

The role of fisheries resources and community-based coastal resource management activities during a natural disaster – Case study of Vanuatu after Tropical Cyclone Pam

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Abstract

Packing Category 5 winds, Tropical Cyclone Pam struck Vanuatu in March 2015 and seriously damaged southern parts of the country. In the aftermath of this natural disaster, local community chiefs and area councils temporarily opened their traditional conservation areas, known locally as *taboo* areas. Coastal resources provided an important source of protein for communities after the disaster. Questionnaires were used to interview local people in affected areas to determine how they coped with the effects of the cyclone. This case study clarifies the importance of coastal fisheries and effective community-based management in food security, especially in times of emergency. The results of interviews and questionnaire surveys showed that coastal fishery resources were relatively resilient compared with other food sources, especially crops and livestock. It has been concluded that the wise use of coastal fishery resources enhances food security following natural disasters.

Keywords: coastal fisheries, crop and livestock damage, food security, protein supply, emergency food supply, traditional conservation areas

Introduction

Between 12 and 14 March 2015, a Category 5 tropical cyclone (Pam), struck Vanuatu and caused serious damage, especially in southern Vanuatu. It was reported that 16 people were killed and more than 160,000 were injured. There was enormous property damage (OCHA Regional Office for the Pacific D, 2015-4), and the economic loss was estimated at approximately VUV 48.6 billion (USD 494.4 million) (OCHA Regional Office for the Pacific D, 2015-4). After this natural disaster, people in many areas suffered and had difficulties obtaining food, especially protein.

Because of this, staff of the Coastal Fishery Development Division of the Vanuatu Fisheries Department (VFD) permitted some of the no-take zones (traditionally called *taboo* areas) to be temporarily opened for one to two months after the cyclone, to ensure food security. These *taboo* areas were in some of the pilot sites of the 'Promotion of the Grace of the Sea in the Coastal Village Project phase II' (hereinafter referred to as 'Phase II'), which was implemented from 2011 to 2014 by the Japan International Cooperation Agency (JICA) (Nimoho et al. 2013, 2016; Terashima et al. 2018).

VFD staff noted that the temporary opening of *taboo* areas was undertaken mainly in accordance with a plan made through a community-based coastal resource management (CBCRM) approach, in order to promote community-based resource management and introduce alternative ways to reduce the impact on reef resources. Local collaborators who were enthusiastic about the activities of Phase II took an important role in decision-making and dealing with emergencies in affected communities, suggesting that community-based management of fishery resources is effective in providing food security after a natural disaster, such as Cyclone Pam. In addition, Eriksson et al. (2017) suggested that marine resources are important for coastal communities recovering from natural disasters that reduce land-based food availability.

This case study was conducted in 2017 when the affected areas were almost restored to their former state in order to estimate the role of fishery resources and the response of local communities in southern Vanuatu, and examine the importance of the CBCRM approach for securing food for local communities.

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⁶ Tropical cyclones are classified by Categories 1 to 5. Category 5 denotes extremely destructive winds with a speed of, or exceeding, 280 km/h.

Research methodology

Survey sites

The survey sites were selected from the two southern provinces of Shefa and Tafea, which were severely damaged by Cyclone Pam (Fig. 1).

Shefa Province

- Northern remote islands in Shefa Province: Emae Island, Makira Island, Mataso Island, Tongariki Island and Buninga Island
- Lelepa Island and Mangaririu in North Efate

Tafea Province

- Tanna Island (Waisisi)
- Aniwa Island
- Aneityum Island

Literature survey

As part of the case study, a literature survey was conducted to review the documented damages caused by Cyclone Pam, and the emergency support following it. The documents reviewed are listed in Table 1.

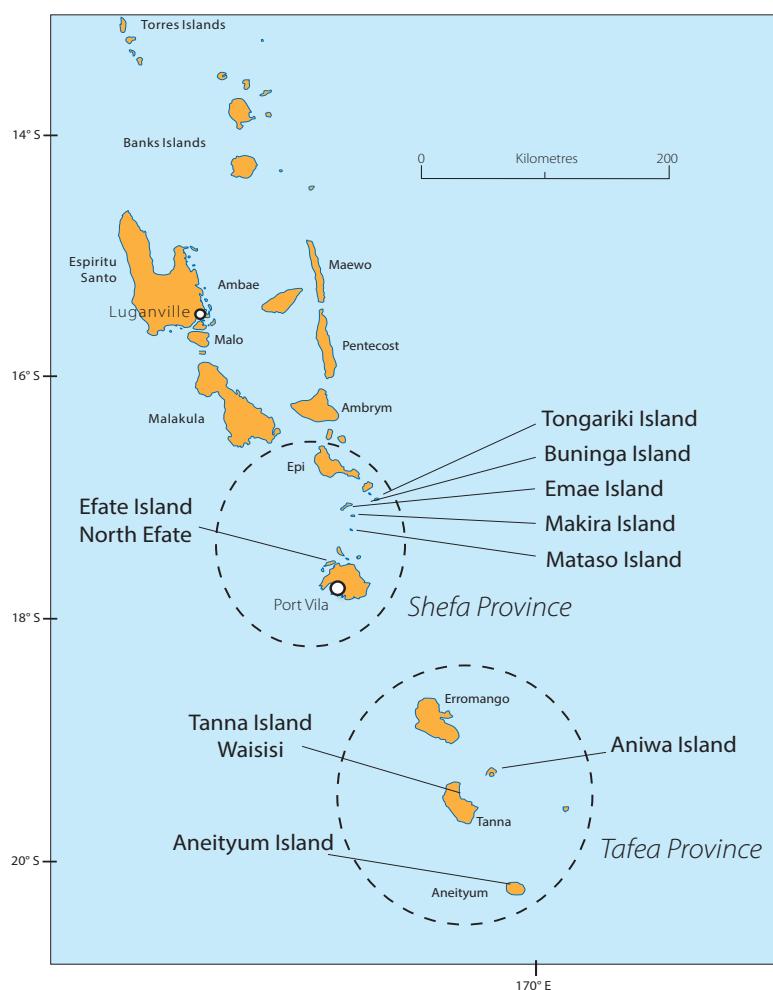


Figure 1. The nine study sites.

Table 1: Documents used in the literature survey.

