



Impact of Tropical Cyclone Winston on Fisheries-Dependent Communities in Fiji



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Cover Photo:
Destruction to Nasau Village in Koro. © Isoa Koroiwaqa/WCS



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Team conducting cyclone assessment in Yaqaga Village. © WCS



Survey team conducting village assessments in Bua Province. © WCS



Team conducting an assessment in Tavua. © Kini Ravonoloa/FLMMA



Fisherwoman being surveyed in Naivaka Village. © WCS



FLMMA assessment team in the Yasawas. ©FLMMA

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Damaged branching corals in Namena Marine Reserve. ©Jack & Sue Drafaht

Executive Summary



Church damaged during cyclone Winston. © Kini Ravonoloa/FLMMA

Key Findings

On 20 February 2016, Fiji was hit by Category 5 Tropical Cyclone Winston. It was one of the largest cyclones Fiji had experienced and the government-led Post-Disaster Needs Assessment (PDNA) estimated the total value of the damages and losses for the country at FJ\$1.99 billion. The timing of the PDNA did not allow the collection of new data to quantify the impact of Cyclone Winston on fisheries-dependent communities. Without this data, it was difficult to quantify the degree and extent to which different coastal villages, districts and provinces were impacted, and therefore the strategies needed to support communities in their recovery process.

On the request of the Department of Fisheries, the Wildlife Conservation Society developed a post-disaster socioeconomic questionnaire with inputs from Fiji-based partners, to assess the impact of Cyclone Winston on fisheries-dependent communities in Fiji to inform national recovery and rehabilitation efforts. Specifically, the assessment aimed to:

- i. estimate the impacts of Cyclone Winston on fishing infrastructure (e.g. boats, engines and gear) and provide a monetary estimate to government of damages and losses;
- ii. assess the communities' dependence on local fisheries to determine the impact on food security and livelihoods; and
- iii. provide a transparent system for ranking impact to local communities to help guide the recovery and rehabilitation efforts of government and development agencies.

The report draws heavily on FAO guidance for post-disaster response and the methodology is aligned to the national PDNA. Surveys were conducted in April and May 2016 across 154 villages, 36 districts and 6 provinces that were directly along the path of the cyclone in Fiji. The only province that was not surveyed was Lau due to inaccessibility and challenges conducting the assessment. Surveys focused on coastal villages and represented only a proportion of the total villages in each province. Most of the communities in these coastal areas were i-Taukei. All figures presented in this report are in Fijian dollars.

Overall, the damages and losses to boats, engines, fishing and post-harvest gear, and to fish aggregating devices ranged from \$205,578 to \$954,581, and totaled \$2,964,139. There were large differences in the losses and damages to boats and engines across districts and provinces, often based on their precise location within the cyclone impact zone. Individual districts recorded losses and damages up to \$93,481 for boats, and up to \$151,834 for boat engines. It is important to note that the estimates of damage are below the actual amount as not all villages were surveyed due to time constraints and resources. Surveys focused on coastal villages as we assumed that they would be more reliant on fisheries resources than inland villages, and thus most impacted.

Data collected on damages and losses to fishing gear and post-harvest gear were gender dis-aggregated to capture gear preferences by men and women. For example, SCUBA gear and spear guns were almost exclusively used by men. Hook and line fishing gear was used mainly by women, though not exclusively, and in general represents the highest proportion in terms of value of gear damaged or lost for both men and women. This is largely because hook and line is the most common gear type in communities. Overall, Lomaiviti (\$584,000) and Ba (\$318,000) Provinces recorded the highest damages and losses in fishing gear. Freezers and ice-boxes represented the large proportion of the value of damaged or lost post-harvest equipment across all provinces. In absolute terms the value of damages and losses is highest in Lomaiviti (\$133,000) and Ba (\$130,000) provinces. Overall damages in Bua, Cakaudrove and Ra provinces were much lower both in absolute value and proportionally (pre- versus post-cyclone) for post-harvest gear.

The assessment also documented the impact of the cyclone on fisheries livelihoods and food security. The number of households fishing for subsistence and/or livelihoods varied substantially within provinces. For example in Cakaudrove the percentage of households dependent on fisheries for livelihoods ranged from 32-100%, and from 36-100% for subsistence. Villages in Ba are generally equally dependent on fisheries for subsistence (72%) and livelihoods (77%), compared to Bua where villages are more dependent on fisheries for subsistence (82%) than livelihoods (4%).

Prior to the cyclone the harvesting of coral reef fish, prawns, shrimp and mud crabs, and the harvesting and processing of sea cucumbers were generally the highest ranked fisheries, though there were notable differences between provinces and districts, and between women and men. In general women engaged in a wider diversity of fisheries than men. For example in Ba Province, women engaged in eight fisheries, while most men engaged in three, largely coral reef fish, mud crabs and oceanic fish. The change to these rankings post-cyclone differed between districts, with some districts (e.g. Ba) experiencing little or no change while others (e.g. Mudu) had large changes.

One of the more dramatic impacts perhaps of Cyclone Winston is the sharp reduction in the number of times a week communities were eating fresh fish. Many coastal villages ate fresh fish over 6 times a week pre-cyclone, and this decreased to less than 2.5 times per week post-cyclone. Weekly fish consumption was most impacted in Lomaiviti, with all districts except Moturiki eating fish once per week or less post-cyclone.

Many coastal communities provided fish to feed the children at local schools pre-cyclone. The percentages of villages providing fresh fish to school declined in all provinces post-cyclone, with the most impacted schools located on Moturiki Island which declined from 100% to 30% of villages providing fish, Koro Island (declined from 64% to 0%), and Tailevu (declined from 100% to 55%). This will have a detrimental impact on the diets of school children in these areas in the short to medium-term. Overall, the impact to diet varies within provinces and likely reflects the amount of damage to fishing infrastructure, access to marine resources and/or ability to buy fish.

Lastly, questions were asked about community based management efforts or plans post-cyclone. Of the 154 villages surveyed, 116 villages (75%) had a periodically harvested closure (tabu) in place. The majority of villages had no plans to open their tabu areas for food or for income. In some districts there were conflicting views on the opening of tabu areas, which may lead to potential conflicts if the recovery process is slow or ineffective and there are pressing needs for food and/or income. The Department of Fisheries, Fiji Locally-Managed Marine Area (FLMMA) Network and NGO partners need to be ready to provide advice to communities with conflicting opinions on the opening or closing of tabu areas.

Ranking of Impact

With inputs from the Department of Fisheries and partners, a number of criteria were selected and scored to rank the impact of Cyclone Winston on fisheries infrastructure, livelihoods and subsistence within the surveyed districts. This approach provides a fair and transparent way to guide and target recovery and rehabilitation efforts to communities that suffered the greatest impacts and therefore in most need. The criteria selected for ranking were:

Impacts on the ability to restore fishing activities and livelihoods

- Proportion of boats and engines damaged and lost
- Proportion of fishing gear damaged and lost
- Proportion of post-harvest equipment damaged and lost

Dependency on fisheries for food security and livelihoods

- Percentage of households relying on fishing for subsistence (food security) pre-cyclone
- Percentage of households relying on fishing as main source of livelihood pre-cyclone
- Change in fish consumption (pre-cyclone to post-cyclone)

In measuring this impact it is important to use proportional (to pre-cyclone levels) or per capita damage to adjust for the size of the community or district. Failure to do this could mean that small communities that did not suffer large absolute damages and losses are overlooked – and yet comparatively their damages and losses represent a significant proportion of their assets.

Based on the scored criteria the districts of Dawasamu, Nakorotubu, Muđu, Naiyalayala, Navitlevu, Raviravi, Bulu, Naweni, Navolau and Cawa were ranked the most impacted by Cyclone Winston. Village level data gathered through the survey should be used to inform the targeting of these measures to ensure that communities are not provided with more gear than their pre-cyclone levels in order to protect fisheries resource for the long-term.

Lastly, it is important to note that this report is not suggesting that less impacted communities should not be helped or supported. Instead the assessment aims to provide evidence-based guidance on the impact of Cyclone Winston on fisheries-dependent communities in Fiji, with a view to better targeting those most in need of assistance and supporting the Department of Fisheries, aid agencies and NGOs to be more strategic and systematic in their support.

Recommendations

The report provides a series of considerations throughout, and twenty-one detailed recommendations are provided in Section 6. These recommendations are summarised below.

Provision of replacement fishing gear

- 1) Target initial recovery efforts on replacing low-cost, low-impact gear (such as hook and line) to pre-cyclone levels, to promote food security and livelihood recovery.
- 2) Care should be taken to ensure that differences in the ownership and use of gear by women and men are taken into account and that distribution mechanisms also ensure that both have equitable access to the gear provided.
- 3) The ecological impact of fishing methods as well as the condition of habitats should be considered when prioritising fishing gear for replacement. The cyclone presents an opportunity to build back better by replacing fishing gear with low-impact and more selective and sustainable fishing gear.
- 4) Avoid providing impacted communities with more fishing gear and infrastructure than they had pre-cyclone. This

could place unnecessary stress on an already damaged resource, particularly as communities that have the highest damages and losses are likely to be those where the habitat is most severely damaged.

- 5) Target boat and engine repairs and replacement in communities significantly impacted by the cyclone. Investigate the feasibility for partial co-financing via a micro-loan facility if communities are already working with existing financial services providers and/or buyers and have trusted relationships with them.
- 6) Ensure that any deployment of Fishing Aggregating Devices (FADs) takes into account the boating infrastructure available to access the FADs.
- 7) Work through existing governance structures at the local and sub-national level (such as Provincial and Commissioner's offices) to complement national efforts to distribute fishing gear to ensure the involvement of trusted actors and reinforce the importance of good governance.

Livelihoods

- 8) For communities involved in fisheries livelihood activities a package of support is likely to be necessary to recover these livelihoods including boat and engine repairs, and gear and post-harvest equipment supplies. Partial support in one of these areas may be insufficient to promote full livelihood recovery.
- 9) In some communities providing alternative non-fisheries livelihoods, in particular agriculture, may provide a faster opportunity to restore food security and help to reduce pressure on impacted fisheries resources. Ideally community members should have existing experience of these alternative livelihoods being offered.
- 10) Coordination between sectors, especially fisheries and agriculture, to avoid duplication of effort and to reduce the pressure on damaged habitats and impacted fisheries. This is particularly important for fisheries-dependent communities where habitats might only be able to support low level subsistence fisheries (rather than commercial fisheries) in the short to medium-term.
- 11) Ensure that there is adequate women's representation at all consultations, to enable them to articulate their needs and priorities separately, if preferred.



Communities lost many boats during the cyclone, some were found deep in the mangroves. © Kini Ravonoloa

Food Security

- 12) The provision of low-impact fishing gear can support a recovery of food security for fishing communities. Supporting the recovery of agricultural crops – through the provision of seeds and planting material – can also restore food security.
- 13) Support to restore food security should include nutrition education sessions to ensure that communities are aware of the higher nutritional content in locally-grown and caught food, rather than relying on bought or processed food provided during the relief efforts.
- 14) A strategy to restore the availability of fresh fish in schools should be developed locally. Appropriate nutrition is vital for children's health and education and schools should be provided with supplementary protein sources, until villages can recommence providing fish for meals.

Community Management

- 15) Guidance should be provided through the FLMMA network on sustainable fishing practices and the opening and closing of tabu areas to minimise conflict in local communities, while promoting local solutions to aid in the recovery of impacted habitats communities are dependent on for food and livelihoods.
- 16) Community, district and provincial natural resource and development plans should be complementary to each other and take into account future impacts from cyclones as well as from climate change to reduce the risk to local communities.

Prioritising and supporting recovery efforts

- 17) Tables 20-21 provide information on the most impacted districts based on the evidence gathered through these surveys. These should be used to guide where recovery efforts are most needed, and complemented with village level information. This will ensure recovery efforts target communities most in need of assistance.
- 18) Data from Lau were not available, and the Department of Fisheries and Lau Provincial Office should collect information from the province to ensure remote communities are not forgotten or neglected in the recovery efforts. The socioeconomic questionnaire designed (Appendix 1) is quick to administer and could easily be done during visits to the different islands by authorities.
- 19) Complementary in-water surveys should be undertaken by government and NGO partners to provide accurate advice to communities on the condition of habitats and fisheries resources, to ensure sufficient measures are in place (e.g. tabu areas, gear restrictions, reduction in commercial licenses), to ensure the recovery of these resources.
- 20) The PDNA estimates ongoing production losses from Cyclone Winston will continue to 2021. In order to give the resource a chance to recover, commercial fishing licences should be restricted to areas not impacted by the cyclone. Failure to control fishing will lead to further declines in fisheries and impact the medium- to long-term food security and livelihoods of coastal communities.
- 21) Data collection systems should be developed for the fisheries sector to ensure the impact from future disturbances and natural disasters are taken into consideration. The questionnaire developed for this survey should be reviewed, adapted where necessary, and adopted by the Department of Fisheries (Appendix 1).

1 Introduction



Offloading goods for people who were affected by the Cyclone. © Kini Ravonoloa/FLMMA

On 20 February 2016, Fiji was hit by Category 5 Tropical Cyclone Winston. It was one of the largest cyclones Fiji had experienced with winds up to 233 km/hr and gusts of 306 km/hr. Over a 24-hour period the cyclone left a trail of destruction along its path. The Fiji Government immediately announced a 30-day state of emergency, calling for coordinated assistance from non-government organisations (NGOs), the private sector, and humanitarian aid agencies for the 40,000 people that needed immediate assistance. Across the country 30,369 homes, 495 schools and 88 medical facilities were damaged or destroyed and 44 people lost their lives (Government of Fiji, 2016). The cyclone destroyed food and agricultural crops on a large scale and impacted the livelihoods of 62 percent of the population.

The Wildlife Conservation Society (WCS) conducted a rapid in-water surveys in March 2016 to assess the impact of Cyclone Winston on coral reefs in the Vatu-i-Ra Seascape (Mangubhai, 2016). The report documented significant damage to coral reefs up to 20-30 m below the surface, with extensive coral breakage, coral abrasion, dislodgement of large coral colonies and structural damage to the reef

framework. While no data were collected on reef fish, there will likely be changes to species composition and biomass which will impact fisheries productivity, especially in areas that sustained high coral and reef structural damage.

In April 2016, the Fiji government in partnership with development agencies, members of the Council of Regional Organisations in the Pacific (CROP) and NGOs commenced a Post-Disaster Needs Assessment (PDNA) based on the best available data. The total value of the damages and losses was estimated at FJ\$1.99 billion. The PDNA report concluded that *“the combined value of destroyed assets and disruptions in the production of goods and services is equivalent to about one fifth of the country’s gross domestic product (GDP) in 2014. Tropical Cyclone Winston will, therefore, have a significant negative impact on the overall performance of the national economy and likewise on the quality of life.”* Fisheries which made up 1.1% of Fiji’s GDP in 2014 had damages and losses estimated at over \$40.7 million with artisanal fisheries and aquaculture sustaining the highest damage (Government of Fiji, 2016).



The timing of the PDNA did not allow the collection of new data, for example, to quantify the impact to fishing communities along the cyclone impact zone (Fig. 1). Without this data, it is difficult to quantify the degree and extent to which different coastal villages, districts and provinces were impacted, and therefore the range in strategies needed to support communities in their recovery process. At the time of this report the Department of Fisheries under the Ministry of Fisheries and Forestry were in discussions with the Pacific Community (SPC), the Food and Agricultural Organisation

(FAO) and the Asian Development Bank (ADB) about potential funding to support fisheries recovery and rehabilitation. However, without baseline information on how different fishing communities were impacted, there is high a risk that funding and projects will not be targeted at those most in need. In situations where the demand for support is high, it is important to have a clear transparent way of allocating limited resources.

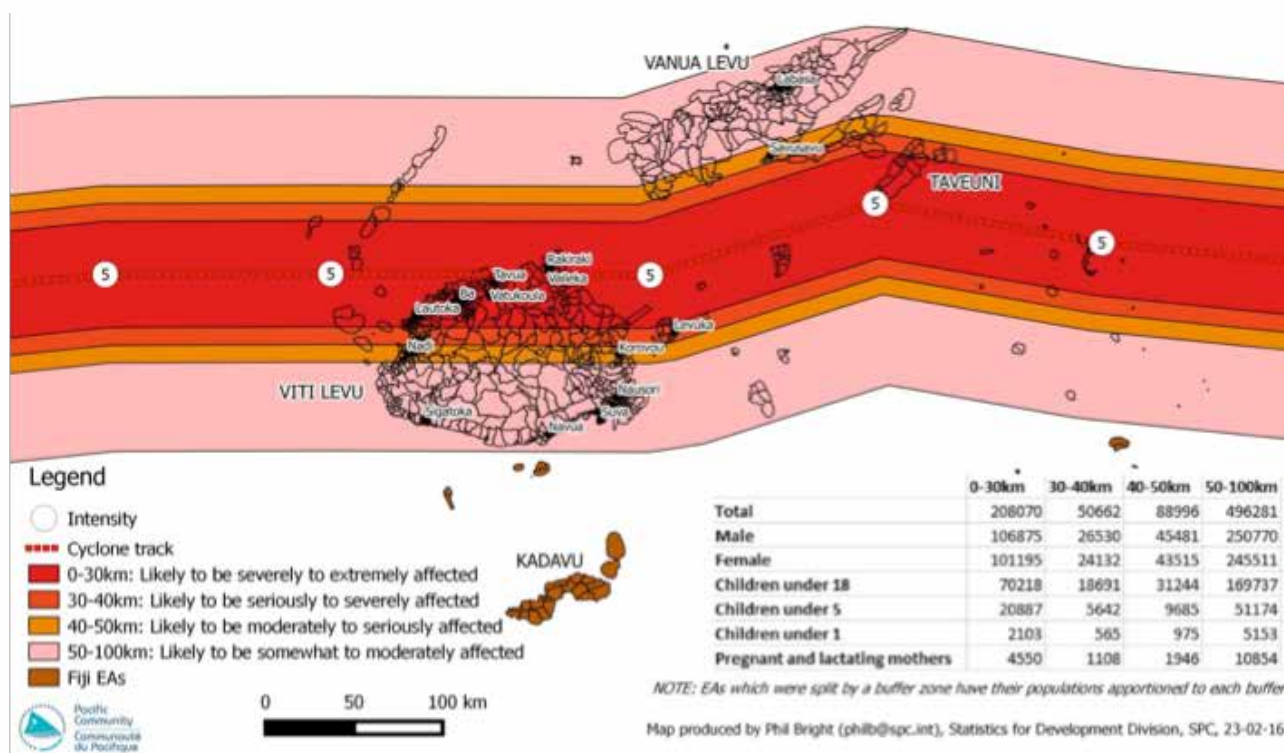


Figure 1. The intensity or predicted level of impact to populations in Fiji caused by Tropical Cyclone Winston. Population figures projected to 2015 using age distribution from 2007 Population and Housing Census then Prorate to match total projected population. Source: Pacific Community

2 Objectives



Village damaged by Cyclone Winston. © Kini Ravonoloa/FLMMA

Following a request by the Department of Fisheries, the WCS developed a post-disaster socioeconomic questionnaire with inputs from Fiji-based partners to assess the impact of Cyclone Winston on coastal communities. Specifically, the assessment aimed to:

- estimate the impacts of Cyclone Winston on fishing infrastructure (e.g. boats, engines and gear) and provide a monetary estimate to government of damages and losses;
- assess the communities' dependence on local fisheries to determine the impact on food security and livelihoods; and
- iii. provide a transparent system for ranking impact to local communities to help guide the recovery and rehabilitation efforts of government and development agencies.

This report represents the findings of that assessment and identifies which communities were the most impacted by the cyclone, and therefore most in need. The results of this work can be used to inform short- to medium-term recovery and rehabilitation efforts by the Fiji Government, development agencies, CROP agencies and NGO partners.

3 Methodology

3.1 Field surveys

The report draws heavily on FAO guidance for post-disaster response (Cattermoul et al., 2014), and the methodology is aligned to the PDNA conducted at the national level (Government of Fiji, 2016). A post-disaster socioeconomic questionnaire (Appendix 1) was developed drawing on the PDNA questions. It was administered in April and May 2016 across 154 villages in 36 districts and 6 provinces that were directly along the path of the cyclone in Fiji (Table 1, Figs. 1-2).

The only province that was not surveyed was Lau due to inaccessibility and challenges faced by the Department of Fisheries in administering the surveys. Surveys focused on coastal villages and represented only a proportion of the total villages in each province (Table 2a). It is also important to note that most of the communities in these coastal areas were iTaukei. While an effort was made to survey the few Indo-Fijian fishing communities in Bua, it was more challenging to administer surveys because households were spread-out and surveys were done at a community rather than household level. The full list of surveyed villages is provided in Appendix 2.

The enumerators included staff from WCS, the Fiji Locally Managed Marine Area (FLMMA) network, Coral Reef Alliance (CORAL), Global Vision International (GVI) and the University of the South Pacific Institute of Applied Science (USP-IAS). The survey team included women and men, to reduce any gender bias.

Survey questions were grouped into the following categories:

- Impact on fishing infrastructure;
- Impact on fisheries activities and livelihoods;
- Impact on fish consumption;
- Impact on perceived habitat health; and
- Changes to management arrangements in community fishing grounds.

There was an emphasis on collecting gender-disaggregated data to understand the differential impact on men and women fishers, and to support the recovery efforts of the Department of Fisheries and Ministry of Women, Children and Poverty Alleviation. The survey was administered at the village level so as not to place undue pressure on households focused on rebuilding their lives, and to enable the team to cover as large an area and as many communities as possible, in the impact zone. In general, interviews were conducted with the Turaga ni Koro (village headman), a representative from the women's group and a youth representative.

