New FAD development approach strengthens community-based fisheries management in Vanuatu

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Community-based management is practiced widely in the Pacific Islands region but often, fisheries management and development activities are not well aligned with the social and economic fabric of community life and the rural fisheries development and management priorities of national fisheries departments. Developed during the Japan International Cooperation Agency-funded "Grace of the Sea" project,[5] an initiative to strengthen community-based fisheries through an improved offshore fishing technology using fish aggregating devices, value adding, and capacity building of communities is attracting interest in Vanuatu. The shift in fishing effort from nearshore to offshore fishing, and the increase in the landing and marketing of catches have worked to reduce pressure on reef fish and lobster resources while improving income needs for communities. Resources traditionally harvested for commercial sale such as trochus, green snail, lobster, reef fish and sea cucumber, are no longer heavily harvested because communities have come to realize the need to allow these stocks to recover to economically viable levels. The initiative has been adopted as a model community adaptation to the impact of climate change in the fisheries sector. Several donors and implementing partners are supporting the initiative, including Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), World Vision, New Zealand Aid, Wan Smol Bag Theatre, and the local Game Fishing Charter Association. The Secretariat of the Pacific Community (SPC) FAME Division also established a memorandum of understanding with JICA in July 2012 for cooperation to the implementation and the promotion of the Grace of the Sea project Phase II in Vanuatu.

Background

Reef resources are important in the Pacific Islands region for food security and livelihood; they are, however, under increasing fishing pressure because of an over-reliance on them. Tuna resources in nearshore areas are underexploited yet their contribution to food and income for communities is far less than that of reef resources (Bell et al. 2011). SPC has been supporting its Pacific Island member countries to lessen their over-reliance on reef resources by increasing tuna landings through fish aggregating device (FAD) fishing (Sharp 2012; Chapman et al. 2005). FADs are human-made objects deployed at sea to concentrate pelagic fish in an area for capture. Pelagic fish such as marlin, tuna and dolphinfish are attracted to FADs for various reasons, including shelter, phototactic behaviour,[6] the presence of small prey, the smell and sound of the FAD structure. FADs also act as a breeding area and attract the schooling of certain species (Dempster and Taquet 2005). FADs come in many designs (Anderson and Gates 1996; Chapman et al. 2005) but the common ones used in inshore waters are static FADs that consist of a float anchored to the ocean floor. Static FADs reduce a fisherman's search time (for fish) and fuel costs, provide fishers with a relatively guaranteed fishing ground (fishing location is known), and better catches when compared with trolling in offshore waters (FAO 2012).

But many FAD programmes in the Pacific have encountered difficulties due to the high cost of gear, complicated logistics of deployment, high rates of loss, and a lack of awareness about the usefulness of FADs. In Vanuatu, the initial FAD programme in the 1980s deployed 131 FADs at Efate, Santo, Malekula, Pentecost, Pamma, Lopevi, Epi and Tongoa. These FADs rarely survived more than five months on average, and 24% were lost on deployment. In the early 1990s, FAD fishing was trialled in several Vanuatu islands with the aim of attracting the interest of fishers. But, local fishers at the time were fishing mainly for subsistence purposes and saw little need for FAD fishing (Anderson 1994). FAD fishing was not popular in subsequent years with the exception of modest activity in Efate and south Santo with a few FADs deployed and used by game fishing charter boat operators. While a lack of funding is a common challenge, the lack of awareness about FADs and their usefulness was the main reason fishermen did not make better use of them. FAD development has recently been highlighted as an opportunity to shift fishing effort away from reefs,

[5] Project for Promotion of Grace of the Sea for Coastal Villages in Vanuatu, Phase 2. Supported financially by JICA and coordinated locally by the Vanuatu Fisheries Department the project will last 34 months, from January 2012 until November 2014.
[6] Phototactic behaviour is the movement of an organism in response to light variation.

which would allow coral reef resources to build up and be more resilient to the impacts of climate change. This has led to a renewed effort to develop FAD technology that is economically viable for resource-limited island communities. We present here the results of an innovative approach to FAD fishing development and community-based management in Vanuatu.