Source	Title	Publication date
Prime Minister's office, Government of Vanuatu	Vanuatu Post-Disaster Needs Assessment Tropical Cyclone Pam	March 2015
United Nations Office for the Coordination of Humanitarian Affairs (OCHA)	Vanuatu: Severe Tropical Cyclone Pam Situation Report No.2	March 2015-1
OCHA	Vanuatu: Severe Tropical Cyclone Pam Situation Report No.6	March 2015-2
OCHA	Vanuatu: Severe Tropical Cyclone Pam Situation Report No.9	March 2015-3
OCHA	Vanuatu: Severe Tropical Cyclone Pam Situation Report No. 12	March 2015-4
International Federation of Red Cross and Red Crescent Societies	Tropical Cyclone Pam: One-year progress report	March 2016
Pacific Community	Tropical Cyclone Pam Lessons Learned Workshop Report	June 2015
Community of Lelema	Community Based Coastal Resource Management (CBCRM) Plan for West Efate-Lelema Area	October 2014
Community of Aneityum	Community Based Coastal Resource Management (CBCRM) Plan for Aneityum	October 2014

Telephone surveys

For the remote northern islands without regular transportation service such as Makira and Mataso islands in Shefa Province, we contacted area secretaries, chairpersons of fisherman’s associations and VFD staff by phone to understand the scope of the damage in those islands and to learn how people were coping due to the lack of regular transportation in the area.

Interview surveys

The authors visited Emae Island, Lelepa Island, Mangaliliu on Efate (Shefa Province), and Waisisi on Tanna Island, Aniwa Island and Aneityum Island (Tafea Province), where regular transportation was available, and conducted interviews in the villages with authorised officers and village representatives such as chiefs.

Questionnaire surveys

A questionnaire survey was conducted to understand the socioeconomic situation before and after the cyclone and the responses of local communities to the natural disaster.

Results

Literature survey

The route of Cyclone Pam

The route of Cyclone Pam, which struck Vanuatu between 12 and 14 March 2015, is shown in Figure 2. It passed quite close to Efate Island and then moved south, passing very close to Erromango and Tanna islands causing severe and widespread damage on those islands.

Damage caused by Cyclone Pam

The damage described in the ‘Severe Tropical Cyclone PAM Situation Report No.12’ is shown in Table 2.

Table 2. Overall damage of Cyclone Pam.

Fatalities	16
People in evacuation centres	3995
People affected by the cyclone	166,000
Islands affected by the cyclone	22

Source: OCHA Regional Office for the Pacific (2015-4)

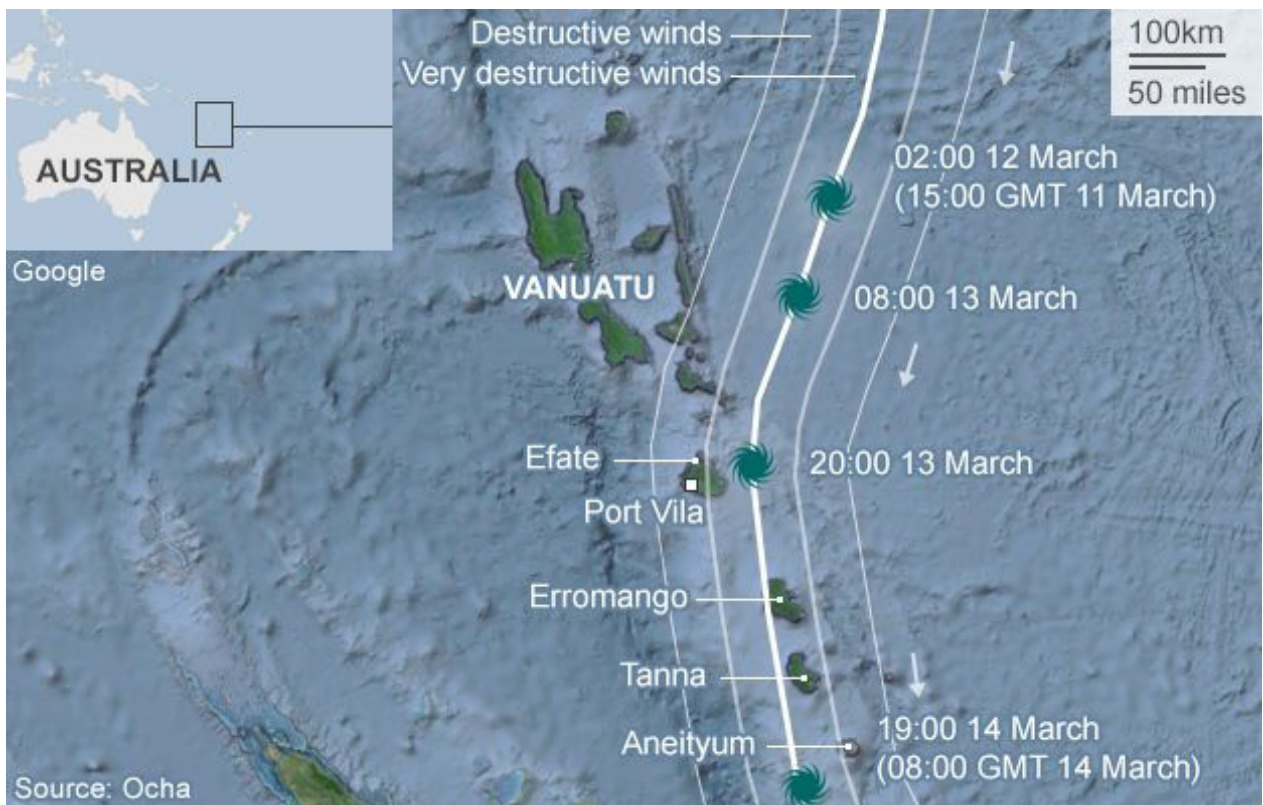


Figure 2. The route of Cyclone Pam. (Source: UN Office for the Coordination and Humanitarian Affairs)

According to the Government of Vanuatu (2015), the total economic damage caused by Cyclone Pam was estimated at approximately VUV 48.6 billion (USD 449.4 million). Of this, VUV 19.3 billion (USD 178.5 million) was regarded

as a total loss. All of the damage combined was more than 64% of Vanuatu's gross domestic product. Details of damage are described in Table 3, and some scenes of the disaster are shown in Figure 3.

Table 3. Summary of damage by sector.

