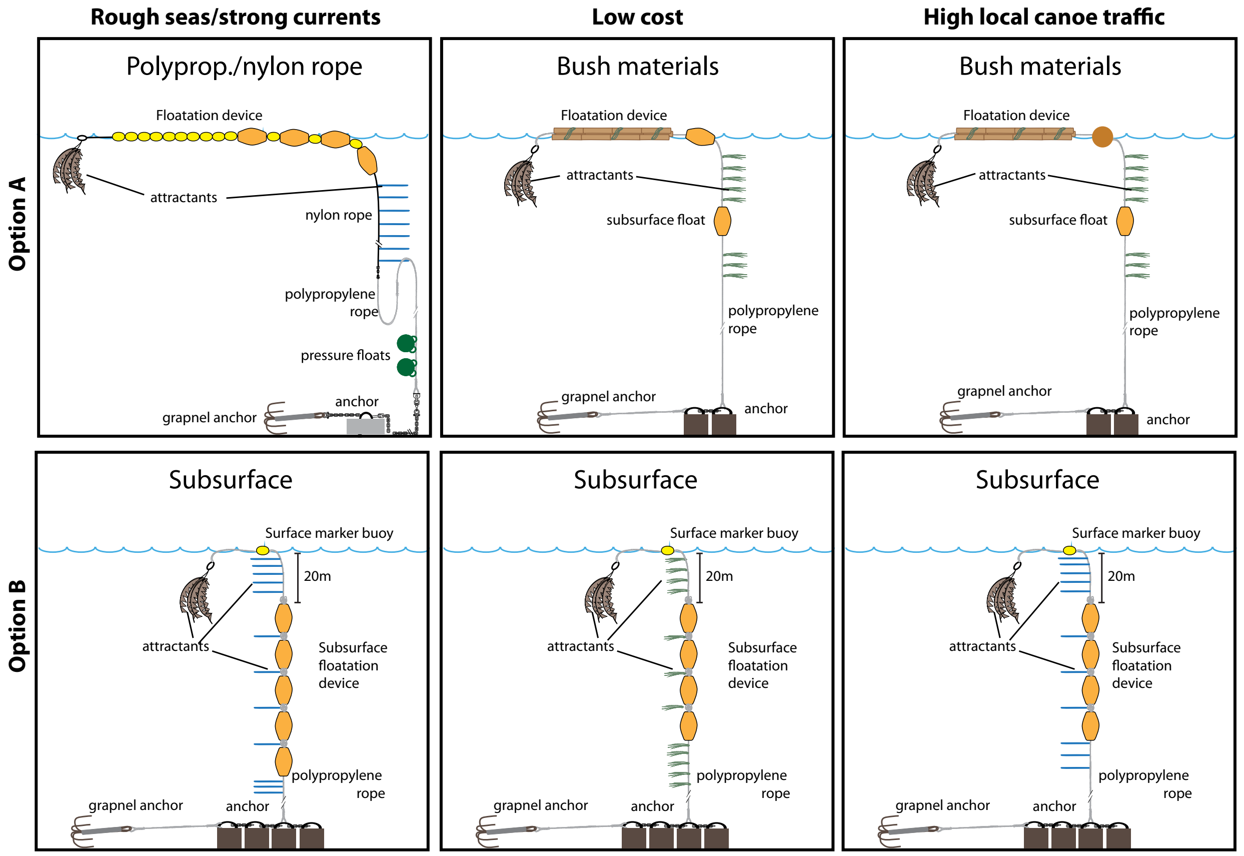

Figure 1. Visual representation of recommended nearshore FAD designs for Solomon Islands, dependent on three key site characteristics

the characteristics of the local environment. Experience from the industrial fisheries sector indicates that anchoring a series of FADs within a given area is most likely to aggregate and maintain schools of pelagic fish. However, there is a risk that if too many FADs are deployed close to one another, FADs or fishing gear can become tangled and nearby FADs may interact, attracting fish from one another, rather than from the open ocean. In Solomon Islands, most local fishers indicated that they were not willing to paddle more than two kilometres to fish at a FAD. However, FADs also need to be at least one kilometre away from seaward reefs to attract pelagic fish and reduce aggregation of reef-associated fish. Using the best information available, as a general rule, nearshore FADs should be deployed in water depths of 200–500 m and more than one kilometre from the coast more (or seaward reef). The recommended minimum distance between nearshore FAD sites is five kilometres. Recent observations by SPC indicate that, at a particular FAD site, a cluster of three FADs separated by ~500 m is optimum. Ultimately, the selection of the FAD deployment site should be undertaken with local village fishers who have an in-depth knowledge of existing pelagic fisheries. This should ensure that FADs are placed in an optimal site to aggregate pelagic fish and are well-utilised by local fishers using boats available in the village.