Community-based FAD fishing approach

Coastal and inshore ecosystems contain a range of resources for communities: invertebrates, coastal pelagic fish, reef fish, coastal demersal fish, deep-slope demersal fish, and offshore fish resources (Fig. 1). Under the Grace of the Sea Project, communities are trained to: 1) manage their reef resources by developing pelagic fisheries using FADs, 2) improve the processing and marketing of catches, and 3) develop ecotourism. Deep-bottom snapper resources are relatively less abundant and should be tapped only to make up the income shortfall from pelagic catches, while reef fish, sea cucumbers, trochus, green snails and land crabs should not be targeted to allow for their recovery. The marketing of tuna and snapper catches has been focused on local markets (rather than Port Vila) to which communities have easy access, and training assistance has been provided to improve value adding. Opportunities in ecotourism related to the marine environment were assessed and, when possible, developed as an alternative income source for each area.

FAD development and management

FAD design and deployment

A cost-effective FAD design referred to as a "Vanuatu FAD" has been developed (Fig. 2). The submerged component (anchor and rope) is based on the Caribbean FAD design (Horner 2011) and the float component is based on the Indian Ocean design used by SPC (Chapman et al. 2005). The main components are a mix of purse-seine and pressure floats, pieces of purse-seine nets, 12-mm rope, pieces of tarpaulin, plastic bottles filled with sand, mid-water pressure float and a sandbag anchor (Fig. 3a). The lifespan of the synthetic sand-filled bags is supposed to be several years. Sand-filled bags conform to the sea floor bottom, thus limiting the possibility of displacement on slopes as opposed to a rigid cement or engine block. The number of sandbags per FAD depends on the depth and current; a FAD anchored in 300–400 m of water uses 12 sand bags, each weighing 60 kg, and a FAD anchored in 1,200 m of water uses 14 sandbags, or even 16 sandbags in areas with strong currents. The modified FAD is more durable in rough seas or from the impact by a passing vessel.

Prior to deployment, a fishing activity map of the area was drawn up using local experience. The map indicated areas used for trolling and frequented by flocks of birds, reef fishing areas, deep-bottom fishing areas, marine protected areas, wind direction, current flow and bathymetry copied from marine charts. Potential deployment locations were first identified on the map, and then visited in order

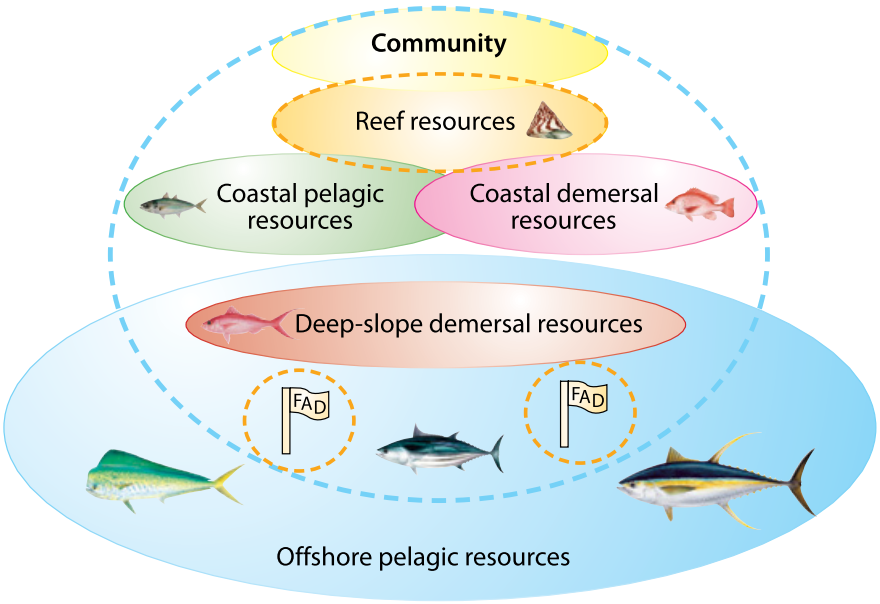

Figure 1. Nearshore and reef fisheries resources available to coastal communities (illustration: Motoki Fujii).