	Damage by natural disaster (VUV million)			Ratio of disaster damage (%)		Lost personal income
	Partly damaged	Total losses	Total	Private	Public	VUV million
Productive sector	8526	10,403	18,928	98	2	1607
Agriculture	1421	4641	6062	93	7	227
Commerce and Industry	1196	2152	3348	100	0	487
Tourism	5908	3610	9518	100	0	983
Social sector	14,339	630	14,969	67	33	-
Housing (private)	9452	440	9893	100	0	-
Health	870	107	977	1	99	-
Education	3908	79	3987	0	100	-
Culture	109	3	112	100	0	-
Infrastructure	6403	2926	9329	51	49	-
Transport	3017	2137	5155	43	57	-
Public buildings	532	12	544	0	100	-
Water	414	284	697	63	37	-
Energy	179	106	285	100	0	-
Communication	2261	387	2648	67	33	-
Cross-cutting sector	0	5328	5328	0	100	-
Environment	0	5328	5328	0	100	-
Grand total	29,268	19,286	48,554	69	31	1607

Source: Government of Vanuatu 2015

International aid after Cyclone Pam

International food aid was provided to the following provinces that were damaged by Cyclone Pam: Tanna, Shefa, Malampa, Penama and Torba. The amount of food provided to these provinces is shown in Table 4. Among these supplies, tinned fish was important for providing protein to communities during the emergency period.

Details of the damage and how coastal communities coped are given hereafter.

Remote islands adjacent to the northern area of Efate Island

Damage situation for Makira and Mataso islands

On Makira and Mataso islands, it took approximately one and a half months until emergency food arrived after Cyclone Pam. Some support was transported by the National Disaster Management Office; it was then distributed by the Village Disaster Committee. Distribution amounts were decided on according to household size. While waiting for supplies and support from the government, people asked for support from other islands. Although it was not enough, some support came from relatives of other islands.

Many of the coral reefs were seriously affected by sand that had washed onto them. Sand erosion changed the landscape of beaches and many coastal trees withered. However, there was no information regarding direct damage to fishery resources.



Coconut palms collapsed on a livestock breeding facility in Teoma, Efate Island, Shefa Province.



Houses destroyed in Malalip, Efate Island, Shefa Province.



Collapsed bridge in Teoma, Efate Island, Shefa Province.



Poultry farm destroyed in Teoma, Efate Island, Shefa Province.

Figure 3. Some of the consequences of Cyclone Pam’s passage over Vanuatu. (images: William Morris, VFD)

Table 4. International food aid sent to provinces that were damaged by Cyclone Pam.

Province/island	Number of households	Population (household × household size)	Rice		Tinned fish		Tinned meat		Instant noodles	
			Overall (tonnes)	Per capita (kg)	Overall (tonnes)	Per capita (kg)	Overall (tonnes)	Per capita (kg)	Overall (tonnes)	Per capita (kg)
Tafea Province	6116	33,657	193.0	-	17.0	-	8	-	7	-
Tanna Island	5535	30,443	175.1	5.8	15.0	0.5	7.0	0.2	6.0	0.2
Aneityum Island	176	986	5.6	5.7	0.5	0.5	0.2	0.2	0.2	0.2
Shefa Province	22,378	111,944	343.4	-	9.7	-	4.6	-	3.8	-
Emae Island	99	495	2.9	5.9	0.2	0.5	0.1	0.2	0.1	0.2
Tongoa Island	454	2270	13.1	5.8	1.1	0.5	0.5	0.2	0.5	0.2
Buninga Island	23	134	0.8	6.0	0.1	0.5	0.03	0.2	0.03	0.2
Tongariki Island	55	415	2.4	5.8	0.2	0.5	0.1	0.2	0.1	0.2
Mataso Island	20	100	0.6	6.0	0.1	0.5	0.03	0.3	0.02	0.2
Makira Island	37	125	0.8	6.4	0.1	0.5	0.03	0.2	0.02	0.2
North Efate	499	2494	14.4	5.8	1.2	0.5	0.6	0.2	0.5	0.2
Lelepa Island	83	415	2.4	5.8	0.2	0.5	0.1	0.2	0.1	0.2
Malampa Province	4098	9887	51.5	-	0	-	2.1	-	1.8	-
Penama Province	4581	22,903	207.0	-	0	-	5.0	-	5	-
Torba Province	112	582	3.4	-	0	-	0.1	-	0.1	-

Many fishing canoes were severely damaged, but most boats suffered only minor damage.⁷ One week after the passage of Cyclone Pam, the *taboo* area was opened, and local people could catch reef fish. The *taboo* area remains open more than two years after the disaster. After Cyclone Pam, fish aggregating devices and solar freezers were provided to support fisheries reconstruction.

In terms of agriculture, most surface crops were damaged, and people survived by eating root crops such as cassava and taro. They also ate fallen bananas until emergency relief supplies arrived. The recovery of farm production requires a long time, such as six to seven months for cassava, and three to four months for sweet potato. The few remaining chickens, goats and pigs were eaten within several months of the disaster. However, fishery products were the only source of animal protein just after the disaster.

On Makira and Mataso islands, reef resources have been recognised as being very important since ancient times, and there is no particular change in people's views on the importance of reef resources before and after the cyclone.

Damage situation on Tongariki and Buninga islands

According to interviews with area secretaries of Bonginga and Tongarika islands, and interviews with heads of the fishermen's association on Tongariki Island, it took two to three weeks until people received support due to the communication network being broken down. Support was distributed through the Village Disaster Committee.

In coastal areas, seagrass and algae beds were destroyed by the waves and many of the shellfish in the rocky areas were washed away.

Approximately 20 fishing canoes were damaged, while two aluminium boats were safely sheltered before the approach of Cyclone Pam. A solar freezer and its contents, donated by the French Embassy, were severely damaged. After Cyclone Pam, it was difficult to catch fish without canoes, and catches declined immediately. Local people consumed crab and clams collected on the reef at ebb tide as sources of animal protein. Although the *taboo* area existed, it had already been opened before Cyclone Pam.

In terms of agriculture, all farm gardens with major crops such as taro, banana, yam and orange were damaged. People survived by consuming fallen bananas and root crops. Cultivation of some root crops such as taro and yam recovered about three months after Cyclone Pam, but due to further damage caused by El Niño-associated bad weather, it took six months to recover completely. Livestock such as cows, pigs and goats starved to death.

The community feels that coastal resources are important because they could only catch and eat crab and clams after the natural disaster.

Interview survey in the target site

Emae Island (Marae, Tongamea and Sangava villages)

The damage status of the three major villages on Emae Island is shown in Table 5.