It is possible that communities may over-estimate impacts immediately after the event for a number of reasons. Biases may arise as people are still experiencing the trauma of the event, they might not have located or assessed all the damage, and/or they may have a tendency to overstate need as they are aware that it will inform response efforts (Cattermoul et al. 2014). Many of the communities surveyed have a long term relationship with NGO partners, and the use of trusted enumerators helped to reduce any potential biases in the respondents' answers.

Table 1. Demographics of the villages surveyed to assess the impact of Cyclone Winston on community fisheries and the organisation responsible for the surveys. For Lomaiviti Province island-level data are provided for Ovalau, Koro and Moturiki.

Province	Districts	Villages	Households	People	Organisations
Ba	5	26	1791	10,497	FLMMA
Bua	9	41	2489	6741	WCS/CORAL/DOF
Cakaudrove	7	23	1133	6105	FLMMA
Lomaiviti (Ovalau)	3	16	824	3987	FLMMA/WWF
Lomaiviti (Koro)	2	14	883	3884	FLMMA
Lomaiviti (Moturiki)	1	10	262	955	GVI
Tailevu	2	11	615	2477	FLMMA/WWF
Ra	7	13	714	2872	USP-IAS
Total	36	154	8711	37,518	

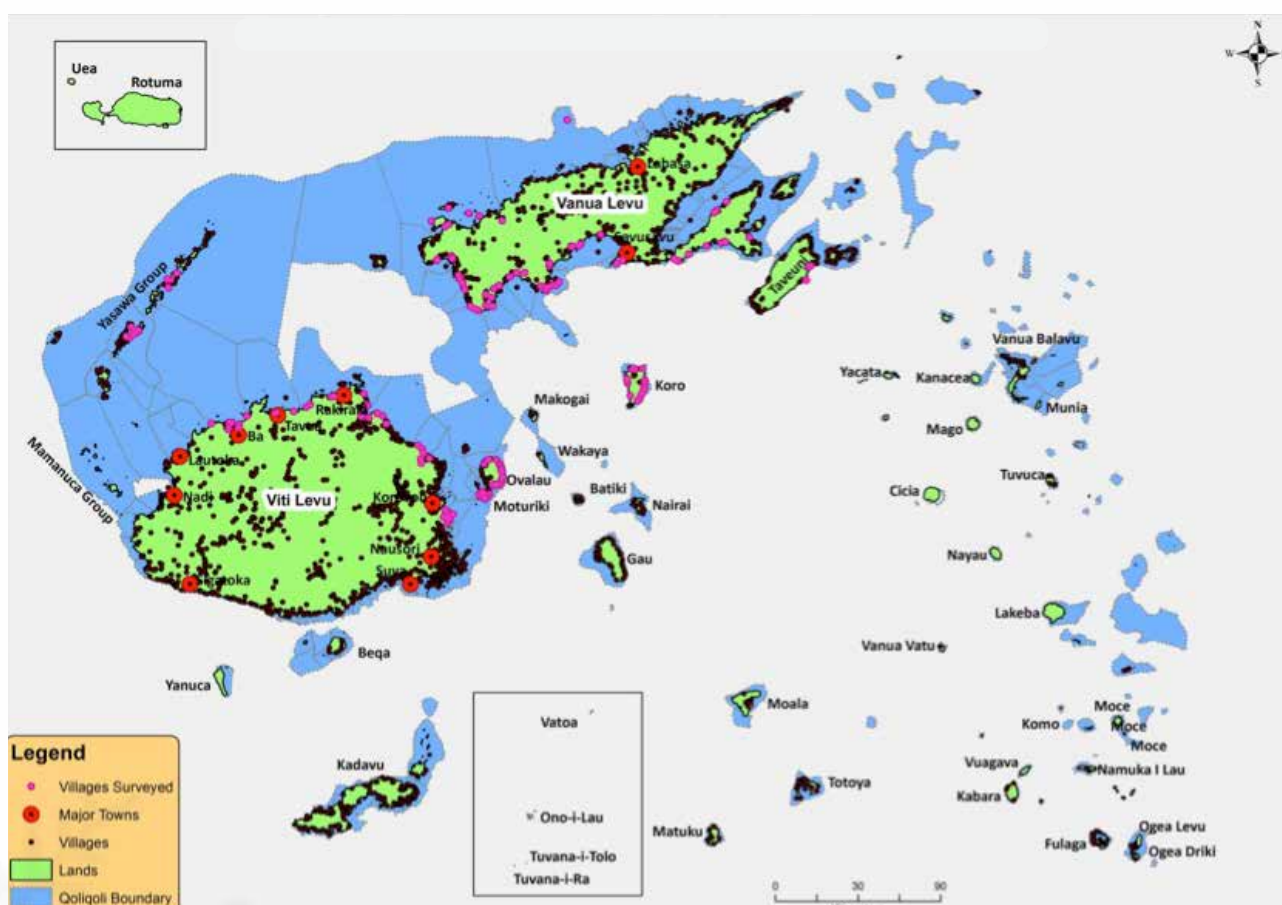


Figure 2. The villages surveyed to assess the impact of Cyclone Winston on fisheries - dependents communities

Table 2a. Proportion of villages surveyed in each province.

Province	# Districts	Total # villages	# Coastal villages	# Villages surveyed	% Total villages	% Coastal villages
Ba	5	107	26	26	24	100
Bua	9	54	40	41	76	100
Cakaudrove	7	133	46	23	17	50
Lomaiviti	6	73	46	40	55	87
Ra	7	93	21	13	14	62
Tailevu	2	141	27	11	8	41

Table 2b. Proportion of villages surveyed on three islands in the Lomaiviti Province.

Island	District	Total # villages	# Coastal villages	# Villages surveyed	% Total villages
Ovalau	Levuka	11	11	11	100
	Lovoni	6	6	1	17
	Nasinu	5	5	4	80
Total		22	22	16	73
Koro	Mudu	8	8	8	100
	Cawa	6	6	6	100
Total		14	14	14	100
Moturiki	Moturiki	10	10	10	100
Total		46	46	40	85

3.2 Economic analysis

Following the PDNA approach and the sustainable livelihoods framework that underpins it (PDNA Guidelines Volume B, 2010), the questionnaire gathered information on the damages that had been incurred to livelihood assets (e.g. fishing boats, engines, gear and post-harvest equipment). These livelihood assets are critical in securing livelihood outcomes such as income, food security and general well-being.

Questions were also asked about the extent to which fisheries activities were an important livelihood activity pre- and post-cyclone and other (non-fishing) livelihoods that were important pre- and post-cyclone. As this information was based on community rankings of importance and good production-level data were not available in all cases, estimated production losses were not calculated.

Questions were also asked about the health of the coral reefs, mangroves and seagrass habitats. However, this qualitative information was also not used to value losses to ecosystem services as communities did not always feel confident about the accuracy of their perceptions of habitat damage (see Section 4.5). Where possible, information was sex-disaggregated to determine possible differential impacts on men and women. All figures on damages are in Fijian dollars (FJD).

Definition of Damages and Losses

(based on PDNA Guidelines Volume A, 2008)

Damages are defined as the total or partial destruction of physical assets and infrastructure. For example, this includes the destruction and damage of fishing boats and gear.

Losses are the changes in flows in the economy as a result of the disaster. For example, the reduction in fisheries production over the coming months and years as a result of an inability to access the resource and/or a reduction in the productivity of the resource.

3.2.1 Damages

Following the approach used for the PDNA the value of damages was estimated at 80% (SPC, pers. comm.) of the locally available replacement value for assets that were fully destroyed and 40% for assets that were damaged but are repairable. Replacement values are provided in Appendix 3. The types of assets assessed (e.g. boats, engines, gear, post-harvest equipment) were determined with reference to those considered in the PDNA. There are some inconsistencies in Tables 3-5 as the number of assets that were good,

damaged and lost do not always match the total number of assets before and after the cyclone. Where this occurred the number of assets damaged and lost was retained as reported by local community representatives. For the purpose of the analysis bamboo rafts (bilibili) were excluded, as it is likely that some communities included them and others did not, and these were often made from locally sourced and made from materials rather than purchased. In general bamboo rafts are seen as relatively low value assets in comparison to boats and engines. Damage to fish aggregating devices (FADs) is presented separately, with replacement costs obtained from SPC and valued at 100% of the total retail value.

3.2.2 Losses

Estimates of losses to fisheries production and ecosystem services such as coastal protection from mangroves were not made. Questionnaires were administered at the community level and questions relating to household level catches were not asked. Communities were asked to rank the importance of fisheries and livelihoods rather than provide any quantitative data. As such other sources of baseline information for the same communities would be necessary to use this information to value losses. As this was not available for all communities, losses were not estimated. Similarly, questions relating to perceived impacts on habitat losses were difficult to value as baseline valuation information was not always available and perceptions alone are not always a reliable indication of actual habitat damage particularly in the weeks after an event. The PDNA estimates these damages at the national scale.

Given the time constraints, this assessment does not assess impacts on future livelihood opportunities, fisheries inputs, credits and loans. Communities were asked to state whether their access to market was affected but additional details were not obtained. Summary tables are presented on total damage values by province. Sex-disaggregated data is presented for fishing gear. Recommendations are made based on this economic analysis as to how this information could usefully be used in targeting short and medium-term assistance measures.

3.3 Criteria for ranking community impact

A number of criteria were developed in consultation with staff from the Department of Fisheries, WCS, Women in Fisheries Network-Fiji (WiFN-Fiji) and FLMMA, and used to rank impacts on communities and inform short-to medium-term recovery efforts. In this report short-term is defined as 6-12 months following the cyclone and medium-term is up to 5 years post-cyclone. In general, it is recommended

that priority for assistance should be given to the areas and communities that suffered the greatest impacts and therefore in most need. **In measuring this impact it is important to use proportional (to pre-cyclone levels) or per capita damage to adjust for the size of the community or district. Failure to do this could mean that small communities that did not suffer large absolute damages and losses are overlooked – and yet comparatively their damages and losses represent a significant proportion of their assets.**

The extent of the impact alone is not necessarily an equitable way to prioritise recovery support. Some communities may have a greater diversity of alternative livelihoods and income generating opportunities than others. The survey provides some limited information on the relative importance of fisheries activities to other income sources in the communities. Information provided related to where fisheries ranked in terms of importance so the level of external support from relatives, NGOs or the private sector is not well captured.

The criteria selected for recovery support are detailed in Section 4.7 and summarised below:

Impacts on the ability to restore fishing activities and livelihoods

- Proportion of boats and engines damaged and lost
- Proportion of fishing gear damaged and lost
- Proportion of post-harvest equipment damaged and lost

Dependency on fisheries for food security and livelihoods

- Percentage of households relying on fishing for subsistence (food security) pre-cyclone
- Percentage of households relying on fishing as main source of livelihood pre-cyclone
- Change in fish consumption (pre-cyclone to post-cyclone)

The prioritisation derived from using these criteria can provide useful information to target those most in need of cyclone recovery assistance. However, it is important to recognise that prioritising communities for support always involves subjective and ethical questions. The results and rankings in this report should be used by government and development agencies as a guide that supports decision-making only and should be cross-checked with other sources of information and expert judgement from those familiar with the communities. Other factors that have not been taken into account in this analysis may be important in determining support. Some of these are highlighted below.

In some cases the surveys do not provide sufficient information to rank communities according to all the criteria listed above. For example, the survey only provides information on the perceptions of habitat loss, which is extremely subjective and should therefore not be used alone in the absence of bio-physical assessments that can validate community perceptions.

Similarly the existence of community governance and management structures alone does not provide information on their effectiveness, which is what matters for the success of recovery efforts. Taking the existence of management structures into consideration as a way of prioritising support should therefore be done with care, and be validated by expert opinion from partners actively working with the community.

Prioritising communities according to the extent of their losses raised a number of important issues that should be considered.

- a) Should communities who lost everything because they did less to protect their assets receive the same access to capacity building and training for recovery? Failing to take this into account can potentially increase “moral hazard” and in the long term increase dependency on external assistance (the so-called hand-out mentality). It may also undermine existing resilience structures as communities that were organised and protected assets may receive less support than communities that did not. However, this is only likely to be a major concern if levels of support are likely to be large in relation to the overall damages. Where assistance is small in relation to overall damages the issue of “moral hazard” is unlikely to be of major concern.
- b) Should the receipt of funding be pre-conditioned on the basis of good governance systems? Doing this would help reinforce their importance and value but may mean that those with weakest structures, and possibly therefore the most vulnerable, miss out.
- c) Should different financial mechanisms be used to create financing options for communities to repair and replace boats? For example, using small micro loans (where communities are already exposed to these kinds of financial instruments) for part-payment of equipment can help target the assistance where it is needed most, as they will self-select to a certain degree, but also risks excluding the most vulnerable who may not have the confidence to utilise these instruments and/or are least able to contribute financially to their own recovery.



Damage in the Yasawas © Kini Ravonoloa/FLMMA

A disaster represents an opportunity to build back better and as such there is a short window of opportunity now to encourage livelihood diversification. It is important to stress that livelihood needs arising from an impact to fisheries activities need not necessarily relate to fisheries. For example, small-scale poultry and vegetables may be more effective in terms of recovering livelihoods than fisheries, particularly when the habitat has suffered extensive damage. **It is therefore important that a cross-sectoral approach to livelihood recovery is taken.**

Lastly, it is important to avoid providing impacted communities with more fishing gear and infrastructure than they had pre-cyclone. This could place unnecessary stress on an already damaged resource and lead to longer-term impacts on food security and livelihoods. This is particularly important as communities that have the highest damages and losses, are likely to be those where the habitat is most severely damaged (Cattermoul et al., 2014).

4 Results and Discussion



Damaged boat in the Yasawas. © Kini Ravonoloa/FLMMA

4.1 Impacts on fishing infrastructure

Respondents were asked to describe the impact of the cyclone on fishing infrastructure – in particular on boats, engines, fishing gear and post-harvest equipment. This provides useful information for targeting recovery measures, in particular to ensure that infrastructure provided is appropriate and that communities are not provided with equipment in excess of pre-cyclone levels, particularly when the resource itself has been badly damaged. The database contains details by village that can be used for recovery purposes. This report contains a summary of the information by province and in some cases, by district.

4.1.1 Boats and engines

In general there are large differences in the losses and damages to boats and engines across cyclone impacted provinces and districts, often based on their precise location within the impact zone (Tables 3-4). **Due to variability in the number of villages surveyed in each district and province, estimates of damage are more meaningful at the district and village level and should not be compared between provinces.** Table 2 details the proportion of villages and the proportion of coastal villages surveyed across each province.

As noted the estimates of damage are incomplete as not all villages were surveyed. Surveys focused on coastal villages as we assumed that they would be more reliant on fisheries resources than inland villages, and thus most impacted. In addition many surveys were administered opportunistically

while delivering relief supplies to the most impacted communities. Results presented in this report for provinces are therefore, to a certain extent, generalising trends in the surveyed communities and assuming similar trends across the coastal area of the entire province. For the purpose of the analysis, bamboo rafts (bilibili) were excluded, as it is likely that some communities included them and others did not. In general they are also relatively low value assets in comparison to boats and engines.

In Ba Province, 34% of boats were damaged and lost completely but the proportion of boats damaged and lost in each district ranged from 100% in Ba, 52% in Nailaga and in Tavua to only 5% in Nacula (Table 3). Similarly in Bua Province, across the province as a whole, 20% of boats were damaged and lost completely but the proportion of boats damaged and lost ranged in each district from 63% in Kubulau and 50% in Wainunu, to less than 10% in Dama, Bua, Lekutu and Navakasiga. It is noteworthy that the 3 villages in Solevu whilst having small numbers of boats (5) and engines (4) avoided any damage to these assets despite being in the most heavily impacted area. This is likely because the villages in Solevu took measures to move boats away from the water prior to the arrival of the cyclone (A. Caginitoba, pers. comm.).

In Cakaudrove, the proportion of boats damaged and lost across the province is 33% but ranged from 75% in Naweni, 43% in Wainikeli and 40% Nasavusavu for districts in the direct track of the cyclone to 17% in Wailevu East and 18%

in Natewa both of which were better protected. No boats were damaged in Wailevu West. It was reported that villages in Vuna District also suffered significant damages, but this was not verified.

In Lomaiviti, 61% of boats were damaged or lost completely with impacts ranging from extensive damage to Koro Island (96%), to lower proportional damage on Ovalau (21%) and Moturiki (25%). The majority of boats on Koro were locally made rafts constructed from corrugated iron roofing known as “bavelo”. Even though these are low cost to replace, the value of boat damage is still relatively high (\$44,672), due to the large number of bavelos lost.

In Ra, across the district as a whole 65% of boats were damaged or lost completely with impacts ranging from 100% damage in Naiyalayala and 50-75% in Raviravi, Navitilevu, Navolau and Nakorotubu. Limited numbers of villages were surveyed in Tailevu, and impacts varied greatly between the northern part of the province and the southern part of the

province. Dawasamu district suffered extensive damage (100%) whereas Verata suffered no damaged or losses to boats.

As expected, in general, engine damage and losses followed similar trends (except Koro) (Table 4), with provinces and districts suffering the most extensive boat damage also recording large numbers of engine damage. Engines are often more valuable than boats so in general engine damages are greater than boat damages across the villages surveyed. For example, in Ba, overall damages to engines were around \$308,000 whereas boat damage was estimated at around \$187,000. This was not the case for Koro, where the majority of boats lost were bavelos that do not require engines (use wooden paddles).

It is important for assessing recovery options to not only look at the overall value of damages but also the proportion of boats damaged and lost to ensure that smaller districts are not being overlooked.

Key consideration

The proportion of boats and engines that are damaged and lost in each district should be considered when assessing recovery options. Otherwise smaller districts, which might have relatively low damage (in terms of \$ value) may be overlooked. For instance, in Ba Province, Nailaga / Tavua and Naviti districts have higher total damages to boats but faced lower proportional losses than Ba and Bulu districts.

Table 3. Number of boats in good condition, damaged or lost post-cyclone in the districts and provinces surveyed. Percentage (%) represents the proportion of boats damaged or lost as a result of Cyclone Winston. Bamboo rafts (*bilibili*) were not included. The percentage of coastal villages surveyed is shown in parentheses. Value of damages is in FJD.

District	#Villages surveyed	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Ba Province (100%)							
Nailaga/Tavua	7	96	93	46	49	3	\$93,481
Naviti	8	63	63	42	33	0	\$41,713
Ba	2	4	0	0	0	100	\$23,901
Bulu	2	12	11	2	75	8	\$20,563
Nacula	7	92	92	87	5	0	\$7,200
Ba Total	26	267	259	177	31	3	\$186,858
Bua Province (100%)							
Kubulau	9	19	15	8	42	21	\$59,170
Vuya	3	15	15	11	27	0	\$11,950
Wainunu	6	14	14	7	50	0	\$9,800
Dama	4	24	23	22	4	4	\$7,575
Nadi	4	11	9	7	27	9	\$7,205
Bua	5	14	13	13	7	0	\$4,600
Lekutu	4	41	41	40	2	0	\$2,988
Navakasiga	3	17	17	17	0	0	\$0
Solevu	3	5	5	5	0	0	\$0
Bua Total	41	160	152	130	16	4	\$103,288
Cakaudrove Province (50%)							
Cakaudrove	5	21	15	10	24	14	\$23,168
Naweni	3	8	2	2	50	25	\$14,034
Wainikeli	4	7	6	4	29	14	\$11,950
Natewa	4	11	10	7	9	9	\$7,034
Wailevu East	1	6	4	2	0	0	\$5,634
Nasavusavu	2	5	3	1	40	0	\$2,800
Wailevu West	4	8	8	8	0	0	\$0
Cakaudrove Total	23	66	48	34	21	12	\$64,620

Table 3. Continued

District	#Villages surveyed	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Lomaiviti Province (87%)							
Cawa	6	52	3	2	10	87	\$11,142
Mudu	8	39	2	0	10	85	\$33,530
Koro Island	14	91	5	2	10	86	\$44,672
Nasinu	4	13	9	9	0	31	\$23,901
Levuka	11	24	19	18	8	8	\$17,755
Lovoni	1	0	0	0	0	0	\$0
Ovalau	16	37	28	27	5	16	\$41,656
Moturiki	10	48	37	19	21	4	\$41,826
Lomaiviti Total	40	176	70	48	12	49	\$128,154
Ra Province (62%)							
Raviravi	3	14	10	3	64	14	\$29,518
Navolau	3	14	3	1	21	29	\$18,575
Navitilevu	3	18	7	0	46	29	\$16,150
Naiyalayala	1	3	3	0	100	0	\$8,963
Nakorotubu	2	2	2	1	50	0	\$2,988
Saivou	1	0	0	0	0	0	\$0
Ra Total	13	51	25	5	47	18	\$76,194
Tailevu Province (41%)							
Dawasamu	4	10	0	0	100	0	\$29,876
Verata	7	44	44	44	0	0	\$0
Tailevu Total	11	54	44	44	0	19	\$29,876

Table 4. Number of engines in good condition, damaged or lost post-cyclone in the districts and provinces surveyed. Percentage (%) represents the proportion of engines damaged or lost as a result of Cyclone Winston. The percentage of coastal villages surveyed is shown in parentheses (after the province). Value of damages is in FJD.