Community awareness can promote effective use of FADs and negate losses

Vandalism is by far the most common reason for loss of FADs. Participatory planning (provider and community) and community awareness programmes prior to FAD deployment (both within the immediate community and the surrounding communities) about the purpose and responsibilities related to a nearshore FAD can promote the effective use of FADs and reduce the risk of early losses. Awareness and sharing lessons among communities can facilitate informed discussions on the positive and negative social effects communities might encounter, and help with making plans to mitigate these before FADs are deployed.

Focus FAD deployments on food 'insecure' communities that have a high dependence on fish and limited access to diverse or productive fishing areas

In contrast to other studies that have shown higher catch rates at nearshore FADs compared to open water fishing in some Pacific Islands nations, catch and effort monitoring in Solomon Islands did not consistently show significantly higher catch rates at the FADs areas compared to the non-FAD fishing areas (in terms of either weight or number of fish caught). The average weight-based FAD catch rates ranged from 1.0 to 2.9 kg fisher^{-1} hr^{-1} at the four study villages and was similar to the average non-FAD catch rate, which ranged from 0.9 to 2.2 kg fisher^{-1} hr^{-1}. These results suggest that, in general, fishing at the nearshore FADs was not more efficient than fishing at existing fishing grounds, but there were important differences from village to village.

FADs were utilised by 35% to 75% of local fishers. In villages with lower non-FAD catch rates and reef fish diversity there was a greater proportion of FAD fishers. Conversely, a lower proportion of FAD fishers was observed in villages with higher non-FAD catch rates and greater diversity of reef fishes. This suggests that villages with limited access to diverse or productive fishing areas are more likely to use FADs to better effect.

Village-based fisher training can improve catch rates and FAD longevity

Troll-line fishing was the most commonly recorded mechanism for fishing at nearshore FADs, despite there being no evidence of higher weight-based troll-line catch rates compared to non-FAD fishing grounds. The aggregating nature of FADs is such that larger fish are located at deeper depths; fishers may underutilise FADs because of limitations in fishing gear and techniques that target larger fish. Lack of knowledge about appropriate methods to catch fish at a FAD can lead to catch rates that are less than their potential, fishers not using the FAD, or early loss of the FAD due to vandalism by frustrated fishers.

In recognition of this, SPC has developed FAD fishing and sea safety training modules (Preston et al. 1998). Boat and sea safety training are important when fishers travel some distance away from the shore. Village-based training of fishers, using a slightly modified version of the SPC modules and taking into account gear and boats available to rural fishers, was undertaken in a small number of the villages where FADs were deployed in this study. The training sessions were well received by fishers and in some cases resulted in higher (gear specific) FAD catch rates. The training also promoted the transfer of knowledge among fishers, and improved their knowledge of the behaviour of fish around FADs. These outcomes highlight the importance of village-based training of fishers, sharing knowledge among villages and drawing on lessons learned by fishers.

Implement nearshore FADs as part of broader development planning

Household and fisher interviews reveal that nearshore FADs can have both positive and negative impacts on village life. The perceived benefits of nearshore FADs were relatively uniform across villages where interviews were undertaken. They were a source of income (through the sale of fish) and improved nutrition (through an increase in fish consumption); and, at the community level, they

The use of local materials may allow communities to deploy and maintain their own FADs. (Image: Grace Orirana).

provided fish for fundraising and feasts (e.g. funerals, weddings, church and community events) and were a source of income for community-related expenses (e.g. church and schools).

There were some negative elements identified in relation to the presence of FADs. At the family level, FADs were said to create arguments between husband and wife (mostly attributed to the husband spending more time fishing and less time assisting with household activities, such as gardening). In one village, the resulting neglect of gardens led to a period of hardship when the FAD was lost in rough seas; there was no food from the garden and no fish from the FAD. At the community level, the most commonly mentioned negative aspect of FADs was a reduction in fishers' attendance at church and other community activities.

Fishing at nearshore FADs, while using existing skills and being consistent with daily village life, has some characteristics consistent with the introduction of a new livelihood option to the community. A reduction in the time male fishers spend attending to other household and community activities may have both short-term and long-term consequences for households and communities. A national FAD programme could benefit from being embedded in the wider development planning by communities and national agencies in order to recognise and respond to benefits and trade-offs, including those that disproportionately affect some members of society, such as women gardeners.

Monitoring can build an information base to allow informed policy making

A general acceptance that FADs are effective in increasing access to fish for a coastal community has resulted in investments to date being dominated by practical issues about FAD design and deployment, rather than quantifying realised benefits and their distribution amongst communities. The results discussed here suggest that benefits can be variable and depend on a range of socio-ecological conditions. If nearshore FADs are to become more widespread, a robust analysis of their contribution to gender equitable development outcomes is required.