In Marae, most crops were damaged. Since fishing gear such as spearguns were included in emergency relief supplies, local people relied on fisheries as food and income sources. Due to the long time required for the recovery of agricultural crops, people relied on fishery products more than ever, and fishing

Table 5. Damage status in Emae Island

Damage to houses	Marae	59 houses out of 65 were damaged
	Tongamea	37 houses out of 42 were damaged
	Sangava	95% of the houses were damaged and only four houses were safe
Damage to boats and canoes	Marae	All six boats were damaged
	Tongamea	No damage to boats, although 4 canoes out of 10 were damaged
	Sangava	One boat out of four was damaged.
Damage to gardens	Marae	Leaves and stems of crops were broken in all gardens and were devastatingly damaged. However, cultivation was started for cassava (six to seven months until harvest) and sweet potato (three months until harvest) again after the cyclone's passage. However, coconut tree and kava cultivation had not resumed at the time of survey – two years after the cyclone's passage.
	Tongamea	All leaves and stems of crops in all gardens were broken or devastated. As of 2017, field crops were returning to normal.
	Sangava	Crops in all gardens were destroyed. The crop land was still in the process of recovery when we visited. Since this was the most populated area on Emae Island, it had not yet reached full self-sufficiency in 2017.

⁷ 'Boat' in this article refers to the small plywood, aluminium or fiberglass boats used by coastal fishers in Vanuatu.

activities increased in the foreshore area. Marae's chief was concerned about the reduction of fishery resources because of these efforts and proposed that the Village Council establish a *taboo* area. A *taboo* area measuring 2000 m × 500 m was established at Marae's foreshore on 3 September 2015, six months after Cyclone Pam. Within this *taboo* area, catching fish, shellfish and crustaceans is prohibited.

In Tongamea, most crops were damaged and the chief decided on 15 May 2015 to open the *taboo* area for three months so that crops could recover and be harvested again. The *taboo* area was closed on schedule in September 2015. According to an interview with the female group, the *taboo* area was at the edge of the village and the foreshore in the centre of the village was open to fishing. Therefore, the *taboo* area was well maintained.

In Sangava, most crops were damaged. Until one month before emergency supplies arrived, local people staved-off hunger with supplies from relatives living in Port Vila and by fishing. There was a proposal by the local villagers for opening the *taboo* area, and it was decided by the Village Council to open it one week after Cyclone Pam's passage. Sangava is the most populated community on Emae Island. Restoration of crops was delayed and supplies could not keep up with demand. Therefore, coastal fishery resources were indispensable in this emergency situation.

Lelepa Island and Mangaliliu Village

The level of damage on Lelepa Island and the village of Mangaliliu on Efate Island (Phase II sites) is shown in Table 6.

On Lelepa Island and in Mangaliliu Village, damage to houses and fishing gear was relatively minor. According to interviews with an authorised officer, a former community counterpart of Phase II, local people predicted Cyclone Pam using a traditional way of checking the movement of stars with certain overlapping branches of trees. They then prepared for the disaster. Nevertheless, farms were severely damaged in

Mangaliliu, and it was difficult to obtain staple foods such as cassava, sweet potato and island cabbage. Lelepa Island has a recurrent and serious problem with the supply of drinking water and it was extremely difficult to obtain potable water after Cyclone Pam. Water was transported to Lelepa many times from Efate Island. According to interviews with the authorised officer on Lelepa Island, Mangaliliu people could access Port Vila and its resources by land. But, on Lelepa, there was a shortage of water and food.

Emergency supplies were distributed based on results of the damage survey, and it took up to one to two weeks to distribute them. Until the emergency supplies arrived, private donations were made by individuals and non-governmental organisations such as the World Heritage Committee. Although emergency relief supplies began arriving one week after the disaster, they consisted mainly of rice and tinned foods. Lelepa's authorised officer was concerned about the residents' unbalanced diet, and so consulted with members of the Marine Protected Area Committee in Mangaliliu to open the *taboo* area temporarily and then proposed it to the chiefs. Fishing in most parts of *taboo* areas was then permitted for coastal fishery resources, except for rare and endangered shellfish (i.e. trochus and green snail, the taking of which was banned by the Fisheries Act). However, in the *taboo* area at Hat Island – a World Heritage site – all fishing activities were still prohibited. In addition, fish caught in the *taboo* area were not allowed to be sold. Although fishing in the *taboo* area was only temporarily allowed, it was acknowledged that fishers were thus able to provide protein to the local population, which contributed greatly to alleviating anxiety concerning food security. Approximately one month after opening the *taboo* area, the authorised officer confirmed that the lives of the locals had returned to almost normal and so recommended closing the *taboo* area again. And because this was approved by the community, the *taboo* area was closed again. The authorised officer played a central role in resource management, in part due to his knowledge of the CBCRM planning that he learned about in Phase I and Phase II of the 'Grace of the Sea Project'.

Table 6. Damage in Lelepa Island and Mangaliliu Village.

Damage to houses	Lelepa	Roofs of two houses were broken.
	Mangaliliu	0
Damage to boats and canoes	Lelepa	0
	Mangaliliu	Five to six canoes were damaged because it took a long time to fix the roof above them and there was no time to move them. The sailing canoe that had been provided by Phase II was also damaged.
Damage to gardens	Lelepa	Originally, there were few gardens on the island, and there was little damage.
	Mangaliliu	All leaves and stems of crops such as cassava and yam were broken. As of 2017, these crops had recovered, but it has been difficult to cultivate yams due to salt damage.

In addition, according to an interview with the authorised officer, after the passage of Cyclone Pam, a large group of skipjack was seen around the fish aggregation device (FAD) that had been deployed during Phase II of the project. Approximately 20 fishermen fished around it and caught 10–30 skipjacks each time, selling most of them and keeping some for themselves. It was a precious source of income after the disaster. The group of skipjacks was seen around the FAD for about a month thereafter, but it gradually declined and is now gone.

Waisisi, Tanna Island

The level of damage in Waisisi Village on Tanna Island is shown in Table 7.

Table 7. Damage in Waisisi village.

Damage to houses	All houses collapsed
Damage to boats and canoes	11 out of 15 fiberglass boats, and 60 out of 100 canoes were damaged
Damage to gardens	All gardens were damaged, but crops in the field had recovered to their original state as of 2017

In Waisisi, Cyclone Pam caused serious damage to crops. People ate what remained such as cassava, bananas, mushrooms and fish for two weeks before the arrival of emergency supplies. Originally, speargun fishing was banned in the *taboo* area, but other fishing activities were not restricted. In addition, there was no request for opening the *taboo* area by local people. Fishers of Waisisi community were familiar with offshore fishing so could fish in the surrounding offshore areas without touching the *taboo* area.

Ikoukau, Isavai and Imatu on Aniwa Island

Damage in Ikoukau, Isavai and Imatu on Aniwa Island is shown in Table 8.