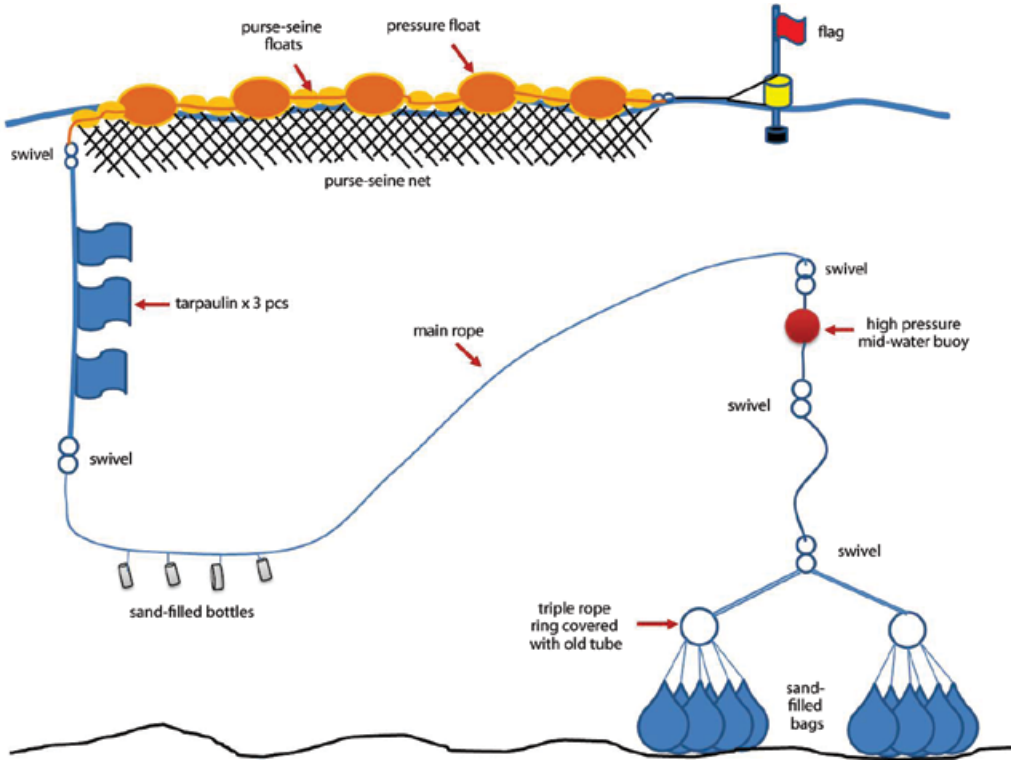

Figure 2. The "Vanuatu FAD" design based on the Caribbean design and the Indian Ocean FAD used by SPC and modified by George Amos, Fisheries Development Officer, Vanuatu Fisheries Department (illustration: Motoki Fujii).

to record depths and positions using a depth sounder and a global positioning system device. FADS were deployed using two small boats (for more details see: JICA and IC Net Limited 2012); one carrying the float and rope, and the other carrying the sandbags (Fig. 3b). At the deployment site, the first boat offloaded the float and rope and moved away. Sandbags were then suspended in the water from the side of the second boat by a rope connecting the pairs of bags. Once the main line was in the water and clear, the suspension rope was cut to let the bags sink to the bottom. A set of three or more FADs was deployed at each site, along tuna migration routes at three miles and eight miles offshore, in the hopes that the FADs would attract schools within the area as they travelled from FAD to FAD.

FAD management and user pay

Community FAD management guidelines were developed for each community. The guidelines set out the rules of FAD use, monitoring and maintenance, safety of fishers around FADs, user registration, and the collection of management fees. FAD development is part of the community's overall community-based fisheries management action plan. A FAD Management Committee was set up in each area to implement the community FAD guidelines in collaboration with the Vanuatu Fisheries Department. FAD users include community members, fishing charter operators and community fishers associations.

Figure 3. FAD construction and deployment at Uripiv, Malekula. a) Filling and tying sand bags; b) En route to the deployment site using small boats (images: T. Takayama).

The only boats allowed to fish around a community FAD are the ones registered by the FAD Management Committee. Non-community members wishing to use the FAD must apply to the respective FAD Management Committee and pay a membership fee to be registered. Troll fishing is permitted 20 m away from the FAD and dropline and deep-bottom fishing are permitted 300 m away. Spearfishing and gillnetting are not permitted around FADs, and mooring to FADs is discouraged. Incomes from registration fees are spent on fuel for monitoring and maintaining the FADs. Monthly FAD checks are carried out on buoys, and six-monthly checks are conducted on line connections. Catch and effort information is recorded in logbooks and submitted to the Vanuatu Fisheries Department.