District	# Villages surveyed	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Ba Province (100%)							
Nailaga/Tavua	7	4	0	0	23	24	\$151,834
Naviti	8	12	9	7	17	15	\$82,460
Nacula	7	98	74	51	16	0	\$41,030
Bulu	2	48	41	33	17	25	\$18,653
Ba	2	86	86	72	0	100	\$13,648
Ba Total	26	248	210	163	19	15	\$307,625
Bua Province (100%)							
Vuya	3	9	9	2	78	0	\$36,623
Nadi	4	10	9	3	70	0	\$30,634
Kubulau	9	15	12	6	13	20	\$24,718
Lekutu	4	48	48	43	10	0	\$17,820
Dama	4	19	18	17	5	0	\$3,564
Bua	5	14	14	14	0	0	\$0
Navakasiga	3	16	16	16	0	0	\$0
Solevu	3	4	4	4	0	0	\$0
Wainunu	6	6	6	6	0	0	\$0
Bua Total	41	141	136	111	16	2	\$113,359

Table 4. Continued

District	# Villages surveyed	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Cakaudrove Province (50%)							
Cakaudrove	5	12	8	6	42	0	\$10,805
Naweni	3	3	0	0	33	67	\$8,910
Wainikeli	4	7	6	6	0	14	\$4,170
Wailevu West	4	2	1	1	50	0	\$2,085
Nasavusavu	2	1	1	1	0	0	\$0
Natewa	4	6	6	6	0	0	\$0
Wailevu East	1	11	11	11	0	0	\$0
Cakaudrove Total	23	42	33	30	17	7	\$25,970
Lomaiviti Province (87%)							
Mudu	8	4	0	0	0	100	\$14,406
Cawa	6	4	2	2	50	0	\$4,957
Koro Island	14	8	2	2	25	50	\$19,363
Levuka	11	21	18	18	0	14	\$10,236
Lovoni	1	0	0	0	0	0	\$0
Nasinu	4	10	10	10	0	0	\$0
Ovalau Island	16	31	28	28	0	10	\$10,236
Moturiki	10	39	32	12	21	10	\$43,750
Lomaiviti Total	40	78	62	42	13	14	\$73,349
Ra Province (62%)							
Navitilevu	3	18	11	9	46	4	\$27,296
Raviravi	3	13	12	4	15%	8%	\$10,918
Navolau	3	4	4	2	100%	0%	\$9,023
Naiyalayala	1	1	1	0	100%	0%	\$2,730
Nakorotubu	2	2	2	1	50%	0%	\$2,730
Saivou	1	0	0	0	0%	0%	\$0
Ra Total	13	38	30	16	42%	5%	\$52,697
Tailevu Province (41%)							
Dawasamu	4	9	1	1	0%	89%	\$46,177
Verata	7	8	8	8	0%	0%	\$0
Tailevu Total	11	17	9	9	0%	47%	\$46,177

4.1.2 Boat ownership

Respondents were also asked to describe the ownership of the boats within their community. This is an important consideration when targeting response measures (Cattermoul et al., 2014). For example, if boats in a particular village have been owned by families or communally in the past it is important that the distribution of new equipment does not undermine existing management structures at the community level which could lead to internal conflicts in a time where relationships may already be strained.

Across most provinces boats are mainly owned by individuals and families with smaller numbers being owned communally by various groups (Fig. 3). In Bua for example boats are owned by individuals (27%) and families (58%) with a further 13% bring owned by either clans (mataqali) or the village. The remaining boats are owned by various groups (women, youth, environment (yaubula) committee, church) and fish wardens. In Ba, Tailevu, Lomaiviti and Ra most boats are owned by individuals.

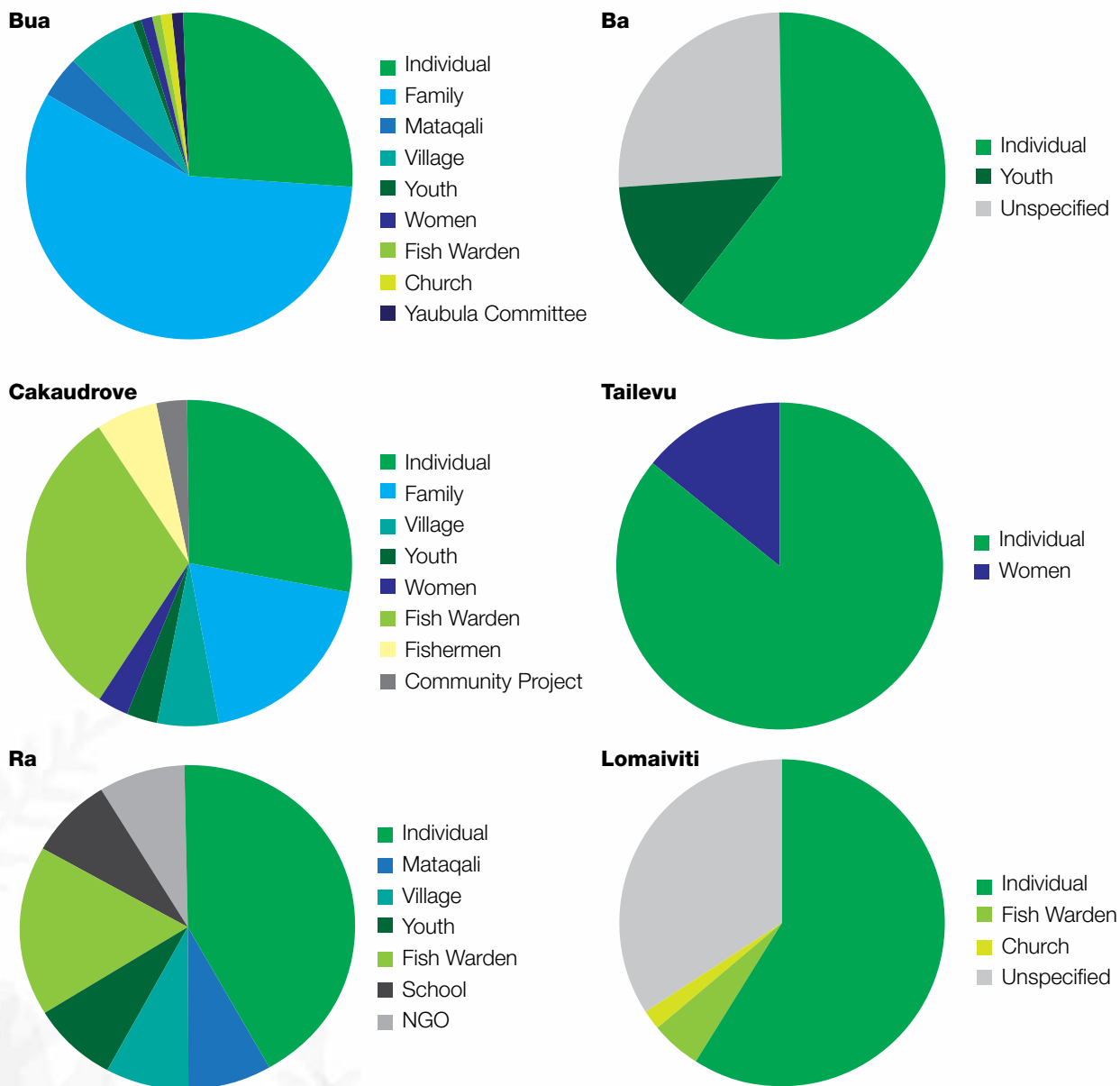


Figure 3. Boat ownership is shown for each of the provinces. Figures represent relative percentages.

Key consideration

Boat ownership should be considered when targeting response measures, so that the distribution of new equipment does not undermine existing management structures at the community level, which could lead to internal conflicts in a time where relationships may already be strained. As most boat ownership is by individuals it is important to target any recovery measures to support individuals and families recover their livelihoods. This could include targeted boat maintenance and micro-credit facilities.

4.1.3 Fishing gear

Respondents were asked to provide information on the type of gear damaged and lost during the cyclone. This included gill nets, cast nets, wading nets, spears and spear guns, masks and snorkels and SCUBA equipment.

In general, the type of gear used shows some gender trends based on the distinct fishing roles and responsibilities of men and women (Tables 5a-f). Spear guns for example are predominantly used by men. Hook and line fishing gear is used mainly by women, though not exclusively, and in general represents the highest proportion in terms of value of gear lost for both men and women, largely because it is the most common gear owned.

The highest damages in terms of value were sustained in Lomaiviti and Ba Provinces with over \$584,000 and \$300,000 of fishing gear damaged, respectively. Hook and lines often represent the type of equipment with the largest damages mainly due to their sheer volume. For example in Bua Province, of the 3,169 hooks and lines owned pre-cyclone, 2,382 were owned by women. Although 76% of hooks and lines remained post-cyclone, because of their sheer number damage to hook and line gear was in excess of \$115,000 with over \$90,000 of the damage to hook and lines owned by women (Table 5b). Significantly lower levels of damage were sustained in Cakaudrove and Ra. In Cakaudrove this was largely due to proportionally small overall damages to gear, whereas in Ra it is largely due to the lower number of fishing gear pre-cyclone.

Key considerations

- Fishing gear should be distributed to both women and men, and based on the type of gear damaged and lost in each district.
- The proportion of gear damaged and lost, not just the value of damages, should be considered when assessing recovery options.
- It is important to avoid providing impacted communities with more fishing gear and infrastructure than they had pre-cyclone, as this could place unnecessary stress on an already damaged resource. It is highly likely that communities that have the highest damages and losses are likely to be those where the habitat is most severely damaged.
- The ecological impact of fishing methods as well as the condition of habitats should be considered when prioritizing fishing gear for replacement. For example the provision of gill nets could put more pressure on fishery resources. The cyclone presents an opportunity to build back better by replacing fishing gear with lower-impact and more selective and sustainable fishing gear.
- Gear should be purchased locally where possible to ensure that it is appropriate for local needs.

Table 5a. The condition of different fishing gear post-cyclone in Ba Province. All the 26 coastal villages in the province were surveyed. The value of damages was calculated on both gear damaged and lost. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD.

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
Hook & line	1751	1058	808	11	19	\$105,360
Spear guns	148	0	0	18	24	\$23,040
Gill nets	78	67	55	27	14	\$13,760
Spear	1103	444	310	4	17	\$6,752
Cast nets	349	31	41	17	13	\$5,700
Portable traps	142	29	29	13	62	\$1,552
Total men						\$156,164
Women						
Hook & line	1616	1189	1001	12	26	\$125,040
Gill nets	102	66	60	6	35	\$24,960
Spear	590	440	357	14	25	\$6,128
Cast nets	142	86	72	10	39	\$4,788
Portable traps	120	72	36	30	40	\$1,056
Total women						\$161,972
Total all damages						\$318,136

Table 5b. The condition of different fishing gear post-cyclone in Bua Province. All 40 of the coastal villages in the province were surveyed. The value of damages was calculated on both gear damaged and lost. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD. *=inconsistencies in the data provided by local communities (see section 3.2.1 for details).

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
Hook & line	787	532	525*	1	13	\$24,720
Spear gun	230	186	156	6	16	\$20,640
Gill net	101	81	70	20	8	\$11,520
Mask & snorkel	57	21	0	0	0	\$1,728
Spear	398	362	349	3	9	\$1,360
Cast net	27	26	21	0	4	\$76
Total men						\$60,044
Women						
Hook & line	2382	2059	1897	6	13	\$90,960
Wading net	194	153	58	37	24	\$13,040
Gill net	53	40	38	11	13	\$6,400
Cast net	7	3	3	0	57	\$304
Spear	32	32	32	0	0	\$0
Spear gun	4	4	4	0	0	\$0
Total women						\$110,704
Total damages						\$170,748

Table 5c. The condition of different fishing gear post-cyclone in Cakaudrove Province. Fifty percent (23 of 46) of coastal villages in the province were surveyed. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD. *=inconsistencies in the data provided by local communities (see section 3.2.1 for details).

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
Hook & line	1330	1257*	1283*	0	1	\$2,640
Spear gun	247	244	219	0	1	\$1,200
Cast net	86	72	63	10	8	\$874
SCUBA	8	6	0	13	0	\$720
Gill net	14	14	13	0	7	\$320
Spear	328	322	318	0	2	\$192
Portable trap	14	2	2	0	86	\$192
Other	26	26	26	0	0	\$0
Total men						\$6,138
Women						
Hook & line	1741	1601	1441	5	0	\$11,520
Other	62	57	36	8	0	\$400
Cast net	39	33	27	10	5	\$304
Spear gun	6	5	5	17	0	\$240
Gill net	6	6	5	0	0	\$0
Spear	80	80	80	0	0	\$0
Portable trap	12	12	2	0	0	\$0
Total women						\$12,464
Total damages						\$18,602

Table 5d. The condition of different fishing gear post-cyclone in Lomaiviti Province. Eighty-seven percent (40 of 46) coastal villages in the province were surveyed. The value of damages was calculated on both gear damaged and lost. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD.

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
Hook & line	705	242	226	2	66	\$113,040
Gill net	220	66	55	5	70	\$102,080
Spear gun	317	172	150	7	46	\$74,880
Cast net	105	52	43	9	50	\$4,370
Mask	78	5	5	0	94	\$3,504
Dive torch	38	16	16	0	58	\$1,584
Spear	69	25	23	3	64	\$1,440
Portable trap	138	77	72	4	44	\$1,016
Fins	20	0	0	0	100	\$800
Total men						\$302,714
Women						
Hook & line	1029	274	254	2	73	\$183,600
Gill net	105	30	27	3	71	\$49,440
Spear gun	103	25	25	0	76	\$37,440
Cast net	129	9	5	3	93	\$9,272
Spear	73	5	4	1	93	\$2,192
Portable trap	3	0	0	0	100	\$48
Total women						\$281,992
Total damages						\$584,706

Table 5e. The condition of different fishing gear post-cyclone in Ra Province. Sixty-two percent (13 of 21) coastal villages in the province were surveyed. The value of damages was calculated on both gear damaged and lost. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD.

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
Spear gun	65	41	18	5	66	\$10,980
Hook & line	103	77	58	0	25	\$6,240
Gill net	43	5	0	0	88	\$6,080
Spear	49	36	35	2	24	\$404
Cast net	11	9	9	0	18	\$152
Life jacket	4	0	0	0	100	\$96
Mask & snorkel	18	0	0	0	100	\$864
Portable trap	2	0	0	0	100	\$32
Total men	295	168	120	1	49	\$24,848
Women						
Hook & line	222	84	85	0	62	\$32,880
Cast net	46	0	0	96	4	\$2,242
Gill net	18	4	4	0	78	\$2,240
Spear	25	25	25	0	0	\$0
Total women	311	113	114	14	49	\$37,362
Total damages						\$63,090

Table 5f. The condition of different fishing gear post-cyclone in Tailevu Province. Forty-one percent (11 of 27) coastal villages in the province were surveyed. The value of damages was calculated on both gear damaged and lost. Percentage (%) represents the proportion of gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD.

Gear type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Men						
SCUBA	40	0	0	0	100	\$64,000
Spear guns	31	0	0	0	100	\$14,880
Hook & line	180	84	98	0	15	\$6,480
Cast net	9	6	6	0	33	\$228
Gill net	44	43	44	0	0	\$0
Portable trap	20	20	20	0	0	\$0
Total men						\$85,588
Women						
Gill net	63	0	0	0	100	\$40,320
Hook & line	138	86	86	0	38	\$12,480
Cast net	6	6	6	0	0	\$0
Total women						\$52,800
Total damages						\$138,388

4.1.4 Post-harvest equipment

In general freezers and ice-boxes represent a large proportion of the value of damaged equipment across all provinces (Table 6). In absolute terms the value of damage is highest in Ba (\$130,000) and Lomaiviti (\$133,000). In the case of Ba this is largely due to the significantly higher quantity of post-harvesting equipment in these communities pre-cyclone. In the case of Lomaiviti this is largely driven by the proportionally higher losses of equipment (39-100% of all post-harvest equipment). Overall damages in Bua, Cakaudrove and Ra were much lower both in absolute value and proportionally.

For communities that depend on fisheries for income generation, equipment related to the processing of sea cucumbers (into the traded form known as bêche-de-mer) also represent common post-harvest equipment damaged or lost completely, such as cookers, racks and dryers. In many cases large proportions (up to 50%) of racks and dryers were lost but these are often low value items.

Key considerations

- Where communities depended on storage of fish in ice-boxes and freezers, impacts on infrastructure across the supply chain (electricity supply, ice-making plants) should be undertaken to determine the appropriate support measures, taking into consideration the state of the nearshore environments. For example, replacing post-harvest equipment alone may not be useful if electricity has not been reconnected, or the availability of the resource has been reduced significantly.
- Provision of low value equipment (e.g. racks, dryers, pots) to affected communities could support a faster return to pre-cyclone livelihood activities. However the ecological impact on fisheries, such as sea cucumber, should be considered. For example, sea cucumber stocks were already depleted before the cyclone with a recommendation that the fishery be closed for 5-10 years (Pakoa et al., 2013).
- Alternative livelihood options should be promoted where resources have been badly impacted to promote income generation and allow the resource to recover.

Table 6. The condition of different post-harvest gear post-cyclone. Percentage (%) represents the proportion of post-harvest gear good, damaged or lost as a result of Cyclone Winston. Value of damages is in FJD. The percentage of coastal villages surveyed is shown in parentheses. BDM = bêche-de-mer, the processed traded form for sea cucumbers.

Equipment type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Ba Province (100%)						
Ice box	266	105	79	28	35	\$62,160
Freezer	69	33	10	25	45	\$40,448
Fish/BDM smoker	225	124	32	34	40	\$15,540
Cookers/pot (BDM)	77	28	18	31	32	\$5,920
Sun dryer	119	58	9	25	43	\$5,280
Racks (seaweed)	19	18	3	79	5	\$680
Racks (BDM)	3	3	0	100	0	\$240
Salting box (BDM)	5	2	0	40	20	\$80
SCUBA	10	10	10	0	0	\$0
Total						\$130,348
Bua Province (100%)						
Fish/BDM smoker	783	546	390	7%	22%	\$22,560
Racks (BDM)	176	92	67	14%	48%	\$7,720
Cookers/pots (BDM)	402	344	285	8%	7%	\$7,040
Ice boxes	149	136	116	2%	9%	\$6,960
Freezers	29	24	17	17%	7%	\$4,608
Equipment storage shed	18	8	8	39%	17%	\$2,600
Sun dryers	204	172	169	0%	16%	\$2,560
Racks (seaweed)	3	3	2	33%	0%	\$40
Salting boxes	7	6	6	0%	14%	\$40
SCUBA	32	32	32	0%	0%	\$0
Total						\$54,128

Table 6. Continued

Equipment type	# Before	# After	# Good	% Damaged	% Lost	Value of damages
Cakaudrove Province (50%)						
Freezers	66	52	46	15	9	\$11,264
Cookers/pots (BDM)	140	79	80	1	44	\$10,000
Ice boxes	123	107	96	3	8	\$5,760
Sun dryers	132	63	56	0	52	\$5,520
Fish/BDM smokers	396	373	345	2	5	\$2,640
Racks (BDM)	16	0	0	31	69	\$1,080
Other	16	16	5	6	6	\$120
Total						\$36,384
Lomaiviti Province (87%)						
Equipment shed	94	25	5	0	73	\$27,600
Freezers	61	34	25	5	39	\$26,112
Ice boxes	77	34	18	0	56	\$20,640
Pots	146	34	32	3	75	\$18,000
Fish shed	43	0	0	0	100	\$17,200
Fish smokers	127	31	11	21	67	\$11,820
Sun dryers	126	0	0	30	70	\$8,560
Racks (seaweed)	24	0	0	0	100	\$1,920
Racks (BDM)	22	0	0	0	86	\$1,040
Salting box (BDM)	15	0	0	0	80	\$480
Total						\$133,372
Ra Province (62%)						
Ice boxes	20	4	2	15	75	\$16,260
Freezers	7	4	2	0	29	\$2,048
Fish/BDM smokers	16	1	1	0	94	\$1,800
Racks (seaweed)	12	0	0	0	100	\$960
Salting box (BDM)	12	0	0	0	100	\$480
Fish storage facility	1	0	1	0	0	\$0
Total						\$21,548
Tailevu Province (41%)						
Freezers	97	74	55	34	7	\$24,064
Ice boxes	34	25	13	0	47	\$7,680
Total						\$31,744

4.1.5 Impact on Fishing Aggregating Devices

Nearshore Fish Aggregating Devices (FADs) can support fisheries production by aggregating oceanic fish closer to shore to make it easier for fishers to catch. This can also help to take pressure off the reef in time of stress. Very few villages had FADs in place before the cyclone (Table 7). FADs were in place in only two districts in Cakaudrove (Wailevu West and Wainekeli), one district in Ba (Nacula) and Tailevu (Dawasamu), and one village in Moturiki (Wawa). Of the 31 FADs in place, 11 (35%) were destroyed by the cyclone. It is possible that FADs could have been made in the village and not purchased, as villages were not asked to specify. We assumed a \$5,000 replacement cost based on guidance from SPC (P. James, pers. comm.), as FADs cannot be repaired.

Under the Offshore Fisheries Management Decree (2012), a permit is required to install FADs, and therefore data from this study should be cross-checked with the Department of Fisheries permit database.

Key consideration

The damage to other fishing infrastructure should be considered when replacing or installing FADs. For example fishers may not have a functional boat to access the FAD or fishing gear. Also, all FADs reported by local communities should be cross-checked with the Department of Fisheries permit database to confirm whether they were licensed prior to the cyclone.

Table 7. Fish Aggregating Devices (FADs) that were deployed pre-cyclone and present post cyclone.