Emergency supplies (e.g. rice, tinned food, toothpaste, soap, towels, clothes, water) were delivered by Care International approximately a week after Cyclone Pam struck. The support was continued for several months. As shown in Figure 5, there was a small *taboo* area in Ikoukau and a *taboo* area in the lagoon. Cyclone Pam passed at the time of the usual opening of the *taboo* area inside the lagoon. Therefore, the *taboo* area was opened without special consideration for food procurement during the emergency period. In the lagoon, fish such as mullets and emperors were caught and became a protein source for Aniwa's local population. Following Cyclone Pam, new *taboo* areas were established in Isavai and Imatu (see Table 9 and Fig. 6) as a result of awareness raising by several projects and through initiatives of the chief, who was concerned about the decline in resources.

Table 8. Damage on Aniwa Island.

Damage to houses	Ikoukau	About 80% of houses were damaged.
	Isavai	Before Cyclone Pam, the non-governmental organisation Care International had taught cyclone prevention measures to the local population. As a result, houses were virtually undamaged and only school classrooms were destroyed.
	Imatu	4 out of 22 houses collapsed
Damage to boats and canoes	Ikoukau	20 out of 35 canoes were damaged
	Isavai	No damage to boats, but two outboard motors were damaged
	Imatu	20 out of 42 canoes were damaged
Damage to gardens	Ikoukau	All gardens were damaged, although crops had returned to normal by 2017. However, many orange trees, which are special products, broke and had not completely recovered by 2017.
	Isavai	In about 95% of gardens, there was some damage to crops, although crops had returned to normal by 2017. However, many orange trees had not completely recovered. The gardens also suffered drought damage and restoration was further delayed.
	Imatu	About 100% of the gardens were damaged although crops had returned to normal by 2017, except for most orange trees.

Table 9. New *taboo* areas established after Cyclone Pam.

Isavai	Since 2016, a taboo area (2500 m × 100 m) was established in the eastern part of the island. Within this area, all fishing is banned. This taboo area was established as a result of support by the Vanuatu Coastal Adaptation Project conducted by the Pacific Community.
Imatu	Taboo area (500 m × 50 m) was established in front of Imatu in 2017. All fishing is prohibited within it. At present, there is an open taboo area, but the chief is considering opening and closing two taboo areas alternately.

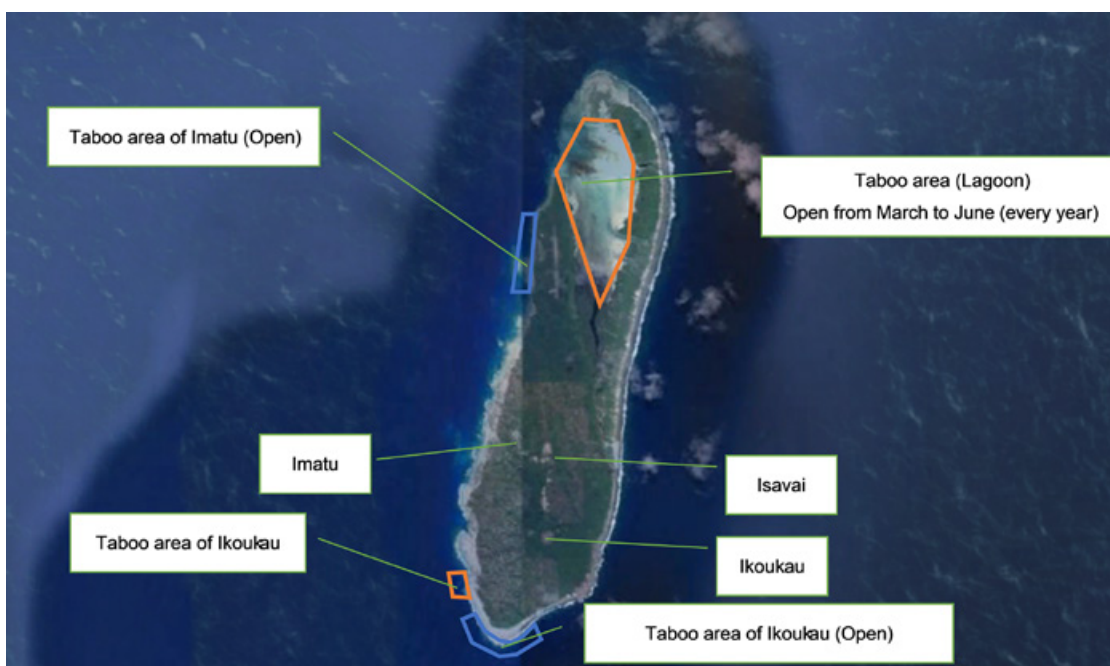


Figure 5. *Taboo* areas on Aniwa Island before Cyclone Pam.

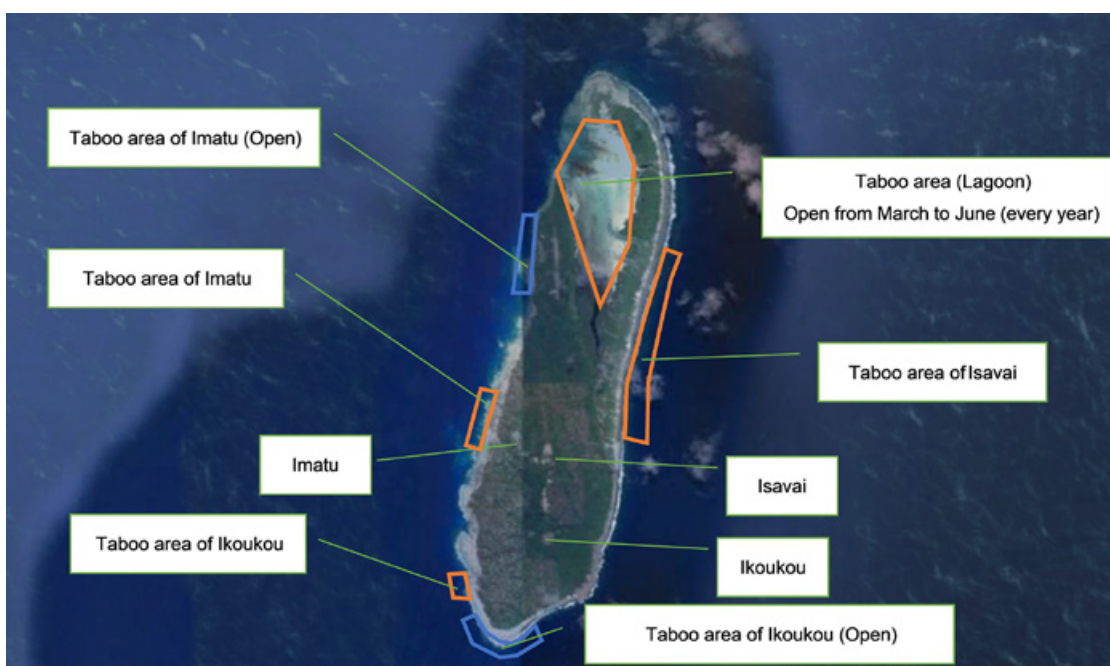


Figure 6. *Taboo* areas established on Aniwa Island in April 2017.