Fishing technology training

Fishers were trained on using vertical longlines (Fig. 4) for mid-water pelagic fish, deep-bottom snappers, and diamondback squid, and five new trolling gear types (Fig. 5). Diamondback squid has been trialled as a potential "new" fishery in New Caledonia (Blanc and Ducrocq 2012) and Cook Islands (Sokimi 2013). Careful exploitation of this resource could open a new fishery in Vanuatu. FADs can also be a source of baitfish to support other fishing activities, thus the importance of maintaining FAD appendages (nets and tarpaulins) so that the FADs continue to be effective in aggregating small fish. Training was conducted on small fishing boats in collaboration with respective provincial administrations.

Marketing support and value adding

The marketing of fish within the community was based on existing opportunities. At Aneityum, fish caught were sold locally at the Mystery Island tourist market, which has an unsatisfied demand for seafood. Food preparation training was conducted for interested fishers in collaboration with the Provincial Tourism Association and the Department of Tourism. Solar-powered ice freezers were provided as less-costly fish preservation facilities and ice fish-bags were used to keep fish fresh during fishing trips.

As required to export fish to Port Vila market, the community fish market at Uripiv Island, Malekula, was HACCP (Hazard Analysis and Critical Control Point) certified by the Fisheries Department Seafood Verification Unit. Training on shell crafting and equipment support was provided to respective communities, again in collaboration with the Department of Tourism.

Figure 4. new vertical longline gear presented to community members (images: K. Nishiyama and T. Takayama).

Invertebrate restocking

Stock enhancement of commercial invertebrates — trochus, green snail and giant clams — was carried out during the first phase of the project from 2006 to 2009.

Stocks of green snail and trochus from Aneityum Island and *Tridacna gigas* from Tonga were introduced to the Lelema area. The offspring of green snail established in Efate were further translocated to Uripiv in 2013. As part of the initiative, the locally extinct giant clam species was introduced from Tonga and placed in a giant clam garden at Lelema. In addition, hatchery production was developed for locally present giant clam species *T. maxima* and *T. squamosa* for community farming.

Figure 5. New trolling gear.

Results and impacts

FAD fishing reduces pressure

Deployment of more Vanuatu FADs increased in 2012 (Fig. 6) and by the end of 2013, 15 FADs were in the water at Efate, Aneityum, Malekula and Santo. By the end of 2014, 24 new FADs will be deployed: 11 at project sites, and the rest at new sites including Tanna, Emae, Santo, and Vanua Lava in the northern province of Torba. The deepest FAD deployed so far was off Hat Island in a depth of 1,200 m. The cost of the new FAD, including materials, construction and fuel used for deployment, varies by depth: USD 760.00 for a FAD anchored in 300 m, USD 950.00 for a FAD anchored in 400 m, and USD 1,300.00 for a FAD anchored in 1,200 m of water. Transport costs of materials to the deployment sites and the hiring of small boats for the deployment are not included in these costings. Deployment by small boats and the use of sandbags as anchors are major cost reductions and provide a solution to the logistical difficulty faced in the past with heavy cement or engine blocks. On average, two FADs of the new design can be constructed and deployed per day. So far no loss has been recorded since deployment began in 2012, despite the passage of three tropical cyclones.

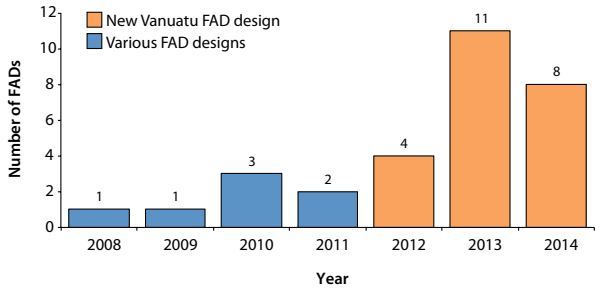

Figure 6. Number of fish aggregating devices deployed in Vanuatu since 2008.

Local interest in the new FAD grew among partners as more communities saw the need for it in their areas. In 2013, four were deployed at south Santo and Hog Harbour, funded by the World Vision Melanesia Office. GIZ has funded two new FADs, which have been deployed at its pilot site at Pele Island on north Efate. The Game Fisheries Association donated materials to the Vanuatu Fisheries Department for an additional 10 FADs. Another 10 FADs were funded by Wan Smol Bag Theater for the Tasi Vanua communities of north Efate. The FAD Management Committees of Uripiv, Lelema and Aneityum have raised sufficient funds, ranging from VUV 100,000 (USD 1,050) to VUV 300,000 (USD 3,150) within a year to meet the cost of at least one new FAD.