Province	# FADs pre-cyclone	# FADS post-cyclone	Value of damages
Bua	0	0	\$0
Cakaudrove	15	3	\$60,000
Lomaiviti (Ovalau)	1	0	\$5,000
Lomaiviti (Koro)	0	0	\$0
Lomaiviti (Moturiki)	13	7	\$30,000
Ba	1	1	\$0
Tailevu	1	0	\$5,000
Ra	0	0	\$0
Total	31	11	\$100,000

4.1.6 Overall summaries of damages and losses by province

The total value of damage to fishing infrastructure varied considerably between provinces, even when taking into account the different proportion of coastal villages surveyed (Table 8). Ba Province had more than double the amount of damage than Bua. The damage in Ra Province was much lower, relatively, than neighboring Ba, despite having more fishing infrastructure pre-cyclone. It could also be due in part to respondents not knowing or underestimating the amount of damage. As noted previously, it is important to consider the proportion of damage as well as the financial cost when prioritising recovery efforts. Although the financial loss is low in Ra Province, several of the districts sustained a high proportion of damage. The biggest financial loss relating to fishing infrastructure occurred in the coastal villages in Lomaiviti and Ba provinces.

The total value of damage to fishing infrastructure varied considerably between provinces. Although differing proportions of coastal villages in each province were

surveyed (Table 8), it is nevertheless worth highlighting that Ba sustained significantly higher damages than Bua – in both provinces, 100% of coastal villages were surveyed. This is consistent with the results of the PDNA which concluded that overall, Ba Province was the most heavily impacted in terms of absolute damages (Government of Fiji, 2016). The high absolute damages in the fisheries sector in the Lomaiviti group confirm their relatively heavy dependence on fisheries activities. Ra had lower overall absolute losses but only 62% of coastal villages were surveyed and several districts sustained a high proportion of losses (Table 8). This is also consistent with the PDNA results which concluded that Ra, Bua and Lomaiviti were the most heavily impacted provinces from a per capita basis (Government of Fiji, 2016).

Key consideration

It is difficult to use the total value of fishing infrastructure damage by province to make direct comparisons between provinces, as not all coastal villages were surveyed in each province. It is therefore important to consider the proportion of damage as well as the overall value when prioritising recovery efforts.

Table 8. Summary of damages and losses in boats, engines, fishing gear, post-harvest equipment and Fish Aggregating Devices (FADs) in surveyed villages. Value of damages is in FJD. Values do not represent the total value in each province, as all villages were not surveyed. The percentage of coastal villages surveyed is shown in parentheses.

Provinces	Boats	Engines	Gear	Post-harvest equipment	FADs	Total
Lomaiviti (87%)	\$128,154	\$73,349	\$584,706	\$133,372	\$35,000	\$954,581
Ba (100%)	\$186,858	\$307,625	\$318,136	\$130,348	\$0	\$942,967
Bua (100%)	\$103,288	\$113,359	\$170,748	\$54,128	\$0	\$441,523
Tailevu (41%)	\$29,876	\$46,177	\$138,388	\$31,744	\$5,000	\$251,185
Ra (62%)	\$76,194	\$52,697	\$61,394	\$21,548	\$0	\$211,833
Cakaudrove (50%)	\$64,621	\$25,971	\$18,602	\$36,384	\$60,000	\$205,578
Total						\$2,964,139

4.2 Impacts on subsistence and livelihoods

Coastal fisheries make an important contribution to community food security (subsistence) and livelihoods. In this report livelihood refers to any fisheries that is generating income for individuals, households or villages. Fisheries include harvesting of coral reef fish, pelagic/oceanic fish, mud crabs (qari), sea cucumbers, lobsters, trochus, prawns/shrimp (ura/moci), sea mussels (kaikoso), seaweed (lumi and nama), freshwater fish, freshwater mussels (kai) and aquaculture by men and women. In general, the reliance of households on fisheries as a source of food is high and is 100% in many of the villages surveyed (Table 9, Appendix 4). Reliance on fisheries for income generation tends to be lower and more variable between communities.

Respondents were asked to estimate the total number of households per village, as there is no current census data (latest census in 2007). Some surveyors were not able to

collect this information. Because of time constraints, the number of households was estimated based on other villages surveyed in the same district or through contact with individual provincial offices. District level information is provided in Appendix 5 and is more meaningful for comparative purposes and prioritising relief efforts. It should be noted that the average percentage of households does not represent the whole province, as not all villages were surveyed.

The number of households fishing for subsistence and/or livelihoods varies substantially within provinces (Table 9). For example in Cakaudrove the percentage of households dependent on fisheries for livelihoods ranged from 32–100%, and from 36–100% for subsistence. Villages in Ba are generally equally dependent on fisheries for subsistence (72%) and livelihoods (77%), compared to Bua where villages are more dependent on fisheries for subsistence (82%) than livelihoods (4%).

Table 9. The average percentage of households that depend on fisheries for livelihoods and subsistence by province. Ranges are provided in parentheses. The percentage of coastal villages surveyed is shown under province.

Province	Fish for livelihood	Fish for subsistence
Ba (100%)	77% (63-86%)	72% (46-89%)
Bua (100%)	4% (0-33%)	82% (55-100%)
Cakaudrove (50%)	78% (32-100%)	93% (36-100%)
Lomaiviti (87%)	36% (11-66%)	87% (72-100%)
Ovalau Island (73%)	15% (11-33%)	78% (86-100%)
Koro Island (100%)	49% (24-61%)	92% (87-100%)
Moturiki Island (100%)	66% (27-100%)	97% (81-100%)
Ra (62%)	71% (18 -100%)	65% (16 -100%)
Tailevu (41%)	40% (23-81%)	61% (44-99%)

Key considerations

Recovery efforts should support the recovery of existing livelihoods where appropriate. If fisheries activities were not a significant source of income generation pre-cyclone, recovery efforts should not seek to introduce or expand them as the resource is unlikely to be able to support additional fishing pressure for many years. Evidence on the different dependency on fisheries for livelihoods should be used in appropriately targeting measures. For example, Ba which sustained significant overall damages is heavily dependent on fisheries for livelihoods whereas Bua is not particularly dependent.

4.2.1 Ranking of fishing activities

Village representatives ranked the importance of different fisheries and the importance of fisheries as a whole for community livelihoods. Men and women were asked to do this separately to determine if fisheries and livelihood dependence were gender specific. Only livelihoods that were ranked number one before or after the cyclone are presented in this section.

In general, prior to the cyclone the harvesting of coral reef fish, prawns, shrimp and mud crabs, and the harvesting and processing of sea cucumbers were the highest ranked fisheries, though there were notable differences between provinces and districts, and between women and men. In general women engaged in a wider diversity of fisheries than men. For example in Ba Province, women engaged in eight fisheries, while most men engaged in three, largely coral reef fish, mud crabs and oceanic fish (Tables 10a-e).

The change to these rankings post-cyclone differed between districts, with some districts such as Ba experiencing little or no change (Table 10a) while Mudu (Koro Island) had dramatic changes (Table 10d). In Mudu the percentage of villages that ranked harvesting of coral reef fish their number one fishery decreased from 100% to 25% for men and by 75% to 0% for women. Although some districts showed little or no change, it may be the case that the rankings have stayed the same even though the intensity or scale of fishing has decreased dramatically. New fishing activities were also reported in some districts where post-cyclone rankings changed. For example women in 50% of villages in Bulu (Ba Province) began harvesting freshwater mussels after the cyclone, while oceanic fish harvesting stopped (50 to 0% of villages). In contrast, mud crab harvesting did not change (50% villages) (Table 10a). The changes recorded likely relate to men and women's ability to access different habitats, which in turn is dependent on the losses and damages to infrastructure such as boats. There were notable increases in ranking of some fisheries in response compared to others.

In some districts, men and women reported different impacts to the same fishery activity. For example in the one village surveyed in Wailevu East the ranking of the coral reef fishery decreased for men but remained the same for women (Table

10b). This may relate again to women generally fishing closer to the coastline whereas men tend to fish further out, and/or men investing their time in the rebuilding of homes and village infrastructure rather than fishing.

When assessing the impact to fisheries, it is important to consider both increases and decreases in fishery rankings post-cyclone. In cases where their main fishery has been heavily impacted, districts and villages that have not been able to change their main fishing activity, should be prioritized for assistance. This is the case for Nasavusavu district in Cakaudrove Province. Sea cucumbers were ranked the top activity for men and women before the cyclone, which was reduced from 100 to 50% and 50 to 0%, respectively post-cyclone (Table 10c). Men did not rank any other fishing activities post-cyclone. Similarly, 50% of women in villages ranked coral reef fish as their main fishing activity pre-cyclone, but were not fishing after. **It is also important to consider that the rankings do not reflect harvest effort, and that village rankings may not change even though their harvest has decreased.**

Key considerations

- Changes in rankings of fishing activities post-cyclone need to be examined more carefully to understand the causes of those changes, and the appropriate support measure that should be applied. These should be examined at the village level when making decisions about the provision of gear or other types of fisheries support.
- It is also important to consider that the rankings do not reflect harvest effort, and village rankings may not change even though their harvest has decreased. Districts and villages that have had their main fishery heavily impacted should be prioritized for assistance, provided the habitat is still productive and has not experienced extensive damage. It is important that any support to community fisheries not further degrade damaged habitats. Consideration should be given if there is a need to develop alternative livelihoods to fishing, to reduce stresses on heavily impacted habitats.

Table 10a. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Ba Province. Data are disaggregated by gender. FW=freshwater

Women District	Coral reef fish		FW mussels		Mud crabs		Oceanic fish		Prawns/shrimp		Sea mussels		Seaweed		Trochus	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after
Ba				100	100	100										
Bulu			0	50	50	50	0	50	0							
Nailaga	13	13	13	13	0	25			38	0	0	13			38	38
Naviti	75	13			25	0										
Nacula	57	57											0	43		

Men District	Coral reef fish		FW mussels		Mud crabs		Oceanic fish		Prawns/shrimp		Sea mussels		Seaweed		Trochus	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after
Ba							100	100								
Bulu	50	50						50	50	50						
Nailaga	75	75					0	25	13	13	0	13	0	0	0	14
Naviti	88	38	13	13	13	0	25	0						0	0	4
Nacula	86	86													14	0

Table 10b. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Bua Province. Data are disaggregated by gender.

Women		Sea mussels		Coral reef fish		Prawns/shrimp	
		before	after	before	after	before	after
District							
Bua	20	0	20	0	0	40	
Dama	50	25	50	75	0	25	
Kubulau	22	0	33	22	11	11	
Lekutu	50	25	25	50			
Nadi			100	75			
Navakasiga	100	67					
Solevu			33	0	33	67	
Vuya			100	100			
Wainunu	17	0	50	50			

Men		Sea mussels		Coral reef fish		Prawns/shrimp	
		before	after	before	after	before	after
District							
Bua	40	40	60	40	0	25	
Dama	25	0	100	75	0		
Kubulau	22	0	78	11	11	11	
Lekutu	50	25	25	25			
Nadi	50	0	75	75			
Navakasiga	100	67					
Solevu					33	33	
Vuya			100	100			
Wainunu	17	0	67	67			

Table 10c. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Cakaudrove Province. Data are disaggregated by gender.

Women District	Sea mussels		Coral reef fish		Prawns/shrimp		Trochus	
	before	after	before	after	before	after	before	after
Cakaudrove	60	40	60	60	20	20		
Nasavusavu	50	0	50	0				
Wailevu West	75	0	50	25	0	25	50	0
Wailevu East			100	100				
Wainikeli			75	50				
Naweni	25	0	50	25				
Natewa			80	80	20	20		

Men District	Sea mussels		Coral reef fish		Coral reef fish	
	before	after	before	after	before	after
Cakaudrove	20	20			80	80
Nasavusavu	100	50				
Wailevu West	100	25			75	0
Wailevu East					100	0
Wainikeli					75	75
Naweni	33	0			33	25
Natewa					60	75

Table 10d. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Lomaiviti Province. Data are disaggregated by gender.

Women District	Coral reef fish		Oceanic fish		Prawns/ shrimp		Sea cucumbers		Sea mussels		Seaweed		Trochus		Mud crabs		
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after	
Koro Island																	
Cawa	67	33			0	17			17	17			17	0			
Mudu	75	0									0	75					
Ovalau Island																	
Levuka	27	18	0	9					0	9	18	9	18	0			
Lovoni	100	0							0	100							
Nasinu	100	13	0	3	0	3			0	10	0	13					
Moturiki Island	10	20					10	0					10	0	10	20	

Men District	Coral reef fish		Oceanic fish		Prawns/ shrimp		Sea cucumbers		Sea mussels		Seaweed		Trochus		Mud crabs		
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after	
Koro Island																	
Cawa	67	33					17	0			17	0					
Mudu	100	25					0	0									
Ovalau Island																	
Levuka	73	9	9	0			9	9	0	9			0	9	0	9	
Lovoni	100	0							0	100							
Nasinu	75	0					25	0					0	25			
Moturiki Island	60	40	10	0	0	20					10	20					

Table 10e. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Ra Province. Data are disaggregated by gender. No data was collected for men in Saivou District.

District	Coral reef fish		Mud crabs		Sea cucumbers		Seaweed		Sea mussels	
	before	after	before	after	before	after	before	after	before	after
Naiyalayala	100	100							0	100
Nakorotubu	100	100								
Navitilevu	75	75	50	0	50	0				
Navolau	67	67					33	0		
Raviravi	100	100								
Saivou	100	0								

District	Coral reef fish		Sea cucumbers		Lobsters		Mud crabs		Oceanic fish		Pearl oysters		Prawns/ shrimp	
	before	after	before	after	before	after	before	after	before	after	before	after	before	after
Naiyalayala							0	100	100	100				
Nakorotubu	100	100									50	50		
Navitilevu	100	100	50	0	50	0	50	0					50	0
Navolau	100	100												
Raviravi	67	67	33	33										
Saivou														



Mud crab are an important source of livelihood for women fishers in Bua Province . (c) Yashika Nand/WCS

Table 10f. The proportion (%) of villages in each district that ranked a particular fishery as number one in importance, pre- and post-cyclone in Tailevu Province. Data are disaggregated by gender. FW=freshwater

Women										
District	Coral reef		Mud crabs		Sea cucumbers		Sea mussels		FW fish	
	before	after	before	after	before	after	before	after	before	after
Dawasamu	100	25								
Verata	0	0	43	29	29	29	14	0	0	14

Men						
District	Coral reef fish		FW fish		Oceanic fish	
	before	after	before	after	before	after
Dawasamu	50	43	0	29	50	14
Verata	57	27	14	18	14	9

4.2.2 Ranking of livelihood activities

In general, fisheries, agriculture (i.e., vegetables including root crops) and kava (yaqona) farming were ranked by villages as the main (i.e. number one) livelihoods for men and women before the cyclone (Table 11a-e). Other sources of livelihoods included copra, weaving, tapa making, seaweed (wild harvested) and formal employment. Most of these livelihoods have been impacted by Cyclone Winston. Whilst there has not been a huge shift in the rank of different fisheries activities there has been a marked decline in the rank of fisheries in relation to other livelihood activities. This is not surprising given the damage to important assets associated with these livelihoods (Tables 3-8). It is possible that respondents may have elevated the importance of fisheries activities over other livelihoods pre-cyclone because the assessment focused on fisheries. In addition some activities may have been overlooked because respondents were estimating activities for the entire village.

Sixty percent of villages in Kubulau district ranked fisheries as the number one livelihood for men pre-cyclone, and 40% ranked it as number one livelihood for women (Table 11b). This decreased to 10% of villages for both men and women's livelihoods, post-cyclone. Similar decreases were apparent in other districts. For example, 100% of surveyed villages in Wailevu West and Wailevu East ranked fisheries as the number one livelihood for women pre-cyclone but this is no longer the case across all villages surveyed (Table 11c). In Wailevu West 75% of villages ranked fisheries as the main livelihood for men pre-cyclone compared to 0% post-cyclone. Interestingly the main livelihood of men in Wailevu East was agriculture pre-cyclone and shifted to kava post-cyclone. Fisheries rankings for both men and women also decreased in Ra (Table 11d) and Tailevu (Table 11e).

There was an increase in the ranking of fisheries in some districts post-cyclone. For example in Ba province, the number of villages ranking fishery activities increased from 50 to 100% in Bulu district and 25% to 38% in Nailaga district (Table 11a). Agricultural livelihoods were also impacted by the cyclone. In Koro, agriculture and kava were ranked by 50% of the villages as the main livelihood for men pre-cyclone, which dropped to 0% post-cyclone (Table 11c).

Several villages reported shifts in livelihoods post-cyclone. There was a small increase in the number of villages ranking small business activities, such as canteens, as their number one livelihood in Bua, Dama and Lekutu (Bua), Dawasamu and Verata (Tailevu), Natewa (Cakaudrove), Levuku (Ovalau) and Nakorotubu, Navitilevu and Raviravi in Ra. This may be related to increased difficulty in accessing markets post-cyclone (Table 12). Market access was impacted in 7 villages in Tailevu (64%) and 11 villages in Ra (85%), 14 villages in Bua (34%), 10 villages in Cakaudrove (42%) and 3 villages in Ovalau (14%).

Copra activities have also increased for women (0 to 50%) and men (50 to 75%) in Dama, while agriculture has increased for women in Kubulau (0 to 20%), and weaving activities increased for women in several districts in Cakaudrove (Cakaudrove, Wailevu West and Naweni), yaqona production increased in a few districts (Wailevu East in Cakaudrove, Navakasiga in Bua), although this was not typical. Men and women reported an increase in casual employment in Cawa on Koro Island (Table 11d). A few villages had become dependent on family in other parts of Fiji such as Dawasamu in Tailevu and Mudu on Koro Island.

Formal employment was one of the few livelihoods that remained relatively stable after the cyclone and even increased in importance in some districts. Those that had formal employment in Ba and Lomaiviti provinces maintained it (except women in Levuka), with increases for men in Nacula (Table 11a), Levuka, Lovoni and Nasinu and women in Mudu and Nasinu (Table 11d). The number of livelihoods often differed between men and women within districts and provinces. Women were engaged in more livelihoods in Cakaudrove (Table 11c) and Lomaiviti (Table 11d) Provinces, and men had more livelihoods in Ra (Table 11e).

However, these results should be viewed with caution as household level assessments conducted prior to the cyclone showed fisheries to be ranked much lower than agriculture and yaqona farming for Kubulau and Nakorotubu Districts, suggesting that respondents may have over-estimated amount of fishing occurring within their communities and the contribution to local livelihoods (R. Dacks, pers. comm.).

Household level data should be collected on livelihoods wherever recovery assistance is being provided.

Key considerations

- Villages may need assistance in finding alternative sources of income, until they are able to re-establish their main livelihood sources, particularly in villages that have lost their crops and have not been able to shift livelihood activities.
- Communities need assistance to diversify their livelihood activities, especially those that rely on only one or a few livelihood activities.
- Household level data should be collected as part of support provided to local communities to reflect the diversity of livelihoods that might have occurred within different households and their pre-cyclone dependence on fisheries for income.

Table 11a. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Ba Province. Data are disaggregated by gender.

Women													
District	Agriculture		Fisheries		Formal employment		Small businesses		Casual employment		Copra		
	before	after	before	after	before	after	before	after	before	after	before	after	
Ba					100	100							
Bulu	50	0	50	50			0	50					
Nailaga	0	25	38	38	25	25	25	25					
Naviti			88	25			25	0	13	0			
Nacula	14	0	57	43	14	14	14	0			14	0	

Men									
District	Agriculture		Fisheries		Formal employment		Small businesses		
	before	after	before	after	before	after	before	after	
Ba					100	100			
Bulu	50	0	50	100					
Nailaga	25	13	25	38	38	38			
Naviti	25	0	75	38	13	13	0	13	
Nacula	29	14	86	86	0	14			

Table 11b. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Bua Province. Data are disaggregated by gender.

Women									
District	Fisheries		Copra		Agriculture		Small businesses		
	before	after	before	after	before	after	before	after	
Bua	80	40	20	20			0	20	
Dama	75	25	0	50			0	25	
Kubulau	40	10			0	20	10	10	
Lekutu	50	25					0	25	
Nadi	50	50			25	25			
Navakasiga	67	67							
Solevu	67	0							
Vuya							25	0	
Wainunu	17	0							

Men										
District	Fisheries		Copra		Kava		Agriculture		Small businesses	
	before	after	before	after	before	after	before	after	before	after
Bua	40	20	60	60						
Dama	50	25	50	75						
Kubulau	60	10	0	10			10	30	0	10
Lekutu	75	50			25	25			0	25
Nadi	25	0			50	50	0	25		
Navakasiga	100	67			0	33				
Solevu					100	67				
Vuya					25	25				
Wainunu	17	0			33	33			33	33

Table 11c. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Ba Province. Data are disaggregated by gender.