Aneityum (Phase II site)

The level of damage on Aneityum Island is shown in Table 10.

Table 10. Damage on Aneityum Island.

Damage to houses	3 houses out of 400 were completely destroyed; repairs to the roofs And other parts were carried out by community members
Damage to boats and canoes	Community members helped each other move boats and canoes to a safe place before the cyclone arrived, and therefore, they were not severely damaged. Canoe repairs were carried out by community members.
Damage to garden	Analcohat (southern part of Aneityum Island): Nearly 80% of cassava, taro and other crops were damaged. Port Patrick (northern part of Aneityum Island): Damage was significant due to the influence of waves and wind, but details are unknown.

On Aneityum Island, the souvenir shops and airport collapsed but damage on the main island side was relatively minor, because information about the cyclone had been provided one week ahead by the Cyclone Disaster Committee (CDC) in coordination with government agencies. Therefore, two hours before the arrival of Cyclone Pam, local people from the flood zone and the coastal area went to the evacuation centre.

It took a month to receive emergency relief supplies, which consisted mainly of rice, noodles, tinned food and water, which was distributed by CDC throughout the entire island. Furthermore, with the guidance of CDC, many households had stored their water and food safely in advance of the cyclone.

In addition, in the community of Aneityum Island, bananas and bread are prepared as 'preservation food' in preparation for disasters such as cyclones. The traditional preservation method for food was as follows. Bananas and breadfruits were wrapped in banana leaves and put in holes. If wrapping leaves are replaced every six months, bananas and breadfruits can usually be preserved for two to three years. Community members also stockpiled staple food, such as cassava and taro in advance of the cyclone. Cassava, banana and taro can be preserved for three days, three weeks and about one month, respectively. Sweet potato did not suffer severe damage and could be harvested again two months after Cyclone Pam. Cassava could be harvested after three months and taro and banana were harvestable after one year.

The *taboo* area in the Mystery Island off the coast of Aneityum Island, was not opened after the cyclone. However, some other *taboo* areas were opened, after approval of the landowners, but restrictions were placed on certain fishing methods and species. These decisions were advised by the Marine Protected Area Committee. Opening of the *taboo* areas ended after one month in some places and all *taboo* areas were closed again within seven weeks.

Questionnaire surveys

A questionnaire survey was carried out to verify the effects of actions taken for food security during the natural disaster. The questionnaires were distributed as shown in Tables 11 and 12.

Table 11. Distribution of the questionnaire in Shefa Province.

Name of communities	Lelepa Island	Mangaliliu Efate Island	Emae Island (Marae, Tongamea, Sangava villages)
Number of households surveyed	81	25	46
Number of whole households	99	76	168
Percentage of surveyed households in whole household	82%	32%	27%

Table 12. Distribution of the questionnaire in Tafea Province.

Name of communities	Aneityum Island (Analcohat)	Waisisi, Tanna Island	Aniwa Island
Number of households surveyed	36	28	24
Number of whole households	130	100	91
Percentage of surveyed households in whole household	28%	28%	26%

The sex and age ratio of respondents in households in this survey are shown in Table 13.

Table 13. Sex and age ratio of respondents in the surveyed households.

Age		20–29	30–39	40–49	50–59	More than 60	No answer
Lelepa Island	Men	7 18%	6 16%	8 21%	11 29%	5 13%	1 3%
	Women	5 12%	16 37%	8 18%	6 14%	5 12%	3 7%
Mangaliliu	Men	3 18%	5 28%	4 24%	2 12%	3 18%	0%
	Women	0%	5 62%	3 38%	0%	0%	0%
Aneityum Island	Men	1 20%	1 20%	2 40%	1 20%	0%	0%
	Women	1 33%	0%	2 67%	0%	0%	0%
Emae Island	Men	7 23%	6 20%	4 13%	9 30%	3 10%	1 4%
	Women	3 19%	3 19%	2 12%	6 38%	2 12%	0%
Waisisi, Tanna Island	Men	3 17%	4 22%	6 33%	1 6%	2 11%	2 11%
	Women	4 40%	2 20%	4 40%	0 0%	0 0%	0 0%
Aniwa Island	Men	3 25%	2 17%	4 33%	1 8%	2 17%	0%
	Women	1 8%	5 42%	4 34%	0 0%	1 8%	1 8%

The sex and educational background of respondents in households in this survey are shown in Table 14.

Table 14. Sex and educational background of respondents in surveyed households

	Lelepa Island		Mangaliliu, Efate Island		Aneityum Island		Emae Island		Waisisi, Tanna Island		Aniwa Island	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Educational background												
No school	26 68%	3 7%	1 6%	0 0%	1 20%	0 0%	0 0%	0 0%	3 17%	2 20%	2 18%	2 17%
Primary school	7 18%	34 79%	13 76%	5 62%	2 40%	0 0%	19 66%	10 63%	10 55%	4 40%	4 33%	7 58%
Secondary school	1 3%	6 14%	2 12%	2 25%	0 0%	0 0%	10 34%	5 31%	5 28%	2 20%	4 33%	2 17%
High school	0 0%	0 0%	0 0%	1 13%	1 20%	2 50%	0 0%	1 6%	0 0%	0 0%	0 0%	0 0%
University	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Other	1 3%	0 0%	1 6%	0 0%	1 20%	1 25%	0 0%	0 0%	0 0%	1 10%	1 8%	1 8%
No answer	3 8%	0 0%	0 0%	0 0%	0 0%	1 25%	0 0%	0 0%	0 0%	1 10%	1 8%	0%
Total	38 100%	43 100%	17 100%	8 100%	5 100%	4 100%	29 100%	16 100%	18 100%	10 100%	12 100%	12 100%

The general focus of the questionnaire survey was on the importance of marine resources for food security, and the role of fishery resource management during and after natural disasters.

1) Importance of marine resources for food security after a natural disaster

Fisheries products became one emergency food source at the time of a natural disaster

The type of food consumed on Lelepa Island and in Mangaliliu after the impact of Cyclone Pam until emergency assistance arrived is shown in Figure 7.