The study reported here has provided important lessons for site selection, FAD design and mechanisms for improving FAD longevity, as well as highlighting social dimensions around FAD deployments in Solomon Islands. The study has also shown that nearshore FADs are used by rural fishers, albeit to varying degrees, and it highlights the potential role that FADs can play in rural communities by providing fishers with access to a 'new' or hitherto under-utilised source of fish. Continued monitoring and assessment of nearshore FAD deployments will provide an ongoing mechanism for the government to assess the contribution of nearshore FADs to food security, livelihoods and income generation for rural communities and to inform future policy.

A national nearshore FAD monitoring programme should include at a minimum, information on FAD

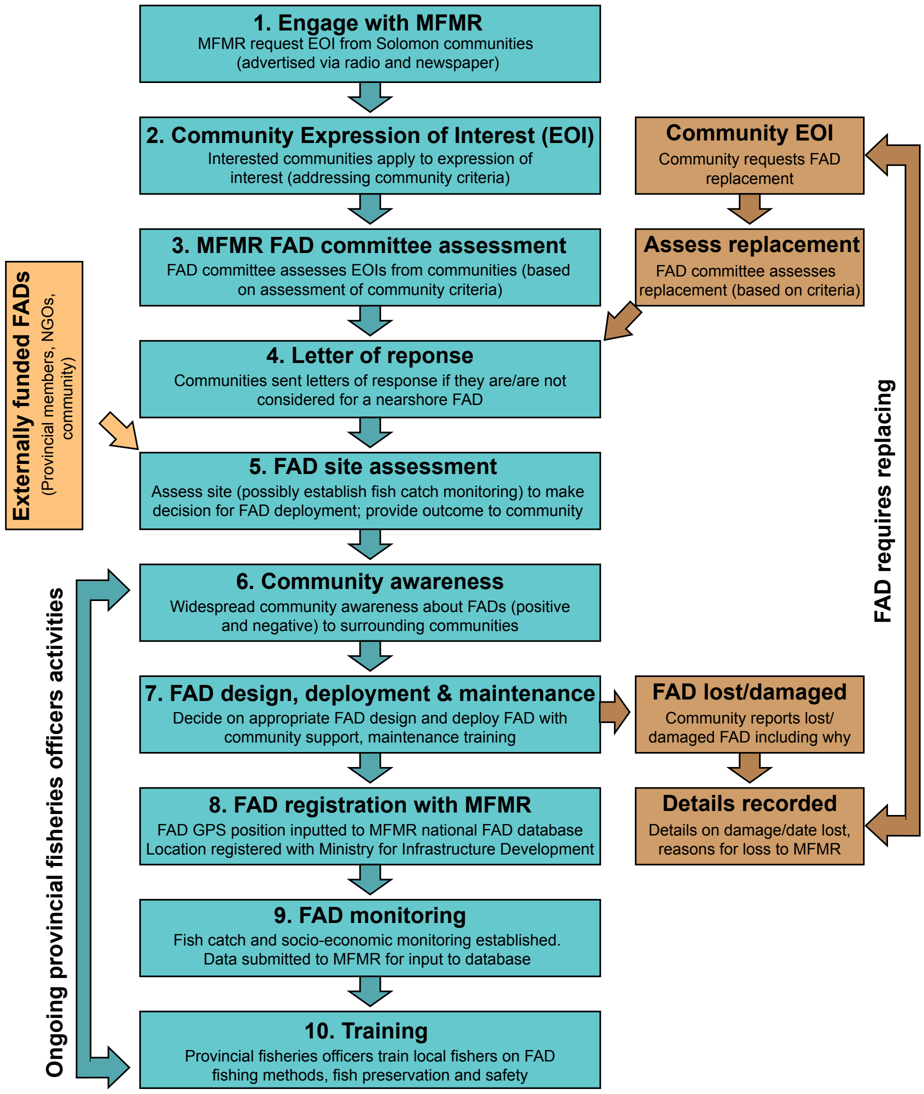

Figure 2. Ten-step process for implementation of nearshore FADs in Solomon Islands

deployment location, longevity and reasons for losses. More detailed recording and analysis of fisher use and fish catches, as well as the social, ecological and economic dimensions of the impact of nearshore FADs, could be included. Monitoring fish catches prior to the deployment of a nearshore FAD, or at least assessing indicators of the productivity and diversity of existing fisheries, can provide an initial indication of likely FAD use, assist with site selection and contribute to a better understanding of the potential impacts of FADs (the shift of fishing effort from reef species to more resilient oceanic species).