Women	District	Fish		Copra		Kava		Agriculture		Small businesses		Weaving		Tapa	
		before	after	before	after	before	after	before	after	before	after	before	after	before	after
	Cakaudrove	60	60	20	20					20	0	20	20	0	0
	Nasavusavu	50	0	50	0								0	100	
	Wailevu West	100	0	50	100						0	25			
	Wailevu East	100	0	0	100										
	Wainikeli	25	25							50	0				
	Naweni	33	0	67	0					0	33	0	33	0	33
	Natewa	20	20			20	20	20	20	0	20	60	0	0	0

Men	District	Fisheries		Copra		Kava		Agriculture	
		before	after	before	after	before	after	before	after
	Cakaudrove			20	20	80	80	0	0
	Nasavusavu	100	0	0	50			50	0
	Wailevu West	75	0	25	100				
	Wailevu East	0	0			0	100	100	0
	Wainikeli	25	25			50	25	0	0
	Naweni	33	0	67	100				
	Natewa			80	80	80	80		

Table 11d. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Lomaliviti Province. Data are disaggregated by gender. bef=before, aft=after

Women District	Agriculture		Casual employment		Copro		Fisheries		Formal employment		Livestock		Other		Small businesses		Kava		Family		
	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after	
	Koro Island																				
Cawa			0	17			0	17					83	0							
Mudu					13	0			0	13	13	0	63	0			25	0			
Ovalau Island																					
Levuka	9	9							73	36					0	27	0	0	0	0	0
Lovoni									100	100											
Nasinu									75	100					25	0			0	0	20
Moturiki Island							100	80													
Men District	Agriculture		Fisheries		Formal employment		Kava		Casual employ		Family in Fiji										
	before	after	before	after	before	after	before	after	before	after	before	after									
Koro Island																					
Cawa	50	0	17	0			50	0	0	33											
Mudu	38	0					50	0			0	13									
Ovalau Island																					
Levuka			0	9	18	36	64	0	0	9											
Lovoni					0	100	100	0													
Nasinu			25	0	25	100	75	0													
Moturiki Island		0	90		50		90														

Table 11e. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Ra Province. Data are disaggregated by gender.

Women	District	Fisheries		Seaweed		Small businesses		Brooms	
		before	after	before	after	before	after	before	after
	Naiyalayala	100	100						
	Nakorotubu	50	50			0	50		
	Navitilevu	50	0			0	50		0
	Navolau	33	33	33	0	33	33		
	Raviravi	67	33			33	67		

Men	District	Agriculture		Copra		Family (in Fiji)		Family (outside Fiji)		Fish		Livestock		Small businesses		Kava	
		before	after	before	after	before	after	before	after	before	after	before	after	before	after	before	after
	Naiyalayala					100	100	100	0	100	100	100	100	100			
	Nakorotubu			50	0					0	50					50	50
	Navitilevu			100	0					75	75	50	50	0	0	50	0
	Navolau	33	33							33	0						
	Raviravi									100	100						
	Saivou									100	0						

Table 11f. The proportion (%) of villages in each district that ranked a particular livelihood as number one in importance, pre- and post-cyclone in Tailevu Province. Data are disaggregated by gender.

Women								
District	Fisheries		Small businesses		Family (in Fiji)		Other	
	before	after	before	after	before	after	before	after
Dawasamu	100	0			0	25	0	75
Verata	71	57	14	29				

Men						
District	Fisheries		Small businesses		Agriculture	
	before	after	before	after	before	after
Dawasamu	50	0	0	25	50	0
Verata	43	43			57	57

4.2.3 Market access to sell fish

Fifty-three villages (35% of villages) stated their access to markets to sell fish was affected by the cyclone. Market access was most impacted in Ra (85% of villages), followed by Tailevu (64%) and Cakaudrove (42%). Koro and Moturiki Islands in Lomaiviti Province were not impacted as their markets were not on the island themselves and transport to Viti Levu resumed fairly quickly after the event (Table 12).

The cyclone impacted people's ability to access markets in a number of different ways. Blocked or damaged roads may have restricted access to markets for buying or selling fish and other products, and access to ice for storage. Damage to ice facilities may have affected the ability of more remote communities to maintain the freshness of their fish during

transport to local markets. This may have also contributed to the decrease in fisheries as the main livelihood in these villages (see sections 4.2.1-4.2.2).

The majority of villages in Cakaudrove (78%) fish for their livelihood and market access to sell fish was impacted in 42% of villages. Villages on Moturiki Island also rely on fish for livelihood and stated their market access was not affected. This was surprising as villages in Moturiki are reliant on their own boats to access markets, as there is no ferry service. This suggests that these villages were able to utilize their remaining boats (25% were damaged and lost) or alternate boats to access markets. In contrast only 85% of villages in Ra Province stated their market access was affected.

Table 12. The number of villages and percentage of villages whose access to markets for the sale of fish was affected by the cyclone.

Province	# Villages	% Villages
Bua	14	34
Ba	8	31
Cakaudrove	10	42
Lomaiviti (Ovalau)	3	14
Lomaiviti (Koro)	0	0
Lomaiviti (Moturiki)	0	0
Tailevu	7	64
Ra	11	85

4.2.4 Number of fishing licences

Respondents also gave details of the number of fishing licences held in each village, district and province (Table 13). As fishing licences are renewed around February each year, it is possible that the figures presented below are distorted as a result of some fishers may not yet have applied for, and been granted their licence. This is likely the case for Tailevu where an average of 40% of villages stated that they fish for livelihood (Table 9), but there are no reported fishing licences. In contrast, Bua has the highest number of fishing licences but reported that only an average of 4% of village

fish for livelihood. Inconsistencies between those that state they fish for livelihoods and those that hold licenses may reflect poor knowledge by the people being interviewed and should be cross-checked with the Department of Fisheries fishing license database. It is important to consider that not all villages in each district were surveyed. Thus data can only be used for general comparisons. For example men are more engaged in commercial fishing activities than women, as they hold more fishing licences.

Table 13: Number of men and women with fishing licences per province and island (for Lomaiviti Province).

Province	Men	Women
Bua	260	118
Ba	176	118
Cakaudrove	95	40
Lomaiviti	66	4
Ovalau Island	26	0
Koro Island	18	3
Moturiki Island	22	1
Ra	41	32
Tailevu	0	0

4.3 Impact on diets

4.3.1 Fish consumption and protein sources

One of the more dramatic impacts perhaps of the cyclone is the sharp reduction in the number of times a week communities were eating fresh fish. Many coastal villages ate fresh fish over 6 times a week pre-cyclone, and this decreased to less than 2.5 times per week post-cyclone (Table 14). Weekly fish consumption has been most impacted in Lomaiviti, with all districts except Moturiki eating fish once per week or less post-cyclone. The impact to diets varies within provinces which may reflect the amount of damage to fishing infrastructure, access to marine resources and/or ability to buy fish. For example, some villages in Ra were still eating fish every day (Naiyalayala District) while the other districts in the province reported eating fish less than 3 times a week. It is important to consider weekly fish consumption before the cyclone when assessing changes and possible impacts.

Respondents were also asked to rank the main sources of protein consumed before and after the cyclone (Fig. 4, Table 15). Fresh fish was the main protein source in nearly all surveyed villages pre-cyclone. Canned fish, pork, dhal and chicken were the main protein source for only a few villages in Bua, Ba, and Lomaiviti pre-cyclone. Fresh fish was replaced with canned fish, dhal or chicken as the main protein source in most villages post-cyclone. The exception was Cakaudrove

where fresh fish was still the main protein source post-cyclone. The biggest change was seen in villages in Lomaiviti, with most villages changing their main source of protein from fresh fish to canned fish and dhal (Fig. 4, Table 15).

One of the reasons for this shift in protein sources away from fresh fish to other sources is not only related to the impacts on fishing infrastructure and fisheries, but also that the rations being distributed contained tinned fish, dhal and other protein sources. It can therefore also be viewed positively in the sense that food relief items appear to have reached communities most in need as part of the cyclone response. A follow up assessment should be conducted to determine whether these patterns have shifted since the provisions of food rations ended.

Key consideration

Low value and impact gear should be distributed quickly to villages so that protein intake from fisheries can be restored as quickly as possible, without further degrading fisheries and putting undue stressed on recovering ecosystems. Where fisheries activities are not expected to recover quickly to restore protein from fisheries, communities may need support to diversity their protein sources (e.g. through small scale poultry).

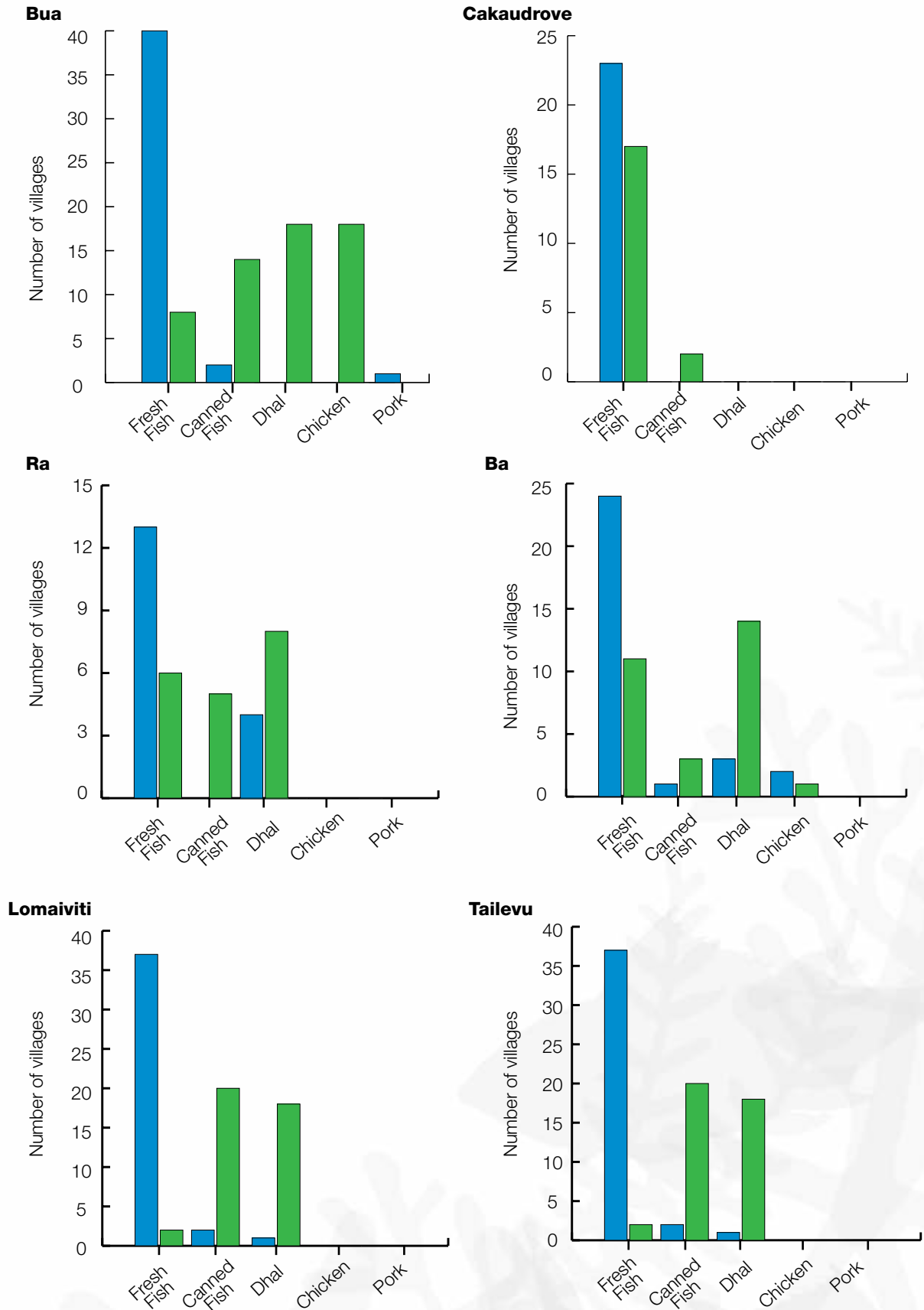


Figure 4. Main protein source before (blue bars) and after (green bars) Cyclone Winston in six provinces

Table 14. Average number of days per week that fish was consumed pre- and post-cyclone and change in number of days.

Province	District	Pre-cyclone	Post-cyclone	Change
Ba	Ba	7	1	6.0
	Nailaga	6.3	1.1	5.2
	Bulu	7	2	5.0
	Naviti	5.6	4.9	0.7
	Nacula	5.1	5.1	0.0
Bua	Kubulau	6.2	0.9	5.3
	Solevu	6.3	2.3	4.0
	Vuya	6.0	2.3	3.7
	Wainunu	5.8	2.2	3.7
	Nadi	5.1	1.5	3.6
	Dama	4.6	1.8	2.9
	Navakasiga	5.5	3.2	2.3
	Lekutu	6.5	4.8	1.8
Cakaudrove	Bua	4.2	3.4	0.8
	Nasavusavu	7.00	2.50	4.5
	Wainikeli	5	1.25	3.8
	Wailevu West	4.88	1.20	3.7
	Naweni	5.00	1.33	3.7
	Wailevu East	5.00	2.00	3.0
	Cakaudrove	4.83	2.83	2.0
Lomaiviti	Natewa	4.57	3.86	0.7
	Mudu	4.9	0.12	4.8
	Cawa	4.83	1.16	3.7
	Nasinu	4.5	0	4.5
	Levuka	4.54	1.2	3.3
	Lovoni	2	0	2.0
Ra	Moturiki	3.7	2.4	1.3
	Navitilevu	7.0	2.0	5.0
	Nakorotubu	7.0	2.5	4.5
	Raviravi	4.0	1.0	3.0
	Navolau	4.7	2.2	2.5
	Saivou	3.0	1.0	2.0
Tailevu	Naiyalayala	7.0	7.0	0.0
	Dawasamu	6	2.25	3.8
	Verata	2.14	1.28	0.9

Table 15. The top three protein sources identified by villages in each province pre- and post-Cyclone Winston. Numbers represent the number of times a protein was identified by a village.

Province	Protein source	Before			After		
		#1	#2	#3	#1	#2	#3
Ba	fresh fish	24	2		11	5	7
	dhal	3	12	8	14	8	2
	canned fish	1	10	13	3	10	12
	chicken	2	2	3	1		2
	beef			3			2
Bua	fresh fish	40	0	1	8	4	8
	canned fish	2	17	11	14	18	5
	dhal		16	9	18	9	5
	chicken		3	10	18	2	6
	pork	1	1	2		2	2
	beef		1	1		2	3
Cakaudrove	fresh fish	23			17	1	1
	canned fish	0	17	6	2	16	5
	dhal						
	chicken			1			2
	pork			1			2
Lomaiviti	fresh fish	37	2	1	2	1	10
	dhal	1	11	12	18	20	1
	canned fish	2	15	14	20	17	3
	beef			1		1	13
	chicken		1	11			9
	pork		1	1			
	other		1				1
Ra	fresh fish	13			6	3	
	dhal	4	2	1	8	1	1
	canned fish	0	4	1	5	2	
	chicken	0	1	1			1
Tailevu	fresh fish	8			3	1	0
	dhal	0	2	5	3	2	3
	chicken						1
	canned fish	0	4	4	1	3	4
	beef					2	1
	other	2	2		2	1	

4.3.2 Provision of fish to schools

Many coastal communities provided fish to feed the children at local schools before the cyclone (Table 16). The percentages of villages providing fresh fish to school declined in all provinces. The most impacted schools were

in Moturiki Island which declined from 100% to 30% of villages providing fish, Koro Island (64% to 0%), and Tailevu (100% to 55%). This will have a detrimental impact on the diets of school children in these areas in the short to medium-term.

Table 16. Number of villages (and their relative percentage) that provided fish for meals at schools pre- and post-cyclone. Data are shown per island for Lomaiviti Province.

Province	# villages pre-cyclone	# villages post-cyclone
Ba	24 (96%)	16 (70%)
Bua	16 (39%)	8 (20%)
Cakaudrove	14 (58%)	10 (43%)
Lomaiviti	22 (55%)	4 (10%)
Ovalau Island	3 (19%)	1 (6%)
Koro Island	9 (64%)	0
Moturiki Island	10 (100%)	3 (30%)
Ra	7 (61%)	5 (43%)
Tailevu	11 (100%)	6 (55%)

Key consideration

Schools should be provided with supplementary protein sources until impacted villages can recommence providing fish for meals. Schools in Koro, Moturiki and Tailevu were most impacted.

4.4 Livelihood needs post-cyclone

Coastal communities have had many of their livelihood assets destroyed or significantly damaged as a result of the cyclone. Respondents were asked to provide suggestions for potential livelihoods they would be interested in, post-cyclone. The top five livelihoods suggested in each province are shown in Figure 5. Livelihoods were grouped into several broad groupings: aquaculture (includes sea cucumber ranching, tilapia, pearl oyster, seaweed); agriculture (vegetables, root and plant crops); fisheries (fishing or post-harvest processing); and replanting (mangroves, corals). Other top livelihoods included bee keeping, poultry, sandalwood, FADs, and small businesses such as bakeries and canteens. Given a number of agencies are interested in supporting FADs post-cyclone, these have been listed separately.

Aquaculture was the main livelihood need identified in Cakaudrove, Tailevu and Lomaiviti provinces, while sandalwood was identified in Ra and small businesses in Ba. The livelihood needs identified in Bua Province were more varied with roughly equal numbers of villages identifying aquaculture, agriculture, poultry and bee keeping (Fig. 5).

It is worth noting that many of the livelihood needs expressed by coastal communities are agricultural and recovery efforts should ensure strong coordination between sectors and the different sources of funding associated with each. It is all too common that as a result of the siloed nature of funding sources fisheries funding is often not available to support

alternative non-fishing livelihood initiatives. Given the scale and extent of damage to coral reefs and associated fisheries (Mangubhai, 2016), promoting other livelihood sources for income generation is likely to be a sensible approach both for the communities and for protecting the fisheries resources as they recover.

Key considerations

- In general, recovery efforts should focus on restoring livelihoods that existed pre-cyclone as these are sources of income that communities are used to earning and have experience in managing.
- Care should be taken not to introduce new livelihood opportunities too quickly or without adequate ongoing support, when communities are in the process also of rebuilding their houses and their lives.
- Recovery efforts should ensure strong coordination between different agencies, sectors and sources of funding to ensure subsistence and livelihood needs are met.
- Given the damage to the marine resources themselves as a result of the cyclone, promoting other livelihood sources for income generation is likely to be a sensible approach both for the communities and for protecting the fisheries resources as they recover.

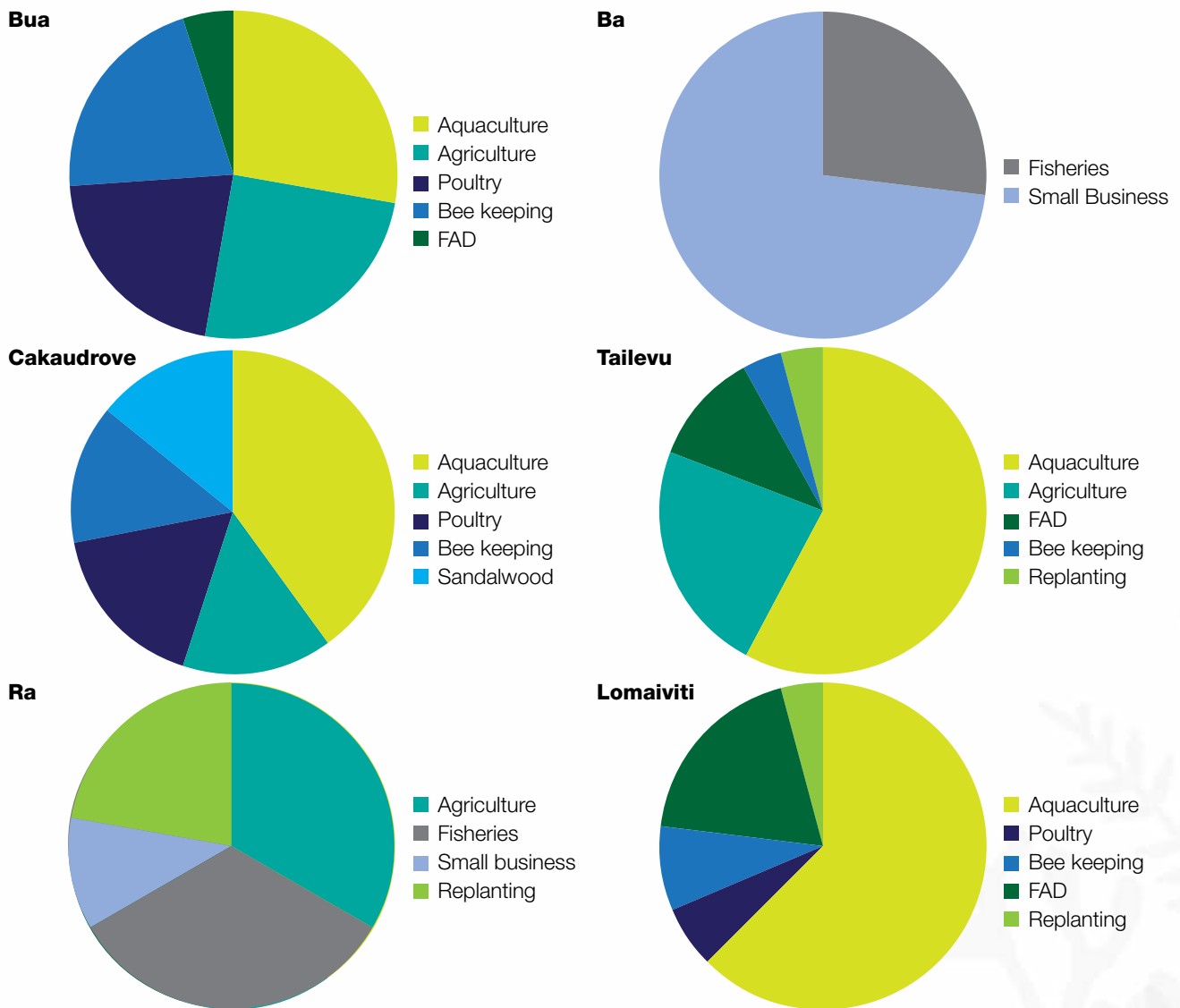


Figure 5. Top five livelihood needs identified by villages in the provinces of Ba, Bua, Cakaudrove, Lomaiviti, Ra and Tailevu. Numbers represent the number of times the livelihood was identified by a village.