The bottom-set, vertical free floating line has made deep-bottom snapper fishing easier than the traditional bottom dropline fishing from a stationary boat. Fishers have come to realize the importance of FAD fishing as a source of economic opportunity other than just for bait fishing. In 2013, the majority (74%) of fishing activities in Anelgouhat, on Aneityum Island, were trolling around FADs for wahoo and tuna, and bottom fishing for deep-bottom snappers (Fig. 7a). This shift in fishing effort towards tunas and snappers resulted in a 95% drop in lobster landings by Anelcouhat fishers between February and June 2013, as fishers no longer relied on lobsters (Fig. 7b). In Uripiv Island, the landing of reef fish dropped by 76% as fishing shifted from the reef to FADs and over deep slopes. Deep-bottom and pelagic species became the main targets both in Lelepa and Aneityum islands (Figs 8 and 9).

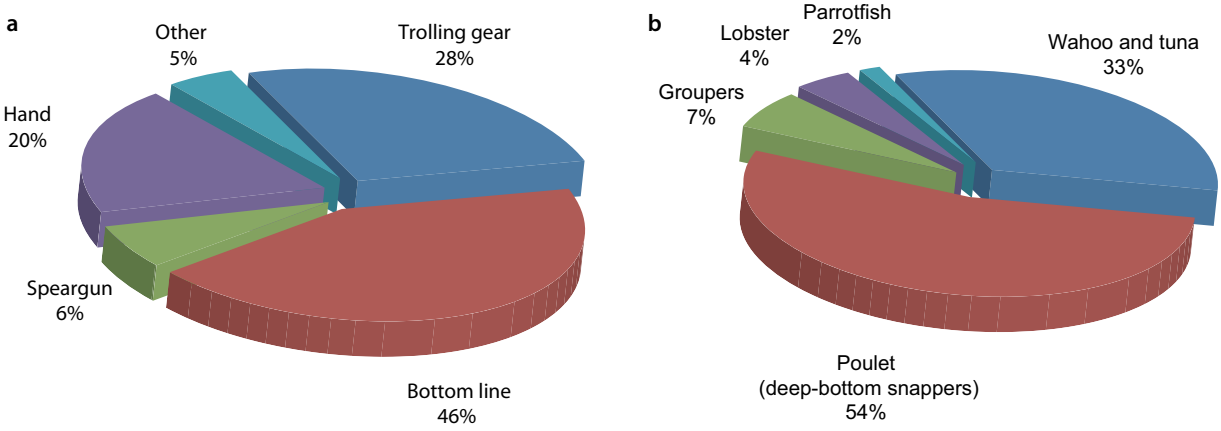

Figure 7. a) Frequency of fishing gear use; b) catch composition for 2013 at Anelgouhat, Aneityum Island.

Figure 8. Deep-bottom catch from Lelepa Island, Efate (image: T. Takayama).

Trial fishing for deep-sea squid landed a diamondback squid for the first time using a small boat and hand reel fishing eight miles southwest of Aneityum Island in November 2013 (see related article on p. 43, this newsletter. This single catch was the third recorded in the region, the first catch of diamondback squid and neon squid were caught in New Caledonia (Blanc and Ducrocq 2012) and in Cook Islands (Sokimi 2013).

Production and marketing of fish

Solar-powered freezers and ice bags with a capacity to hold ice up to eight hours were provided to rural fishers to keep their fish fresh. Catches from Uripiv Island were exported to hotels in Port Vila and Santo. Improved seafood preparations, especially those for snapper and wahoo, have increased sales at the Mystery Island market (Fig. 10). Lobster fishers at Aneityum have decided to raise the minimum harvest size limit of spiny rock lobster to 250 mm — the national limit is 220 mm — to safeguard their stock. Efate is a good market for fish and has so far absorbed catches from the community. Poulet (deep-bottom snappers) are being caught just off the island using bottom-set, vertical free floating lines, which is an indication of the availability of stocks in nearby fishing grounds.

Shell handicraft production

Locally made shell handicrafts are sold at the local tourist markets in Aneityum and Port Vila. Resource owners have realized that their local shells could be worth much more if transformed into handicrafts rather than sold as raw shells. For example, a handicraft producer in Aneityum recently earned VUV 12,000 (USD 130.00) from selling jewellery made from a single trochus shell. As interest grows, more families have purchased their own tools and equipment to make handicrafts (Fig. 11).