On Lelepa Island and in Mangaliliu Village, many households used fisheries products during the disaster, especially

Mangaliliu, where 52% of surveyed households answered that they ate only fish and shellfish after Cyclone Pam for up to three weeks. Before the disaster, community people said that root crops such as cassava and taro were the centre of the meal, and that fish and shellfish were supplementary food. Therefore, it seems that coastal resources are an important source of food during an emergency. In addition, among the sites surveyed, livestock died due to insufficient feed on many islands where damage was severe, and so fishery resources – which were accessible from the coast even when canoes and boats were damaged – became a critical source of animal protein for the population after the disaster. In communities where a *taboo* area had been established, the *taboo* area served as an emergency food store

Fishing days in the *taboo* areas before emergency supplies arrived are shown in Figure 8.

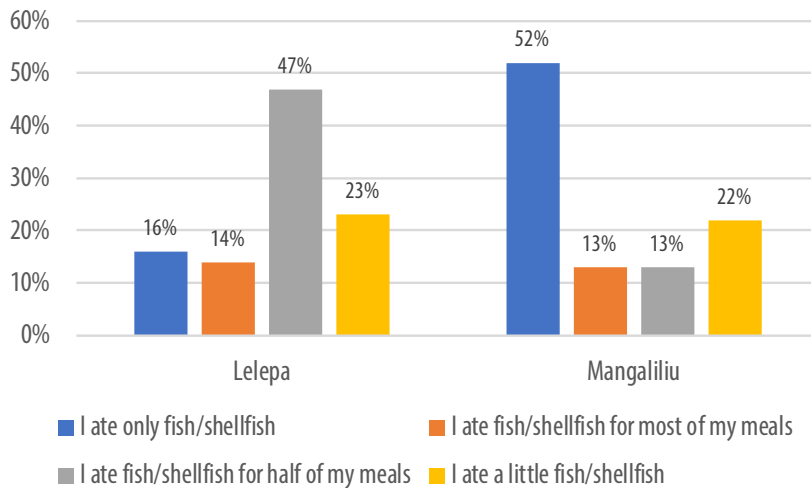


Figure 7. Finfish and shellfish consumption in surveyed households of Lelepa Island and Mangaliliu Village after Cyclone Pam.

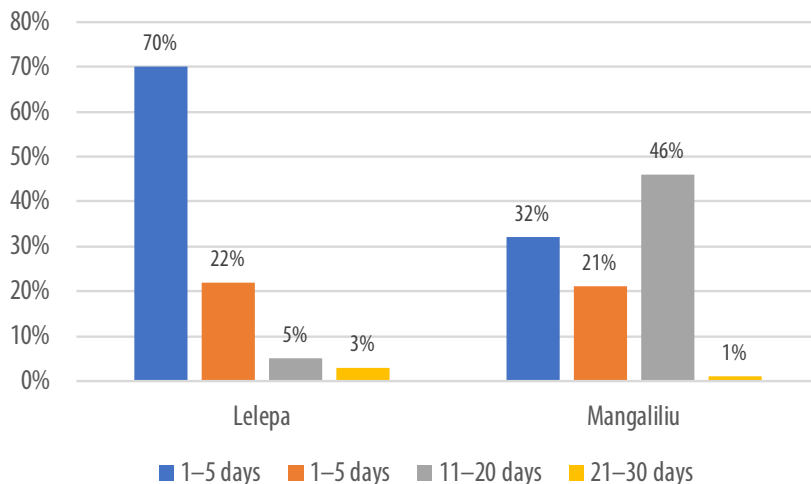


Figure 8. Number of days using the *taboo* area before emergency supplies arrived after Cyclone Pam, Lelepa Island and Mangaliliu Village.

On Lelepa Island, 70% of the surveyed households used the *taboo* area for one to five days. According to interviews, emergency supplies arrived one or two weeks after Cyclone Pam, so many households used the opened *taboo* area during the first half of this period. In Mangaliliu Village, many households used the *taboo* area almost every day until emergency supplies arrived.

2) *The role of fishery resource management during and after natural disasters*

During the survey carried out on Lelepa Island and Mangaliliu, people were asked: ‘Do you agree that the expansion

of the *taboo* area was useful to secure fishery resources?’ Answers are summarised in Figure 9. More than 90% of surveyed households answered that the expansion of the *taboo* area was useful for resource management and the provision of emergency food.

In addition, people were asked: ‘Were you mindful of food security by conducting marine resource management activities before Cyclone Pam?’ A high percentage of surveyed households answered positively, as show in Figure 10. This may indicate that many community people consider that the *taboo* area is functioning to ensure food security.

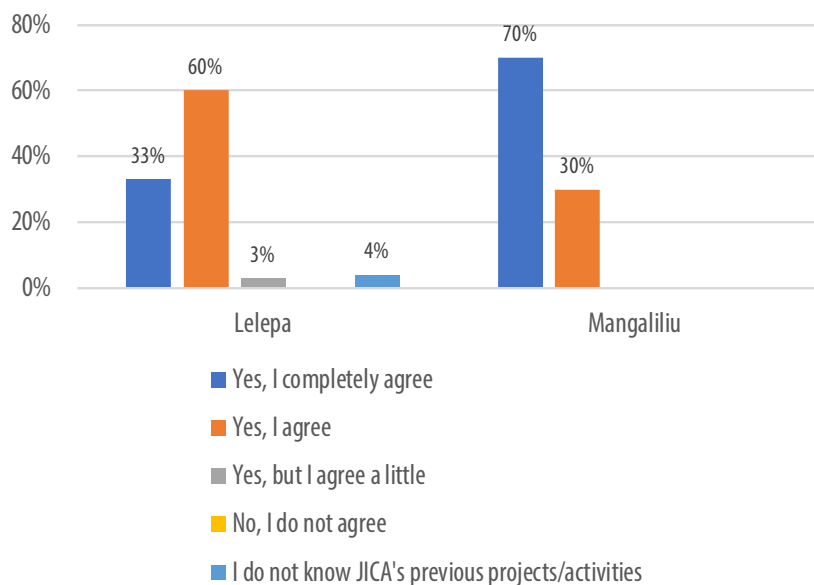


Figure 9. Household responses from Lelepa Island and Mangaliliu Village to the question ‘Do you agree that the expansion of the *taboo* area was useful to secure fishery resources?’