4.5 Impacts to Marine Habitats

It is clear that coral reefs, seagrass and mangrove habitats in all the surveyed villages have been damaged by Cyclone Winston (Fig. 6). However the amount of perceived damage varies and should only be used for general comparisons within or between provinces due to the variability in responses, which are discussed by habitat below. Coral reefs and seagrass are perceived to have been badly damaged in all provinces. Mangroves have also been damaged in all provinces, although the percent damage is generally less (except for Ra).

We did not ask respondents how they estimated damage and if it was from in-water observations or from land. It is likely that mangroves are more accurately estimated as they are easier to observe and access from land. The high damage estimates in coral cover could be due to coral rubble being pushed up on the reef flat and easily visible. These data

therefore should only be taken as perception of damage, and not a reflection of actual damage.

4.5.1 Coral Reefs

The majority of villagers believed their coral reefs were badly damaged from cyclone Winston (Fig. 6). Reefs in Lomaiviti Province were perceived to be the most impacted with half of the surveyed villages estimating their reef had 75–100% damage, and just under 50% stating the reef had 5–50% damage. Coral reefs in Ra were also perceived to be badly impacted with 46% of surveyed villages estimated between 50–75% damage, 31% estimating between 75–100% damage. The majority of villages in Cakaudrove (50%) estimated damage between 5–50%. Coral reefs in Ba were believed to be less impacted, with half of the villages stating the reef had 25–50% damage. Thirty-one percent of villages estimated between 50–75% damage and 19% estimated there was between 0–25% damage.

4.5.2 Seagrass

The perceived damage to seagrass within the surveyed villages was variable, with few clear trends. Seagrass beds Lomaiviti and Bua Province, were believed to be most damaged, with the majority of villages stating damage was between 5-50% and 75-100%. The majority of villages (37%) in Cakaudrove estimated 50-75% damage, while 26 villages estimated between 25-50% damage. An equal amount (31%) of surveyed villages in Ra estimated damage was between 75-100%. The perceived damage to seagrass in Ba was divided between the 3 categories ranging between 0-25% (34%), 25-50% (31%), and 50-75% damage (35%).

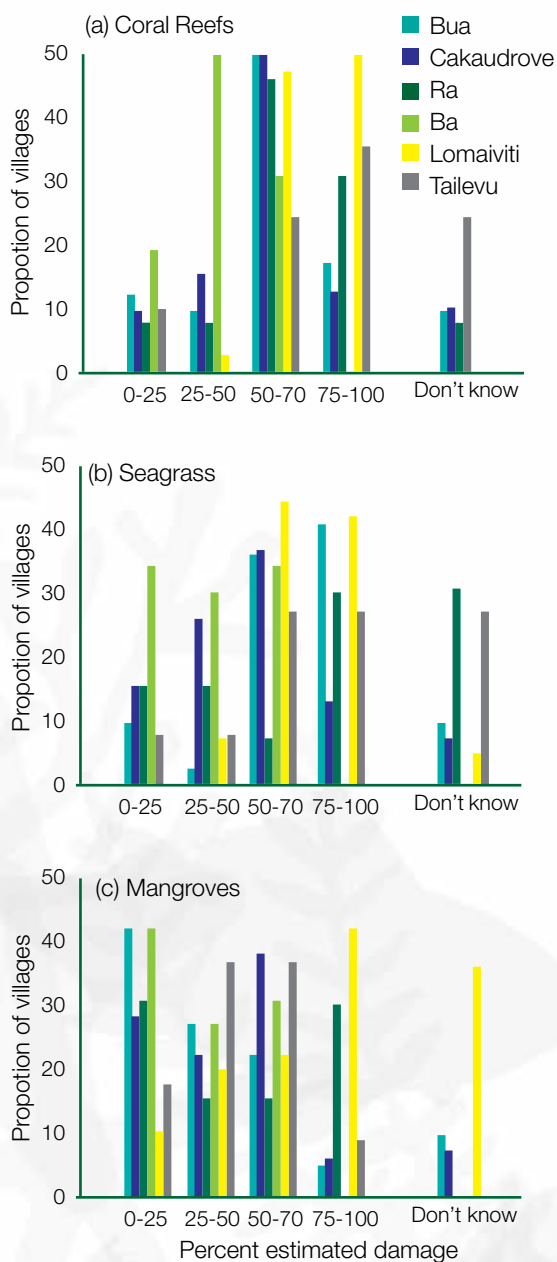


Figure 6. Proportion of villages indicating 0-25, 25-50, 50-75 and 75-100 percent damage to (a) coral reefs, (b) seagrass and (c) mangrove habitats, as a result of Cyclone Winston.

4.5.3 Mangroves

In general damage to mangroves was perceived to be less than damage to coral reefs and seagrass, except for Ra, with the majority of villages in Ra estimating damage between 75-100%. The majority of villages in Bua and Ba believed there was low damage (0-25%), and damage was roughly divided between 0-25% (28%) and 50-75% damage (33%) in Cakaudrove. The majority of villages in Lomaiviti did not know the amount of damage (35%) followed by 50-75% damage (22%). The villages that didn't know the amount of damage were located in Koro and Ovalau. This lack in knowledge may be related to their proximity and access to mangroves, as you would assume that it would be easier to visualise mangrove damage compared to coral reef and seagrass areas.

4.5.4 Condition of community fishing grounds

The majority of surveyed villages in Bua, Lomaiviti, Ra and Cakaudrove thought the condition of their fishing grounds (qoliqoli) was very good and unchanging before Cyclone Winston (Fig. 7). In contrast, the majority of villages in Ba believed their qoliqoli was degrading slowly or rapidly. The trend was not as strong in Cakaudrove and Lomaiviti although the greatest proportion of villages thought the condition was very good. An equal amount of villages in Tailevu thought the qoliqoli condition was either very good or degrading slowly, with the remainder thinking it was moderately good. There were variations within the Islands surveyed in Lomaiviti province. All villages in Koro thought the qoliqoli condition was very good and unchanging, while the majority though it very good in Ovalau, and moderately good in Moturiki.

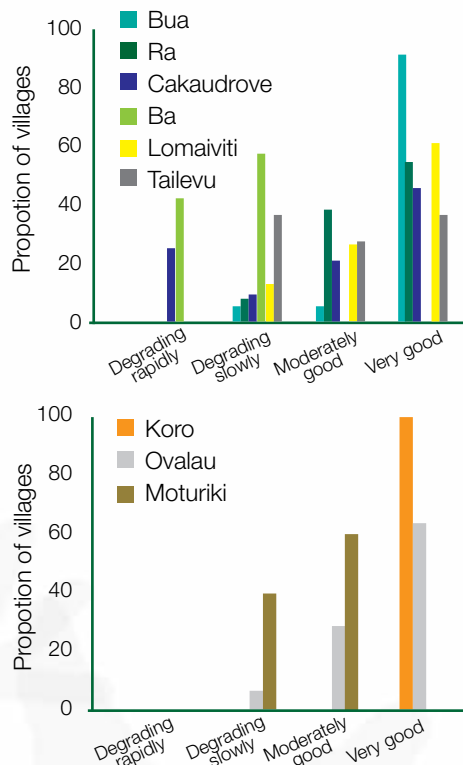


Figure 7. Perception of the condition of community fishing grounds before Cyclone Winston.

4.6 Marine Resource Management

4.6.1 Tabu areas

When interpreting the results of questions relating to community-based marine resource management it is important to remember that information was gathered from 2-3 representatives from the community and may not represent the views of everyone in that village.

Of the 154 villages surveyed, 116 villages (75%) had a periodically harvested closure (tabu) in place (Table 17). For those provinces that had tabu areas (excluding Ba where 42% of villages did not respond), the majority of villages had no plans to open their tabu areas for food (Fig. 8a). Of the 26 villages in Ba that did respond 8 wanted to open tabu areas for food and 7 wanted to keep them closed. The majority of surveyed villages in all provinces are also not considering opening their tabu areas for income. Even in Ba, where 42% of villages did not respond, 46% did not want to open their tabu areas while only 12% would consider opening them.

The willingness of some villages in Ba to open their tabu areas for food may be related to their perception of damage to marine habitats and condition of their fishing grounds (qoliqoli). The majority of villages in Ba estimated damage of coral reefs to be 25-50%, while other provinces estimated damage to be higher (Fig. 6). Similarly damage to seagrass and mangroves were perceived to be lower than the other

provinces. In contrast to the other provinces, all villages in Ba said their fishing grounds were degraded (slowly or rapidly), while the majority of other villages said their fishing grounds was in very or moderately good condition (Fig. 7).

There are some interesting trends between Islands in Lomaiviti Province. The majority of villages in Koro and a small percentage of the villages in Ovalau would consider opening their tabu areas for food but not for income (Fig. 8b). Moturiki was more divided with many villages not responding. Of the villages that responded, half would not open tabu areas for food while half would, and slightly less than half would consider opening the tabu areas for income. Incidentally all villages in Koro rated their fishing grounds in very good condition, while the majority in Ovalau and Moturiki said it was very good. Forty percent of the villages in Moturiki thought their fishing grounds were degrading slowly.

These results suggest that in some provinces there is not consensus on whether tabu areas should be opened or not (Figs. 8a-b). This means in some areas, there may be potential conflicts if the recovery process is slow or ineffective and there are pressing needs for food and/or income. It will be important for the Department of Fisheries, FLMMA and NGO partners to be ready to provide advice to communities with conflicting opinions on the opening or closing of tabu areas.

Table 17. Number of surveyed villages with tabu areas.

District	# Villages surveyed	# Villages with tabu areas
Ba Province		
Ba	1	0
Bulu	2	1
Nailaga	8	3
Naviti	8	5
Nacula	7	5
Total	26	14
Bua Province		
Bua	5	4
Dama	4	0
Kubulau	9	9
Lekutu	4	3
Nadi	4	4
Navakasiga	3	3
Solevu	3	3
Vuya	3	1
Wainunu	6	4
Total	41	31

Table 17. *Continued*

District	# Villages surveyed	# Villages with tabu areas
Cakaudrove Province		
Cakaudrove	5	4
Nasavusavu	2	2
Natewa	4	4
Naweni	3	3
Wailevu East	1	1
Wailevu West	4	3
Wainikeli	4	3
Total	23	20
Lomaiviti Province		
Koro Island	14	14
Cawa	6	6
Mudu	8	8
Ovalau Island	16	14
Levuka	11	9
Lovoni	1	1
Nasinu	4	4
Moturiki Island	10	5
Total	40	33
Ra Province		
Naiyalayala	1	1
Nakorotubu	3	3
Navitilevu	2	2
Navolau	3	2
Raviravi	3	1
Saivou	1	1
Total	13	10
Tailevu Province		
Dawasamu	4	2
Verata	7	6
Total	11	8

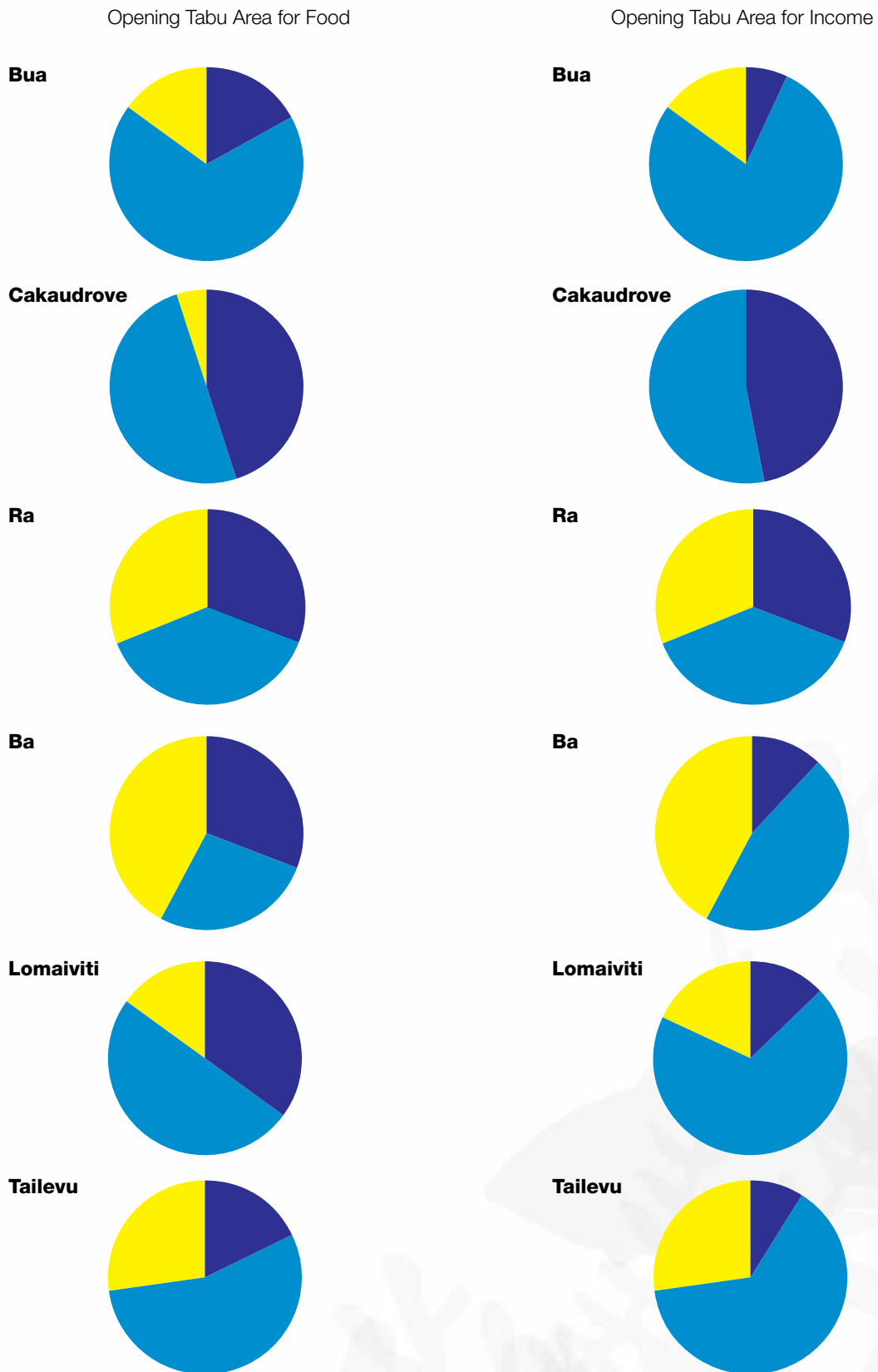


Figure 8a. The proportion of villages in each province that are considering opening their tabu areas for food or income post-Cyclone Winston. Dark blue is yes, blue is no, and yellow is not answered or not applicable (e.g. if there are no tabu areas).

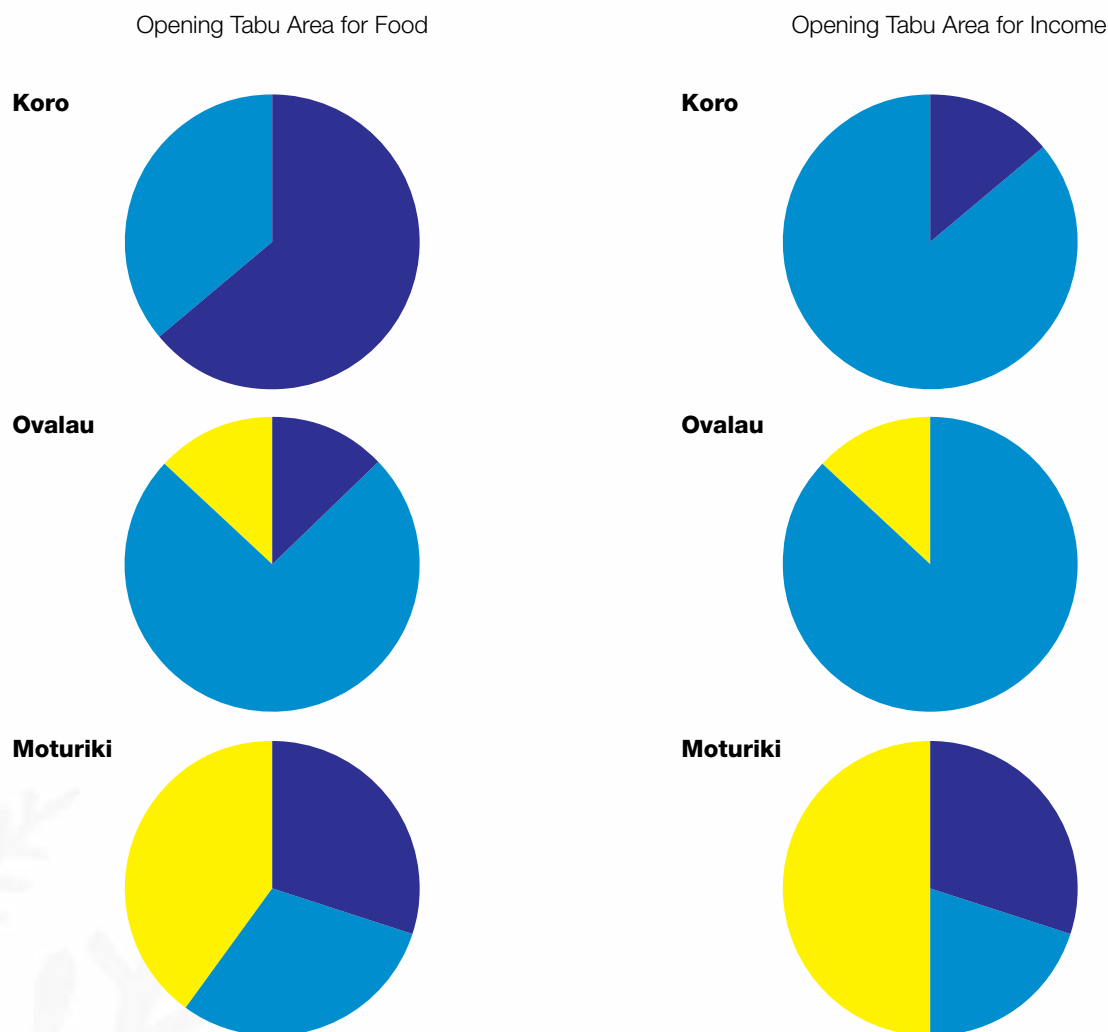


Figure 8b. The proportion of villages in each of the surveyed Islands in Lomaiviti province that are considering opening their tabu areas for food or income post-Cyclone Winston. Dark blue is yes, blue is no, and yellow is not answered or not applicable.

4.6.2 Qoliqoli Management pre- and post-cyclone

Tabu areas were the most commonly used management practice in traditional fishing areas before the cyclone although the proportion varied between provinces (Fig. 9). Cakaudrove, Lomaiviti and Tailevu had the biggest percentage of tabu areas compared to other management practices. The variety of management practices also varied between provinces. Ra had the most management practices (8 in total) while Tailevu and Ba only listed tabu areas and no other practices. A large proportion of villages in Ba did not answer the questions about their fishing grounds and tabu areas. Only a small proportion of villages in Bua, Cakaudrove, Ba and Tailevu said there were no practices in place before the cyclone.

The majority of villages, excluding those in Ba, said there had been no changes to management practices after the cyclone. A small percentage in Cakaudrove, Lomaiviti and Tailevu indicated that the tabu areas had been opened, a few

villages in Bua and Ra said the management practices were not being followed, and a few villages in Ba, Lomaiviti and Ra indicated changes in fishing practices. The majority of villages in Ba did not answer the question.

4.6.3 Will management practices help with recovery?

The majority of surveyed villages in all provinces thought that the management practices they put in place before Cyclone Winston would help them recover, although the proportion varied between provinces (Fig. 10). All villages in Lomaiviti thought practices would help, while in Tailevu 40% of villages thought they would help and 30% did not think they would help. Bua was the only other province where a small proportion of villages thought the practices would not help. A small number of villages indicated there were no practices (Cakaudrove and Ra), or did not know if they would help (Bua, Cakaudrove, Ra, Ba and Tailevu).