Source recurring funds to maintain a national FAD programme

Nearshore FADs have a finite lifetime and all FADs, regardless of vandalism, will eventually break free. Recurrent and readily available funds should be in place at national level to deploy, redeploy and provide ongoing support to communities (i.e. training, technical advice, site surveys, FAD maintenance). Nearshore FADs that are routinely maintained (e.g. floatation system checked, excess growth from the FAD ropes removed) are more likely to remain in the water for a longer period of time. Building community ownership and the capacity to maintain and redeploy their own FADs (particularly designs that use local materials) can increase FAD longevity and reduce the burden on limited government resources.

A common national approach for nearshore FADs

Developing a coordinated national approach for implementing a long-term nearshore FAD programme for Solomon Islands is proposed. A ten-step process to guide those who commonly implement nearshore FADs (government, NGOs and provincial and national political representatives) is outlined in Figure 2.

Contributions

The contents of this programme brief draw on the experiences of WorldFish, the Ministry of Fisheries and Marine Resources, the Secretariat of the Pacific Community and the University of Queensland in the deployment and monitoring of nearshore FADs in Solomon Islands and elsewhere in the Pacific region.

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Further reading

Albert J.A., Beare D., Schwarz A.M., Albert S., Warren R., Teri J., Siota F. and Andrew N.L. 2014. The contribution of nearshore fish aggregating devices (FADs) to food security and livelihoods in Solomon Islands. PLoS ONE 9(12): e115386. Doi:10.137/journal.pone.0115386.

Anderson J. and Gates P.D. 1996. Planning FAD programmes. South Pacific Commission fish aggregating device (FAD) manual. Volume 1. 46 p.

Bell J.D., Kronen M., Vunisea A., Nash W.J., Keeble G., Demmke A., Pontifex S. and Andréfouët S. 2009. Planning the use of fish for food security in the Pacific. Marine Policy 33:64–76.

Bell J.D., Allain V., Allison E.H., Andréfouët S., Andrew N.L., Batty M.J., Blanc M., Dambacher J.M., Hampton J., Hanich Q., et al. 2015. Diversifying the use of tuna to improve food security and public health in Pacific Island countries and territories. Marine Policy 51:584–91.

Castro J.J., Santiago J.A. and Santana-Ortega A.T. 2002. A general theory on fish aggregation to floating objects: An alternative to the meeting point hypothesis. Reviews in Fish Biology and Fisheries 11:255–77.

Chapman L. 2000. Small-scale FAD associated fishing techniques used in the Pacific region. In Méthodes de péche associées aux DCP. IFREMER, Proceedings of the tuna fishing and fish aggregating devices workshop, Caribbean-Martinique, 15–19 October 1999.

Chapman L., Pasisi B., Bertram I., Beverly S. and Sokimi W. 2005. Manual on fish aggregating devices (FADs): Lower-cost moorings and programme management. Secretariat of the Pacific Community, Noumea. 47 p.

Dempster T. and Taquet M. 2004. Fish aggregation device (FAD) research: Gaps in current knowledge and future directions for ecological studies. Reviews in Fish Biology and Fisheries 14:21–42.

Desurmont A. and Chapman L. 2000. The use of anchored FADs in the area served by the Secretariat of the Pacific community (SPC): Regional synthesis. In: Le Gall J.-Y., Cayre P. and Taquet M. (eds.). Pêche thoniere et Dispositifs de Concentration de Poissons, Caribbean-Martinique, 15–19 October 1999. Ifremer, Actes et colloques, p. 108–40.

Gillett R. 2009. Fisheries and the Economies of the Pacific Island Countries and Territories. Mandaluyong City, Philippines: Asian Development Bank. 520 p.

Preston G.L., Chapman L. and Watt P.G. 1998. Vertical longlining and other methods of fishing around fish aggregating devices (FADs): A manual for fishermen. Secretariat of the Pacific Community, Noumea. 64 p.

Secretariat of the Pacific Community. 2012. Fish aggregating devices (FADs). Policy Brief 19/2012. Secretariat of the Pacific Community, New Caledonia. 4 p.

Secretariat of the Pacific Community. 2013. Status report: Pacific Islands reef and nearshore fisheries and aquaculture. Secretariat of the Pacific Community, Noumea. 37 p.

Sokimi W. and Beverly S. 2010. Are moored fish aggregation devices the solution to sustaining small-scale fishing? SPC Fisheries Newsletter 132:10–12.

Taquet M. 2011. Artisanal and industrial FADs: A question of scale: Tahiti conference reviews current FAD use and technology. SPC Fisheries Newsletter 136:35–45.

Weeratunge N., Pemsl D., Rodriguez P., Chen O.L., Badjeck M.C., Schwarz A.M., Paul C., Prange J. and Kelling I. 2011. Planning the use of fish for food security in Solomon Islands. Coral Triangle Support Partnership. 53 p.

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