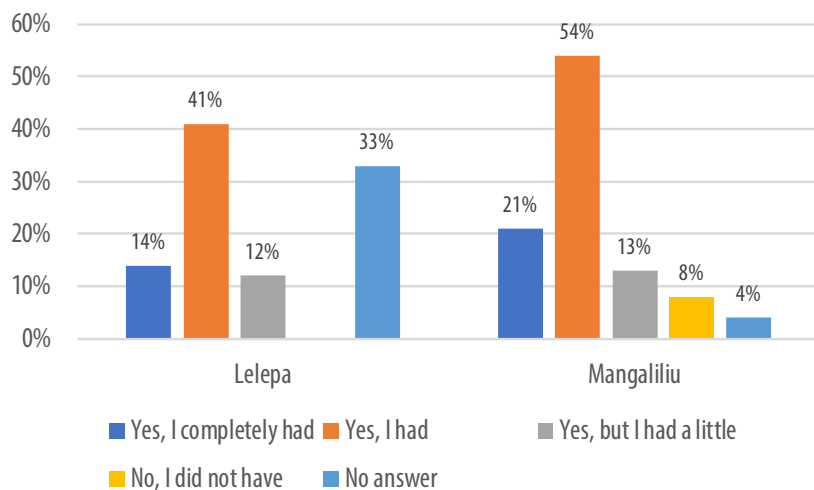


Figure 10. Household responses from Lelepa Island and Mangaliliu Village to the question: ‘Have you ever felt that *taboo* areas could help food security before the Cyclone Pam disaster?’

Answers to the question: ‘Should resource management activities be continued in your community in the future?’ are shown in Figure 11. A high percentage of positive responses were given at every survey site, and every site wants to continue resource management activities in the future.

However, answers to the question ‘Is the continuation of resource management possible?’ differ by community, as shown in Figure 12.

On Lelepa Island, the entire island is a *taboo* area, so many locals seem to think the *taboo* area may be too large. On Aniwa Island, where a large *taboo* area was established after Cyclone Pam, more than half the people answered that it is possible, but many people also considered that a smaller area is better.

In view of the above, it seems that the motivation for the continuation of fishery resource management has declined over time in the community with a large *taboo* area, although people recognise the importance of fishery resources and fishery resource management.

Conclusion

According to the data we collected, fishery resources are an important source of food, especially of animal proteins, during the emergency situation that follows natural disasters, such as Cyclone Pam. Fishery resources are more resilient to natural disasters than agricultural and livestock products. So, it can also be said that they contribute to the climate change resilience of local population in coastal areas. Aquaculture activities can also contribute to food security in emergencies, and can therefore play an important role in the livelihoods of communities in inland areas.

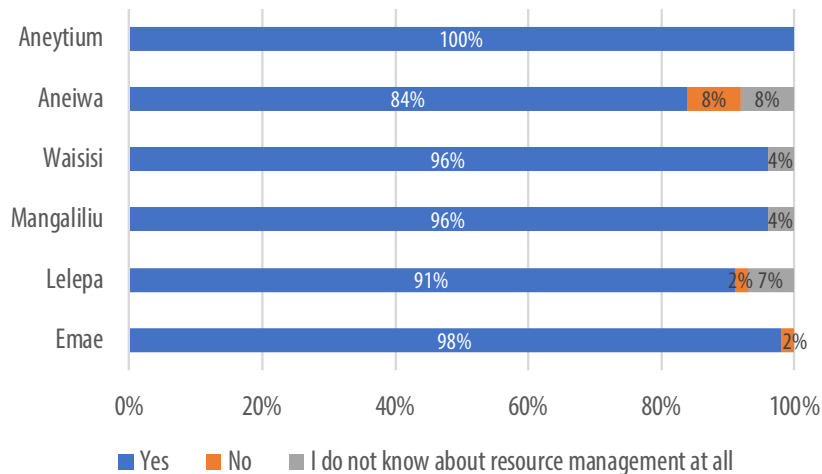


Figure 11. Answer to the question ‘Should resource management activities be continued in your community in future?’

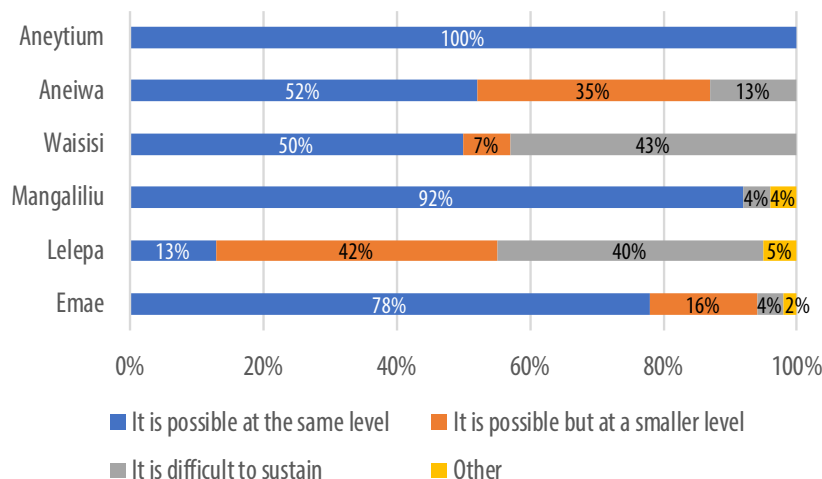


Figure 12. Answers to the question ‘Is the continuation of resource management possible?’.

A number of communities opened their *taboo* area for their members. Some communities, especially in target sites of CBCRM activities, opened their *taboo* area for a limited period to survive during a major catastrophe, with rules limiting fishing gears that could be used and target species. The cases mentioned above should be noted as an excellent example of a wise use of marine resources based on community rules.

In addition, after Cyclone Pam, new *taboo* areas were set up in Emae and Aniwa Islands. This might be due to local people realising the importance of fishery resources for their livelihood after experiencing such a tragic natural disaster. It seems that these communities are now concerned about excessive catch of fishery resources. The CBCRM approach seems to contribute greatly to food security and resilience of communities following a natural disaster. We believe that the CB-CRM approach also enhances consciousness of coastal resource management in local communities.

On the other hand, even though local people recognise the importance of fishery resources, it may be difficult to maintain or further expand large *taboo* areas. Although being effective for resource conservation and food security, very large *taboo* areas increase dissatisfaction among local fishers. Therefore, it is necessary to have a balanced approach when defining how much space is appropriate for the *taboo* area as a disaster countermeasure.

It is also necessary to balance the effects of coastal resource management measures, by offering alternatives such as the utilisation of untapped natural resources, the development of new resources with the transplantation of less-mobile organisms, such as clams, or the deployment of artificial reefs in protected areas. When new fishing activities develop, it is of course necessary to ban *taboo* areas completely, but also to take measures to manage the resource while considering the interests of fishers and the community. In the decision process, VFD and the local population must thoroughly discuss while respecting the opinion of the chiefs.

Fishery products will continue to play an important role in food security during natural disasters. VFD must continue to motivate and support local populations in their coastal resource management activities. It must also encourage their ownership of these management activities. CBCRM has a great role to play, especially in small island nations of the Pacific that are vulnerable to the large-scale effects of climate change.

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