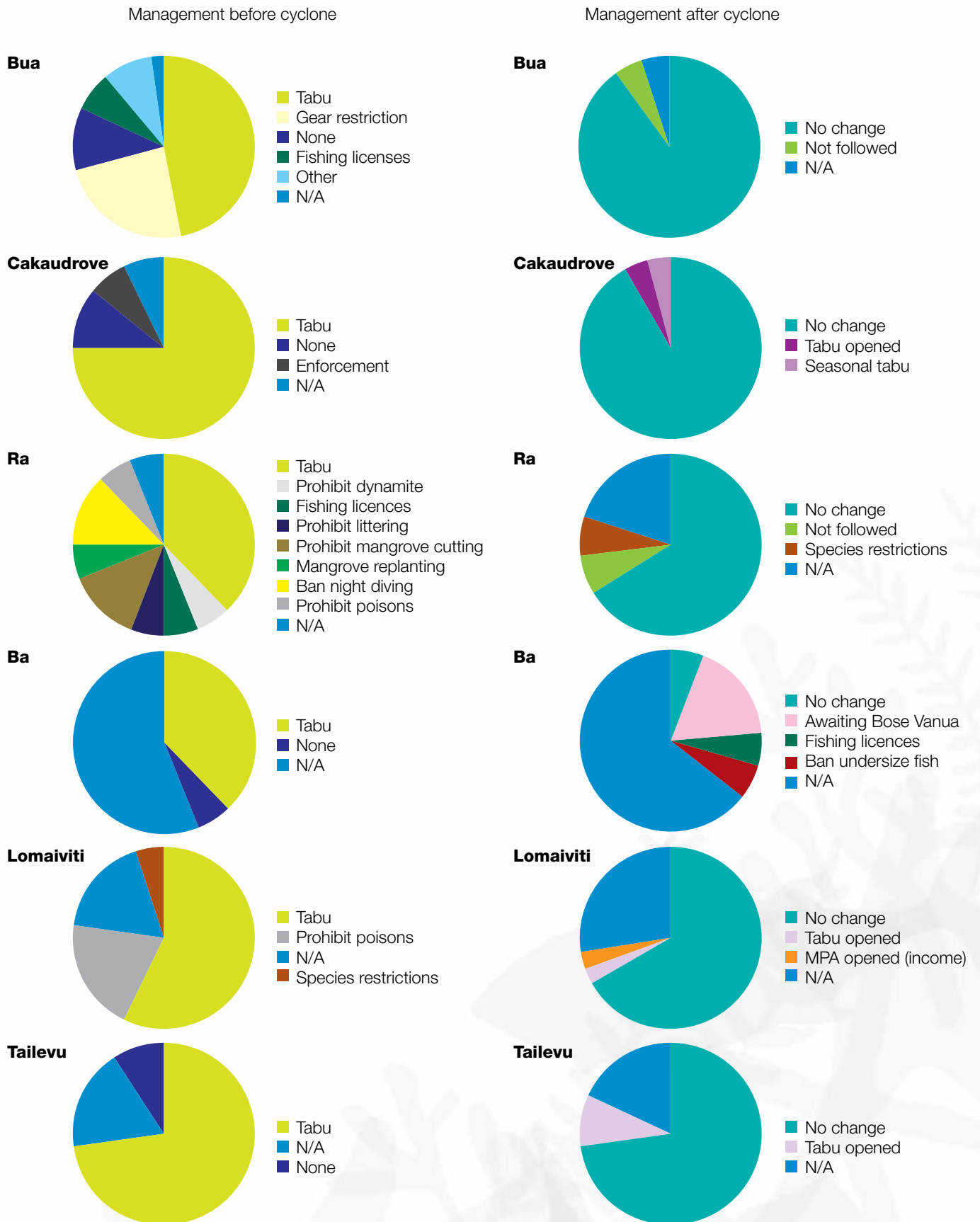


Figure 9. Qoliqoli management practices in place before and after Cyclone Winston.

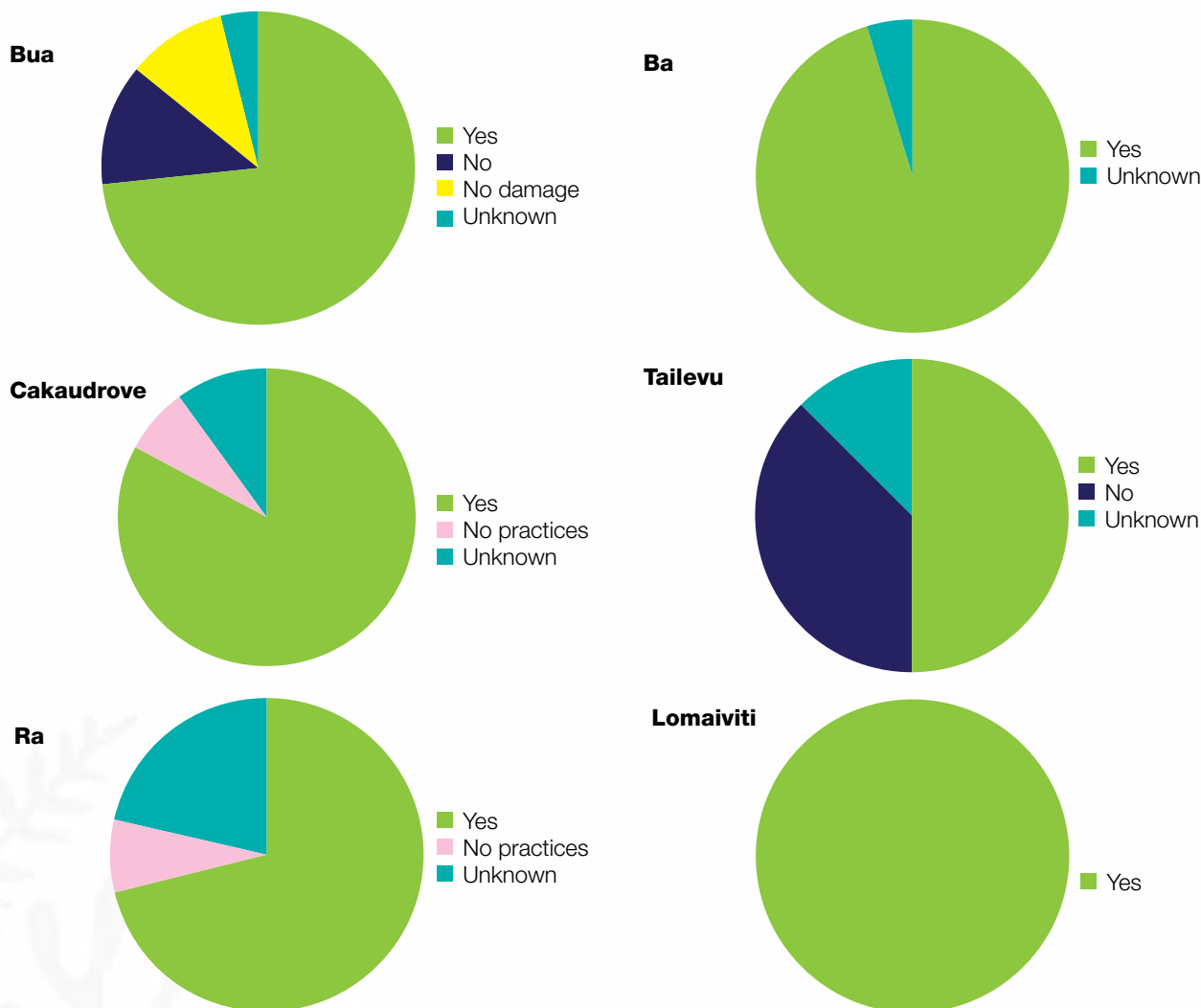


Figure 10. The proportion of villages in each province that believe the management practices established in their qoliqoli before Cyclone Winston will help with recovery.

4.7 Ranking of impact to districts

In consultation with partners and after examining the survey results and quality of data, a number of criteria were used to weight and rank the impact of the Cyclone Winston on fisheries infrastructure, livelihoods and subsistence within the districts surveyed (Table 18). The criteria are intended to guide the Department of Fisheries and partners towards districts with the greatest need for recovery assistance for their fisheries, to ensure support is done in a fair and transparent way. Districts were given a score of 1 to 4 based on the proportion of damage or reliance on fisheries, with 4 indicating the greatest impact. Scores were assigned as follows: 1 = 0-24%, 2 = 25-49%, 3 = 50-74%, 4 = 75-100%

(Table 19). The criteria for reliance on fisheries for subsistence and livelihood were weighted twice as much as the other criteria. The summed and average scores for each district are shown in Table 20. The scores for each criterion for each district is shown in Table 21.

It is important to note that the criteria do not take into account the value of losses and do not include biological criteria (e.g. amount of actual habitat damaged), which should also be considered when prioritising villages for assistance. Village level data are available and should be used for further prioritisation.

Table 18. Criteria used to weight and rank the impact of Cyclone Winston on districts in Fiji.

Criteria	Weight
1. Proportion of boats damaged per district	1
2. Proportion of boats lost per district	1
3. Proportion of engines damaged per district	1
4. Proportion of engines lost per district	1
5. Average proportion of fishing gear damaged per province men	1
6. Average proportion of fishing gear lost per province men	1
7. Average proportion of fishing gear damaged per province women	1
8. Average proportion of fishing gear lost per province women	1
9. Average proportion of post-harvest equipment damaged, per province	1
10. Average proportion of post-harvest equipment lost per province	1
11. Proportion of households relying on fishing for subsistence per district	2
12. Proportion of households relying on fishing as main source of livelihoods per district	2
13. Change in fish consumption per district	1

Table 19. Scoring system used to for each of the 13 criteria defined in Table 18. HH=households

Score	% Boats	% Engines		% Fishing gear		% Post-harvest equipment		% HH fishing for:		Changes in fish consumption before after
	Damaged	Damaged	Lost	Damaged	Lost	Damaged	Lost	Damaged	Lost	
1	<25	<25	<25	<20	<20	<25	<25	<25	<25	0-<1.5
2	25-<49	25-<49	25-<49	25-<49	25-<49	25-<49	25-<49	25-<49	25-<49	1.5-<3
3	50-<74	50-<74	50-<74	50-<74	50-<74	50-<74	50-<74	50-<74	50-<74	3-<4.5
4	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	4.5-7

Dawasamu district (Tailevu Province) was the most impacted, followed by Nakorotubu (Ra). Mudu (Lomaiviti) and Naiyalayala (Ra) were the third most impacted, followed by Navitevu (Ra) and Raviravi (Ra). Bulu (Ba), Naweni (Cakaudrove) and Navolau (Ra) were the next most impacted, followed by Cawa (Lomaiviti). In general Ra, Tailevu Lomaiviti, and Ba provinces, were most impacted although the amount of impact varied between districts. For example, of the two districts surveyed in Tailevu, Dawasamu scored second highest (42) while Verata had one of the lowest scores (24). Mudu district in Koro was fourth highest (40) and Cawa was seventh (34). These variations reflect differences in the degree of exposure to the

cyclone as well as impact to fishing infrastructure and reliance on fisheries. Verata was more sheltered than Dawasamu and villages in Mudu were more reliant on fisheries than Cawa.

Six of the ten most impacted districts (Nasau, Nakorotubu, Naiyalayala, Raviravi, Navolau, Navitilevu) are in Ra. Districts in Bua were the least impacted.

Recommendation

Based on the scored criteria, the ten most impacted districts were Dawasamu, Nakorotubu, Mudu, Naiyalayala, Navitevu, Raviravi, Bulu, Naweni, Navolau and Cawa.

Table 20. Summed scores (listed from highest to lowest score) for each district surveyed, based on 13 criteria listed in Table 18. Higher scores indicate more impact from Cyclone Winston. Districts with the same score are shaded.

Province	District	Score	Average
Tailevu	Dawasamu	42	3.2
Ra	Nakorotubu	41	3.2
Lomaiviti	Mudu	40	3.1
Ra	Naiyalayala	40	3.1
Ra	Navitilevu	36	2.8
Ra	Raviravi	36	2.8
Ba	Bulu	35	2.7
Cakaudrove	Naweni	35	2.7
Ra	Navolau	35	2.7
Lomaiviti	Cawa	34	2.6
Ba	Ba	33	2.5
Cakaudrove	Wailevu West	32	2.5
Ba	Nailaga/Tavua	31	2.4
Lomaiviti	Moturiki Is	31	2.4
Lomaiviti	Nasinu	31	2.4
Ba	Nacula Is	30	2.3
Cakaudrove	Cakaudrove	30	2.3
Cakaudrove	Wailevu East	30	2.3
Lomaiviti	Lovoni	30	2.3
Ba	Naviti Is	29	2.2
Bua	Kubulau	27	2.1
Bua	Vuya	27	2.1
Cakaudrove	Wainikeli	27	2.1
Lomaiviti	Levuka	27	2.1
Bua	Nadi	26	2.0
Cakaudrove	Natewa	26	2.0
Cakaudrove	Nasavusavu	24	1.8
Tailevu	Verata	24	1.8
Bua	Bua	23	1.8
Bua	Solevu	23	1.8
Bua	Wainunu	23	1.8
Ra	Saivou	23	1.8
Bua	Dama	22	1.7
Bua	Navakasiga	22	1.7
Bua	Lekutu	21	1.6

Table 21. Individual, summed and average scores (listed from highest to lowest) for each district surveyed, based on the 13 criteria listed in Table 18. Higher scores indicate more impact from Cyclone Winston. HH=households, Dmg=damaged, Live=livelihoods, Sub=subsistence, Avg=average

Province	District	% Boats		% Engines		% Fishing gear men		% Fishing gear women		% Post-harvest equipment		% HH fishing for		Change fish consumed	Score	Avg
		Dmg	Lost	Dmg	Lost	Dmg	Lost	Dmg	Lost	Dmg	Lost	Live	Sub			
Taillevu	Dawasamu	4	1	1	4	1	4	1	4	2	1	8	8	3	42	3.2
Ra	Nakorotubu	3	1	3	1	1	3	1	3	1	4	8	8	4	41	3.2
Lomaiviti	Mudu	1	4	1	4	1	3	1	3	1	3	6	8	4	40	3.1
Ra	Naiyalayala	4	1	4	1	1	3	1	3	1	4	8	8	1	40	3.1
Ra	Navitilevu	2	2	2	1	1	3	1	3	1	4	6	6	4	36	2.8
Ra	Raviravi	3	1	1	1	1	3	1	3	1	4	6	8	3	36	2.8
Ba	Bulu	4	1	1	2	1	1	1	2	2	2	8	6	4	35	2.7
Cakaudrove	Naweni	2	2	2	3	1	1	1	1	1	2	8	8	3	35	2.7
Ra	Navolau	1	2	4	1	1	3	1	3	1	4	6	6	2	35	2.7
Lomaiviti	Cawa	1	4	3	1	1	3	1	3	1	3	2	8	3	34	2.6
Ba	Ba	1	4	1	4	1	1	1	2	2	2	6	4	4	33	2.5
Cakaudrove	Wailevu West	1	1	3	1	1	1	1	1	1	2	8	8	3	32	2.5
Ba	Nailaga/Tavua	2	1	1	2	1	1	1	2	2	2	6	6	4	31	2.4
Lomaiviti	Moturiki Is	1	1	1	1	1	3	1	3	1	3	6	8	1	31	2.4
Lomaiviti	Nasinu	1	2	1	1	1	3	1	3	1	3	2	8	4	31	2.4
Ra	Navitilevu	2	1	2	1	1	3	1	3	1	4	4	4	4	31	2.4
Ba	Nacula	1	1	1	1	1	1	1	2	2	2	8	8	1	30	2.3
Cakaudrove	Cakaudrove	1	1	2	1	1	1	1	1	1	2	8	8	2	30	2.3
Cakaudrove	Wailevu East	1	1	1	1	1	1	1	1	1	2	8	8	3	30	2.3

Table 21. Continued

Province	District	% Boats		% Engines		% Fishing gear men		% Fishing gear women		% Post-harvest equipment		% HH fishing for		Change fish consumed	Score	Avg
		Dmg	Lost	Dmg	Lost	Dmg	Lost	Dmg	Lost	Dmg	Lost	Live	Sub			
Lomaiviti	Lovoni	1	1	1	1	1	3	1	3	1	3	4	8	2	30	2.3
Ba	Naviti	2	1	1	1	1	1	1	2	2	2	6	8	1	29	2.2
Bua	Kubulau	2	2	1	2	1	1	1	1	1	1	2	8	4	27	2.1
Bua	Vuya	2	1	4	1	1	1	1	1	1	1	2	8	3	27	2.1
Cakaudrove	Wainikeli	2	1	1	1	1	1	1	1	1	2	4	8	3	27	2.1
Lomaiviti	Levuka	1	1	1	1	1	3	1	3	1	3	2	6	3	27	2.1
Bua	Nadi	2	1	3	1	1	1	1	1	1	1	2	8	3	26	2.0
Cakaudrove	Natewa	1	1	1	1	1	1	1	1	1	2	6	8	1	26	2.0
Cakaudrove	Nasavusavu	2	1	1	1	1	1	1	1	1	2	4	4	4	24	1.8
Tailevu	Verata	1	1	1	1	1	4	1	4	2	1	2	4	1	24	1.8
Bua	Bua	1	1	1	1	1	1	1	1	1	1	4	8	1	23	1.8
Bua	Solevu	1	1	1	1	1	1	1	1	1	1	2	8	3	23	1.8
Bua	Wainunu	3	1	1	1	1	1	1	1	1	1	2	6	3	23	1.8
Ra	Saivou	1	1	1	1	1	3	1	3	1	4	2	2	2	23	1.8
Bua	Dama	1	1	1	1	1	1	1	1	1	1	2	8	2	22	1.7
Bua	Navakasiga	1	1	1	1	1	1	1	1	1	1	2	8	2	22	1.7
Bua	Lekutu	1	1	1	0	1	1	1	1	1	1	2	8	2	21	1.6

5 Conclusions



Fisher in Bua holding his catch. ©Yashika Nand/WCS

This report aims to provide evidence-based guidance on the impact of cyclone Winston on fisheries-dependent communities in Fiji with a view to better targeting those most in need of assistance, and supporting the Department of Fisheries, CROP agencies, development agencies and NGOs to be more strategic and systematic in their support. The information and data collected can also be used to guide the sustainable recovery of fisheries dependent communities in Fiji. It is also important to note that this report is not suggesting that less impacted communities should be ignored or not helped.

In general, for communities that have incurred damages to boats, engines, fishing gear and post-harvest equipment, support will be required to replace and repair lost assets to ensure that impacts on food security and livelihoods that depend on fisheries activities are minimised over the short and medium term. Village level data gathered through this survey should be used to inform recovery efforts, to ensure communities are not provided with more gear than their pre-cyclone levels, and should take into account the condition and recovery of their natural resources.

It is also important to ensure that packages of support are provided that include fishing gear, post-harvest equipment, financial support and alternative livelihood support where relevant. In the absence of such packages, response efforts may not achieve their desired effect. For example if a community's main livelihood is sea cucumbers, support may be needed along the whole supply chain. Working with private sector buyers could be a useful way of creating the space for discussion with the buyers about the impact on the resource and the need for strong management in the coming months

and years. It is important that all local actors supporting community development in a particular area, including the provincial and district government, churches, NGOs and the private sector are consulted, to identify opportunities for ongoing collaborative support. Care should be taken not to duplicate support that private sector buyers or other actors are providing to communities.

In some cases relatively small amounts of finance (e.g. replacing hooks and lines) can play a large role in restoring some fisheries activities and recovery support should initially focus on low-cost, low impact, gear replacement. Where possible, a cross-sectoral approach should be taken to ensure support to communities is strategic and complementary. For example in areas where marine habitats and fisheries resource are highly impacted, it may be better to support only subsistence fishing while diversifying land-based livelihood options.

Recovery efforts should focus on building resilience to future cyclones and other disturbances. By working together partners can support communities to recover their livelihoods and food security and can reinforce the importance of good governance and natural resource management, risk reduction and disaster preparedness measures. The distribution of supplies to these communities should be combined with education and awareness activities to assist in preparing for the next cyclone season. Using the networks created as part of the disaster response efforts to work jointly throughout the year can also support communities to access more coherent and consistent support towards achieving their sustainable development goals.

6 Recommendations



Fishers cleaning fish in Bua. ©Yashika Nand/WCS

The twenty-one recommendations below provide some guidance for the Department of Fisheries and partners to support fisheries-dependent communities recover from Cyclone Winston.

Provision of replacement fishing gear

- 1) Target initial recovery efforts on replacing low-cost, low-impact gear to pre-cyclone levels (e.g. hook and line), to promote food security and livelihood recovery.
- 2) Care should be taken to ensure gendered-dimensions of gear ownership and use are taken into account and that distribution mechanisms also ensure that both men and women have equitable access to the gear provided. Working through existing community structures (e.g. youth and women's groups) is a useful way to ensure this happens.
- 3) The ecological impact of fishing methods as well as the condition of habitats should be considered when prioritizing fishing gear for replacement. For example the provision of gill nets could put more undue pressure on damaged fisheries resources. The cyclone presents an opportunity to build back better by replacing fishing gear with low-impact and more selective and sustainable fishing gear.
- 4) Avoid providing impacted communities with more fishing gear and infrastructure than they had pre-cyclone. This could place unnecessary stress on an already damaged resource. Particularly as communities that have the highest damages and losses, are likely to be those where the habitat is most severely damaged.

- 5) Target boat and engine repairs and replacement in communities significantly impacted by the cyclone. Investigate the feasibility for partial co-financing via a micro-loan facility if communities are already working with existing financial services providers and/or buyers and have trusted relationships with them.
- 6) Ensure that any deployment of FADs takes into account the boating infrastructure available to access the FADs.
- 7) Work through existing governance structures at the local (e.g. Yaubula Management Support Teams, Natural Resource Committees, Qoliqoli Management Committees) and sub-national level (e.g. Commissioner's Office, Provincial Office, NGOs, FLMMA, churches) to complement national efforts (e.g. Department of Fisheries) to distribute gear to ensure the involvement of trusted actors and reinforce the importance of good governance.

Livelihoods

- 8) For communities involved in fisheries livelihood activities a package of support is likely to be necessary to recover these livelihoods including boat and engine repairs, and provision of fishing gear and post-harvest equipment. Partial support in one of these areas may be insufficient to promote full livelihood recovery.
- 9) Provide alternative non-fisheries livelihoods. For many fisheries-dependent communities alternative non-fisheries livelihoods, in particular agriculture, may provide a faster opportunity to restore food security and help to reduce pressure on impacted fisheries resources.

Communities have expressed various needs, which should determine the type of support to provide. Ideally community members should have existing experience of these alternatives. The introduction of new opportunities such as bee keeping or poultry production that require new technical skills and time commitments that may not be appropriate in a situation where community members are still rebuilding their lives.