Figure 9. Pelagic catch from Aneityum (image: T. Takayama).

Figure 10. A plate of seafood at a Mystery Island market restaurant, Aneityum Island (image: K. Nishiyama).

Figure 11. Shell jewellery produced by community women and presented for sale (image: T. Takayama).

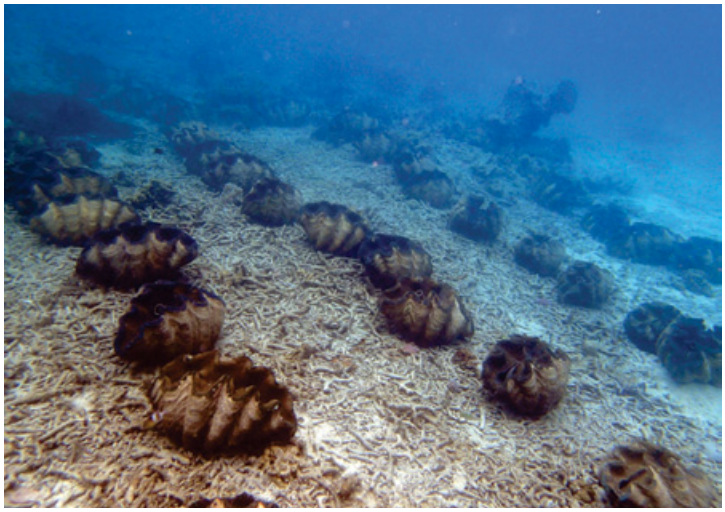

Figure 12. Giant clam garden at Lelepa used as a tourist tour site (image: T. Takayama).

Figure 13. Game fishing charter boat trolling around a fish aggregating device (image: T. Takayama).

Ecotourism and invertebrate stock recovery

Introduced *Tridacna gigas* grown in a garden at Lelema are surviving well and are being monitored by the community and used as part of tourist tour to generate income (Fig. 12). Green snail and trochus, which have been overexploited in the area, have been re-established in a wider marine protected area declared in early 2014 and covering all of the reefs owned by the community of Lelema. Income from fees paid by tour operators are used to fund monitoring and maintenance of the giant clam garden and the marine protected area.

Game fishing charter boat operators are the major beneficiaries of FADs on Efate (Fig. 13). Ten charter boat operators have registered with the Lelema FAD Management Committee and are cooperating to provide catch data to the Vanuatu Fisheries Department. Game fishing activities have been organised at Anelcouhat to support cruise ship visitors. At Uripiv, new moorings have been deployed at Crab Bay lagoon for use by yachts visiting the area, and New Zealand Aid has agreed to assist with the funding of mangrove ecotourism activities in the Crab Bay Conservation Area, which is part of the Uripiv and Crab Bay managed area.

Lessons learned and ways forward

The renewed approach is a working model for rural fisheries development that Vanuatu Fisheries has adopted to strengthen its rural fisheries work. Stock enhancement of trochus and green snail at Lelema has helped re-establish these resources on Efate and the low-cost FAD development and associated fishing technology has revived coastal tuna fisheries development in Vanuatu. Delegating management responsibility to communities has reinforced their sense of resource ownership. User registration for FAD use can be seen as a solution to sustainable FAD programmes. Less costly fish preservation methods using solar power and local marketing of products, as close as possible to each community, have also increased economic returns for communities.

Within a short period, the approach has had a positive effect on reducing fishing pressure on reef resources by 70–80% as seen with the lobster fishery in Anelcouhat and for the reef fish fisheries of Uripiv and Efate. Moving fishing effort outside the reef across the country can be achieved with FAD programmes using the FAD design developed for this project. In a short period, the use of the innovative approach has spread to other communities in Efate, Emae, Malekula, Santo and the Banks Islands, and a increasing number of partners have stepped forward to support the initiative. Community-based management in the three areas where the project was developed was strengthened, with communities deciding to keep their sea cucumber fisheries closed, and to expand their managed areas beyond existing boundaries.

It is hoped that lessons learned can be replicated widely within and outside the country.

For more information

For more information about the Vanuatu community-based fisheries management approach and/or the new "Vanuatu FAD", please contact George Amos, Fisheries Development Officer, Vanuatu Fisheries Department at sio.amos@gmail.com or Graham Nimoho, Manager for Fisheries Development Section at gnimoho@gmail.com.

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