- 10) In general, many partners providing post-cyclone support have expertise in a number of sectors – but due to funding constraints often operate in silos and do not have holistic strategies for delivering coordinated support. Coordination between sectors, especially fisheries and agriculture, to avoid duplication of effort and to reduce the pressure on damaged habitats and impacted fisheries. This is particularly important for fisheries-dependent communities where habitats might only be able to support low level subsistence fisheries (rather than commercial fisheries) in the short to medium-term.
- 11) Ensure the inclusion of women when providing support, especially since they have less representation through official decision-making channels in Fiji than men do. Village headmen, who act as the main point conduit for coordinating external support, are usually men and the involvement of women or women's group representatives is therefore not guaranteed when priorities are set. It is important that distribution mechanisms acknowledge this existing inequality and take this into account by ensuring women's representation at all consultations, targeting women's groups specifically as a distribution mechanism and ensuring separate spaces exist for them to articulate their needs and priorities separately.

Food Security

- 12) The provision of low-impact fishing gear can support a recovery of food security for fishing communities. Supporting the recovery of agricultural crops through the provision of seeds and planting material can also restore food security.
- 13) Post-cyclone, ration packs contained rice, noodles and other easy to prepare convenient food. Support to restore food security should include nutrition education sessions to ensure that communities are aware of the higher nutritional content in locally-grown and caught food, rather than relying on bought or processed food.
- 14) Appropriate nutrition is vital for children's health and education and schools should be provided with supplementary protein sources, until villages can recommence providing fish for meals. A strategy to

restore the availability of fresh fish in schools should be discussed locally.

Community Management

- 15) Guidance should be provided through the FLMMA network on opening and closing of tabu areas to minimise conflict in local communities, while promoting local solutions to aid in the recovery of impacted habitats communities are dependent on for food and livelihoods.
- 16) Community, district and provincial natural resource and development plans should be complementary to each other and take into account future impacts from cyclones as well as from climate change to reduce the risk to local communities.

Prioritising and supporting recovery efforts

- 17) Tables 20-21 provide information on the most impacted districts based on the evidence gathered through these surveys. These should be used to guide where recovery efforts are most needed, and complemented with village level information. This will ensure recovery efforts target communities most in need of assistance.
- 18) Data from Lau were not available, and the Department of Fisheries and Lau Provincial Office should collect information from the province to ensure remote communities are not forgotten or neglected in the recovery efforts. The socioeconomic questionnaire designed (Appendix 1) is quick to administer and could easily be done during visits to the different islands by authorities.
- 19) Complementary in-water surveys should be undertaken by government and NGO partners to provide accurate advice to communities on the condition of habitats and fisheries resources, to ensure sufficient measures are in place (e.g. tabu areas, gear restrictions, reduction in commercial licenses), to ensure the recovery of these resources.
- 20) The PDNA estimates ongoing production losses from Cyclone Winston will continue to 2021. In order to give the resource a change to recover, commercial fishing licences should be restricted to areas not impacted by the cyclone. Failure to control fishing will lead to further declines in fisheries and impact the medium- to long-term food security and livelihoods of coastal communities.
- 21) Data collection systems should be developed for the fisheries sector to ensure the impact from future disturbances and natural disasters are taken into consideration. The questionnaire developed for this survey should be reviewed, adapted where necessary, and adopted by the Department of Fisheries (Appendix 1).

7 References



Soft corals in Namena Marine Reserve that survived cyclone Winston. ©Jack & Sue Drafa

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8 Appendices

Appendix 1: Survey Questionnaire

QUESTIONNAIRE:

POST-CYCLONE ASSESSMENT OF IMPACT TO COMMUNITY FISHERIES

Goal:

To understand the socio-economic impacts of Tropical Cyclone Winston on community-based fisheries in Fiji to inform recovery and rehabilitation efforts.

Objectives:

- Estimate the impacts of Cyclone Winston on fishing infrastructure (e.g. boats, engines and gear) and provide a monetary estimate to government and donor agencies for recovery efforts.
- Assess the villages dependence on local fisheries to determine the impact on food security and livelihoods.
- Identify villages that need alternative livelihood initiatives.

Instructions for Surveyors:

Please conduct interviews with relevant community representatives (e.g. fisherman and fisherwomen, YMST representatives, Village Headmen etc.) or facilitate small group discussions. There should be at least one female representative present.

Introduction to respondents (please tick boxes to confirm completion):

- Introduce yourself/the team
- Explain the survey can take 20-30 minutes
- Explain that the information collected during this survey will be provided to government agencies, provincial offices and donors who are supporting fisheries recovery and rehabilitation efforts.
- Give the respondent the relevant contact information in case they have any further questions or concerns.

Name/s	
Gender (Male/Female)	
Contact Information	
Village	
District	
Province	
Number of households	
Number of people	

FISHERIES INFRASTRUCTURE DAMAGE AND LOSS

1. How were boats and engines impacted? (insert numbers)

Boats	#Before cyclone	#After cyclone	# Good	# Damaged	# Lost
Fiberglass			# _____ size _____ m/ ft	# _____ size _____ m/ ft	# _____ size _____ m/ ft
Aluminium			# _____ size _____ m/ ft	# _____ size _____ m/ ft	# _____ size _____ m/ ft
Wooden			# _____ size _____ m/ ft	# _____ size _____ m/ ft	# _____ size _____ m/ ft
Billibili			# _____ size _____ m/ ft	# _____ size _____ m/ ft	# _____ size _____ m/ ft
Engines	#Before cyclone	#After cyclone	# Good	# Damaged	# Lost
<15 hp					
25 hp					
40 hp					
60 hp					
>60 hp					

2. Who owns boats (within the village)? (youth, women, fish wardens?)

3. How was fishing gear impacted? (separate for men and women)

Fishing Gear	#Before cyclone	#After cyclone	#Good	#Damaged	#Lost
MEN					
Cast nets					
Gill nets					
Spear Guns					
Hook & Line					
Spear					
Portable traps					
SCUBA					
Other					
WOMEN					
Cast nets					
Gill nets					
Spear guns					
Hook & line					
Spear					
Portable traps					
Other					



4. How was post-harvest equipment impacted? (insert numbers)

Post-harvest equipment	#Before cyclone	#After cyclone	#Good	#Damaged	#Lost
Fish/BDM smokers					
Sun dryers					
Cookers/pots (BDM)					
Racks (BDM)					
Salting box (BDM)					
Racks (seaweed)					
Ice boxes					
Freezers					
SCUBA					
Fish storage facility (fish shed)					
Equipment storage shed					
Other					

FISHERIES DEPENDENCY

5. RANK what were the main fisheries men in the village were engaged in, before and after the cyclone? (1=highest)

*Oceanic Fish = barracuda, trevally, mackerel, tuna

	Before	After
Sea cucumbers	<input type="radio"/>	<input type="radio"/>
Lobsters	<input type="radio"/>	<input type="radio"/>
Trochus	<input type="radio"/>	<input type="radio"/>
Prawns/Shrimp (ura)	<input type="radio"/>	<input type="radio"/>
Sea Mussels (kaikoso)	<input type="radio"/>	<input type="radio"/>
Mud Crabs (qari)	<input type="radio"/>	<input type="radio"/>
Seaweed (lumi)	<input type="radio"/>	<input type="radio"/>
Seaweed (nama)	<input type="radio"/>	<input type="radio"/>
Coral reef fish	<input type="radio"/>	<input type="radio"/>
Oceanic fish*	<input type="radio"/>	<input type="radio"/>
Fresh water fish	<input type="radio"/>	<input type="radio"/>
Fresh water mussels	<input type="radio"/>	<input type="radio"/>
Aquaculture (e.g. tilapia)	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>

6. RANK what were the main livelihoods men in the village had, before and after the cyclone? (1=highest)

	Before	After
Fisheries	<input type="radio"/>	<input type="radio"/>
Agriculture	<input type="radio"/>	<input type="radio"/>
Yaqona	<input type="radio"/>	<input type="radio"/>
Copra	<input type="radio"/>	<input type="radio"/>
Formal employment	<input type="radio"/>	<input type="radio"/>
Small Business	<input type="radio"/>	<input type="radio"/>
Family (in Fiji)	<input type="radio"/>	<input type="radio"/>
Family (outside Fiji)	<input type="radio"/>	<input type="radio"/>
Casual employment	<input type="radio"/>	<input type="radio"/>
Livestock	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>

7. RANK what were the main fisheries women in the village were engaged in, before and after the cyclone? (1=highest)

*Oceanic Fish = barracuda, trevally, mackerel, tuna

	Before	After
Sea cucumbers	<input type="radio"/>	<input type="radio"/>
Lobsters	<input type="radio"/>	<input type="radio"/>
Trochus	<input type="radio"/>	<input type="radio"/>
Prawns/Shrimp (ura)	<input type="radio"/>	<input type="radio"/>
Sea Mussels (kaikoso)	<input type="radio"/>	<input type="radio"/>
Mud Crabs (qari)	<input type="radio"/>	<input type="radio"/>
Seaweed (lumi)	<input type="radio"/>	<input type="radio"/>
Seaweed (nama)	<input type="radio"/>	<input type="radio"/>
Coral reef fish	<input type="radio"/>	<input type="radio"/>
Oceanic fish*	<input type="radio"/>	<input type="radio"/>
Fresh water fish	<input type="radio"/>	<input type="radio"/>
Fresh water mussels	<input type="radio"/>	<input type="radio"/>
Aquaculture (e.g. tilapia)	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>

8. RANK what were the main livelihoods women in the village had, before and after the cyclone? (1=highest)

	Before	After
Fisheries	<input type="radio"/>	<input type="radio"/>
Agriculture	<input type="radio"/>	<input type="radio"/>
Yaqona	<input type="radio"/>	<input type="radio"/>
Copra	<input type="radio"/>	<input type="radio"/>
Formal employment	<input type="radio"/>	<input type="radio"/>
Small Business	<input type="radio"/>	<input type="radio"/>
Family (in Fiji)	<input type="radio"/>	<input type="radio"/>
Family (outside Fiji)	<input type="radio"/>	<input type="radio"/>
Casual employment	<input type="radio"/>	<input type="radio"/>
Livestock	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>

9. How many households are relying on fishing as the main source of income?

10. Has the cyclone affected the village's access to markets to sell their fish?

Yes **No**

11. How many Fish Aggregation Devices (FADs) does the village have?

Before the cyclone:

After the cyclone:

12. How many men have fishing licenses in the village?

13. How many women have fishing licenses in the village?

14. How many households in the village fish for food?

15. How many times per week do most households eat fresh fish?

Before the cyclone?

After the cyclone?

16. Rank what is the main source of protein, before and after the cyclone? (1=highest)

	Before	After
Fresh Fish	<input type="radio"/>	<input type="radio"/>
Canned Fish	<input type="radio"/>	<input type="radio"/>
Pork	<input type="radio"/>	<input type="radio"/>
Chicken	<input type="radio"/>	<input type="radio"/>
Beef	<input type="radio"/>	<input type="radio"/>
Dhal	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>
_____	<input type="radio"/>	<input type="radio"/>

17. Does the village provide fish for meals at the local primary/secondary school ?

	Before	After
Yes	<input type="radio"/>	<input type="radio"/>
No	<input type="radio"/>	<input type="radio"/>

18. Given that the fishery resources have been affected, what livelihoods would like to see introduced in the village post-cyclone?

HABITAT CONDITION

19. How much damage was done to coral reefs?

0-20%
 20-50%
 50-75%
 100%
 Don't Know

20. How much damage was done to seagrass areas?

0-20%
 20-50%
 50-75%
 100%
 Don't Know

21. How much damage was done to mangrove forests?

0-20%
 20-50%
 50-75%
 100%
 Don't Know

22. How would you describe the condition of the qoliqoli over the years (before cyclone Winston)?

Very good and unchanging

Moderately good and unchanging

Degradingslowly

Degradingrapidly

Other

QOLIQOLI AND TABU AREAS

23. How many tabu areas does the community have?

24. Is there any discussion of opening tabu areas for food?

No
 Yes
 If Yes, when will tabu areas be open?

25. Is there any discussion of opening tabu areas to generate income?

No
 Yes
 If Yes, when will tabu areas be open?

26. What management practices (e.g. rules) did the community have for their whole qoliqoli before the cyclone?

.....

.....

27. What management practices (e.g. rules) have been changed since cyclone Winston for the whole qoliqoli area? (find out why the changes)

.....

.....

28. Do you think the management practices you put in place before the cyclone, will help you better recover after the cyclone?

.....

Appendix 2. List of all villages surveyed

Province	District	Village	Province	District	Village
Ba	Bulu	Natanuku	Bua	Lekutu	Nasarowaqa
		Sasa			Tavea
Ba	Nailaga	Nailaga			Galoa
		Naiwaqarua			Yaqaga
		Nakavika Settlement	Bua	Navakasiga	Naivaka
		Natutu			Naviqiri
		Navau Settlement			Nasau
		Tavualevu	Bua	Bua	Bua
		Vatutavui			Dalomo
		Votua			Tiliva
Ba	Naviti	Muira			Waitabu
		Soso			Tacilevu
		Kese	Bua	Dama	Nawaca
		Marou			Tavulomo
		Somosomo			Nasau
		Gunu			Dama
		Malevu	Bua	Vuya	Wairiki
		Nasoqo			Nabouwalu
Ba	Nacula	Namatayalevu			Navave
		Vuaki			Vuya
		Matacawalevu	Bua	Solevu	Makolei
		Nacula			Nawaido
		Malakati			Cavaga
		Naisilisili	Bua	Nadi	Nasavu
		Navotua			Nasolo
					Nasawana
Cakaudrove	Cakaudrove	Mataikoro			Sawani
		Nanuca			Saolo
		Nawi	Bua	Wainunu	Nakorotiki
		Nakobo			Daria
		Vunisavisavi			Nakawakawa
Cakaudrove	Nasavusavu	Nukubalavu			Batinivurewai
		Nacekoro	Bua	Kubulau	Raviravi
Cakaudrove	Natewa	Buca			Namalata
		Natewa			Navatu
		Nadavaci			Kiobo
		Dawa			Natokalau
Cakaudrove	Naweni	Tacilevu			Nasasaivua
		Dromuninuku			Waisa
		Naweni			Nakorovou
Cakaudrove	Wailevu East	Wailevu			Kilaka

Province	District	Village	Province	District	Village
Cakaudrove	Wailevu West	Vunitawamoli	Lomaiviti	Levuka (Ovalau)	Rukuruku
		Naiqaqi			Taviya
		Laucala			Arovudi
		Natuvu			Nauouo
Cakaudrove	Wainikeli	Lavena			Vatukalo
		Korovou			Toki
		Vidawa			Vuma
					Waitovu
Ra	Navitilevu	Navuniivi	Lomaiviti	Levuka	Nukutocia
		Nayavaira			Naikorokoro
		Veidrala			Vagadaci
Ra	Nakorotubu	Naocobau	Lomaiviti	Lovoni	Visoto
		Saioko	Lomaiviti	Nasinu	Draiba
Ra	Naiyalayala	Togovere			Tokou
Ra	Raviravi	Vunitogoloa			Natokalau
		Narewa			Nasinu
Ra	Nasau	Nasau	Lomaiviti	Koro	Mudu
Ra	Navolau	Navolau 2			Nacamaki
		Namuaimada			Nakodu
Ra	Saivou	Nanukuloa			Namacu
					Naqaidamu
Tailevu	Verata	Ucunivanua			Nasau
		Naloto			Sinuvaca
		Sawa			Tuatua
		Uluiloli			Kade
		Navunimono			Nabasovi
		Naivuruvuru			Nabuna
		Kumi			Navaga
Tailevu	Dawasamu	Driti			Tavua
		Nataleira			Vatulele
		Silana	Lomaiviti	Moturiki	Daku
		Nasinu			Naicabecabe
					Nasauvuki
					Nasesara
					Navuti
					Niubasaga
					Savuna
					Uluibau
					Yanuca
					Wawa

Appendix 3. Financial figures used to estimate damages and losses

Replacement values for boats, engines, fishing gear and post-harvest equipment. The value of damages was estimated at 80% for locally available assets that were fully destroyed and 40% for assets there were partially destroyed. Prices are in FJD.

Item	Price	80%	40%
Boats			
Wooden open	\$3,500	\$2,800	\$1,400
Wooden half cabin	\$7,000	\$5,600	\$2,800
Wooden double cabin + inboard	\$50,000	\$40,000	\$20,000
Aluminium	\$4,000	\$3,200	\$1,600
Bavelo	\$60	\$50	\$25
Fiberglass 19	\$7,043	\$5,634	\$2,817
Fiberglass 23	\$7,469	\$5,975	\$2,988
Engines			
15hp	\$4,455	\$3,564	\$1,782
25hp	\$5,213	\$4,170	\$2,085
40hp	\$6,824	\$5,459	\$2,730
60hp	\$9,383	\$7,506	\$3,753
75hp	\$10,426	\$8,341	\$4,170
Safety items	\$1,660	\$1,328	\$664
Fishing Gear			
Gill net 300m - commercial	\$1,200	\$960	\$480
Gill net 100m - subsistence	\$400	\$320	\$160
Cast Net	\$95	\$76	\$38
Hook & line set (fishing lines, hooks, sinkers, hand casters)	\$300	\$240	\$120
Spear gun & torch	\$600	\$480	\$240
Spear	\$40	\$32	\$16
Wading net	\$200	\$160	\$80
Mask and snorkel	\$60	\$48	\$24
Trap	\$20	\$16	\$8
Snorkel fins	50	40	20
BDM Diving	\$200	\$160	\$80
SCUBA gear (tank and BCD)	1800	1440	720
Scuba regulator	1200	960	480
SCUBA BCD	600	480	240
SCUBA Tank	650	520	260
Dive torch	90	72	36
Post-harvest equipment			
Gleaning Equipment	\$40	\$32	\$16
Ice box	\$600	\$480	\$240
Freezers	\$1,280	\$1,024	\$512
BDM cookers	\$200	\$160	\$80
Fish / BDM smokers	\$150	\$120	\$60
Sun dryers / racks (wire mesh)	\$100	\$80	\$40
Equipment storage shed	\$500	\$400	\$200
Salting boxes	\$50	\$40	\$20

Appendix 4. Average percentage of households that depend on fisheries for livelihood and subsistence per district.

District	# Households	Fish for livelihood	Fish for subsistence
Ba	44	64%	45%
Bulu	165	81%	61%
Nailaga	747	74%	65%
Naviti	450	73%	89%
Nacula	385	86%	75%
TOTAL	1791	77%	72%

Bua Province

District	# Households	Fish for livelihoods	Fish for subsistence
Bua	134	33%	100%
Dama	155	6%	93%
Kubulau	213	9%	100%
Lekutu	176	1%	99%
Nadi	225	11%	100%
Navakasiga	128	2%	100%
Solevu	144	0%	100%
Vuya	978	0%	88%
Wainunu	336	2%	55%
TOTAL	2489	4%	82%

Cakaudrove Province

District	# Households	Fish for livelihoods	Fish for subsistence
Cakaudrove	282	89%	100%
Nasavusavu	86	32%	36%
Natewa	222	65%	100%
Naweni	185	76%	100%
Wailevu East	200	100%	100%
Wailevu West	108	100%	92%
Wainikeli	185	48%	88%
TOTAL	1268	78%	93%

Lomaiviti Province

District	# Households	Fish for livelihoods	Fish for subsistence
Cawa	299	24%	100%
Mudu	584	61%	87%
Koro	883	49%	92%
Levuka	522	11%	72%
Lovoni	45	33%	100%
Nasinu	257	20%	86%
Ovalau	824	15%	78%
Moturiki	236	66%	97%
TOTAL	1943	36%	87%

Ra Province

District	# Households	Fish for livelihoods	Fish for subsistence
Naiyalayala	84	100%	100%
Nakorotubu	63	79%	100%
Navitilevu	137	54%	54%
Navolau	205	62%	56%
Raviravi	169	69%	96%
Saivou	56	18%	16%
Total	714	65%	71%

Tailevu Province

District	# Households	Fish for livelihoods	Fish for subsistence
Dawasamu	185	81%	99%
Verata	430	23%	44%
	615	40%	60%

Appendix 5. Lists of all livelihood needs identified for each province

Ba Province

Livelihoods	# Households	Fish for livelihoods	Fish for subsistence
Fisheries	11	58%	99%
Small Business	8	42%	44%

Ba Province

Livelihoods	# times identified	% count
Aquaculture	17	20
Agriculture	15	18
Poultry	13	16
Bee keeping	13	16
FAD	3	4
BDM project	2	2
Sandalwood	2	2
Livestock	2	2
Fishing	2	2
Bakery	1	1
Gillnet	1	1
Pig farming	1	1
Small business	1	1
Village canteen	1	1
Casual/formal employment	1	1
Microfinance	1	1
Mangrove planting	1	1

Cakaudrove Province

Livelihoods	# times identified	% count
Aquaculture	26	28%
Poultry	11	12%
Agriculture (crops)	10	11%
Bee keeping	9	10%
Sandalwood	9	10%
Fishing	4	4%
Piggery	3	3%
Sewing machines	2	2%
Bakery	2	2%
Virgin coconut oil	2	2%
Mangrove planting	2	2%
Cattle	1	1%
Canteen	1	1%
Shells	1	1%
FADs	1	1%
Canteen	1	1%
Ice plants	1	1%
Cooperative store	1	1%
Livestock farming	1	1%
Mangrove planting	1	1%

Lomaiviti Province

Livelihoods	# times identified	% count
Aquaculture	30	56%
Bee Keeping	5	9%
Coral Planting	2	4%
FADs	9	17%
Mangrove Planting	1	2%
MPA	2	4%
Poultry	3	6%
Tin Fish	1	2%

Ra Province

Livelihoods	# times identified	% count
Agriculture	3	33%
Fisheries	3	33%
Small business	1	11%
Replanting (coral/mangroves)	2	22%

Tailevu Province

Livelihoods	# times identified	% count
Vegetable farming	11	100%

Note: Most villages listed several livelihood needs

