



# Rapid Assessment of Priority Coastal Areas (RapCA) in the Hihifo District, Tongatapu

## Social and Economic Survey Report

### Tonga International Waters Ridge to Reef Project





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in the Hihifo District, Tongatapu**

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By Pelenatita Cara



Suva, Fiji, 2021

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## ABBREVIATIONS

CBD	Convention of Biodiversity
CBO	Community Based Organisation
CCDRM	Climate Change Disaster Risk Management
DoE	Department of Environment
GEF	Global Environment Facility
HHS	Household Survey
IWCM	Integrated Water and Coastal Management
MAFF	Ministry of Agriculture, Forest and Foods
MEIDECC	Ministry of Energy, Information, Disaster, Environment, Communication and Climate Change
MLNR	Ministry of Lands and Natural Resources
MoF	Ministry of Fisheries
MPAs	Marine Protected Areas
NGO	Non-governmental organisation
NSPAO	National Spatial Planning Authority Office (formerly PUMA)
PACC	Pacific Adaptation to Climate Change (project)
PICs	Pacific Island Countries
PMU	Project Management Unit
PUMA	Planning and Urban Management Agency
R2R	Ridge to Reef
RapCA	Rapid Assessment of Priority Coastal Areas
SMAs	Special Management Areas
SPC	Pacific Community
TOP	Tongan Pa'anga
USD	United States Dollar
VEPA	Vava'u Environmental Protection Association

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I also must acknowledge the efficiency and effectiveness of the R2R IWCM team, especially in arranging the socio-economic survey activities with stakeholders and with partnering government ministries. Their excellent performance pays dividends to the leadership of its Coordinator, Ms. Silla Leger. I also must thank Ms Leger for the selected enumerators – they were very efficient when undertaking the socio-economic survey although for most, this was their first field survey. The 12 Enumerators must also be acknowledged as although most were new to doing the survey, some were also very new to the discipline, yet they have done their best.

Also, I wish to acknowledge the assistance from the Constituency's Member of Parliament Mrs. Losaline Ma'asi, as well as the village officers of the two surveyed sites, who provided support and guidance to the survey team whilst they were out on the field.

Finally, I would like to acknowledge the assistance and continuous support of the staff of the Ministry of Fisheries and the Geology Division. The former, for their support in providing the original questionnaires and those many meetings and workshops they participated in; and the latter, who provided transportation and human resource support during the survey process. I am indeed very grateful.



First Enumerators Training: 20<sup>th</sup> April 2020, Basilica.

## EXECUTIVE SUMMARY

Integrated Water and Coastal Management (IWCM) is crucial throughout the Pacific islands, including in Tonga, with 70 per cent of its population living near the coast. The emergence of a cash-orientated economy has shifted the historical trading paradigm; however, communities continue to rely on and are directly related to the ocean and coastal areas.

Tongans, as Drew Havea from Civil Society Tonga, once said, “are a people of the sea and the land<sup>1</sup>”. No matter how these natural resources, marine resources as well as agriculture products came to be, Tongans need both the sea and the land.

With climate change thrown into the mix, there is a growing imperative to formulate appropriate and relevant management strategies such as Integrated Coastal Management (ICM) plans, that will holistically encompass the vulnerability of communities who depend on coastal ecosystems and resources, and which would ensure ownership and sustainability for the future.

Understanding these vulnerabilities is key to developing appropriate management strategies. While it is understood that eroding coastal ecosystems impact people’s livelihoods, there is also acknowledgement that social and cultural structures, and the economic activities of communities contribute to most of the issues arising in coastal habitats and ecosystems. Social and cultural structures and the economic activities of communities can be better understood when discussed using a gender approach and identifying the different roles, status, access, and roles of decision making of men and women in communities. However, we can only provide an adequate and systematic process of ranking level of vulnerability, readiness, and resilience of coastal communities to social, economic, and environmental challenges once we have a set of standardised indicators.

This report focuses on the social and economic component of a Household Survey undertaken between 25 and 28 April 2020 at the villages of ‘Ahau and Kanokupolu in the Hihifo district. The findings will be overlaid with social and governance indicators to ascertain various levels of ‘readiness’ (or not) of the surveyed communities. Under the R2R IW program, all projects, research undertaken, and studies done are required to be gender and social inclusive. This means the collection of sex-disaggregated data and in this socio-economic survey, the highlighting of gender roles in resource management, gender participation in RTR programs and impacts or benefits of any planned interventions.

The report findings show a decline in population at both the studied sites. There is also a decline in resource abundance, increase in natural disaster activities, increase in drought, which is further aggravated by increasing coastal pressures from an urban boom, demand for residence and agricultural spaces, as well as the infrastructural development of wharves and coastal protection, leading to changes in the hydrodynamic of the Nuku’alofa urban area (SPREP 2016). This has led to a downdrift of costal erosion (McCue 2014), thus affecting areas in the western side of Tongatapu especially those villages on the far western side. Whilst there might be a high number of residents who have access to water, power and income, sanitation is still an issue especially with the management of human waste and septic tanks. Given the proximity of the residents to coastal areas and the narrow geological base of the Hihifo Zone, it is critical to develop strategies to manage the sanitation issue and improve sustainable access to water and power.

It is envisaged that the recommendations below will support resolutions that would equip coastal communities to mitigate, adapt and manage their social and their economic undertaking whilst sustaining a robust coastal ecosystem. The findings and recommendations of this study are summarised here.

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<sup>1</sup> “Deep Sea Mining, People’s Voice” – Radio 88.7. June 10th, 2020

## **Social and Economic Pressure on land space and resource habitat**

1. Land space seems sufficient and there is opportunity to encourage sustainable agriculture, with 55% of households already conducting organic farming.
2. Primary house roofing material is iron, which could be beneficial for supporting rainwater collection. However further studies are needed to ensure the roofs are suitable for rainwater harvesting and not impactful to human health.
3. Most of the employment is private work with remittances from the Seasonal Labour Scheme being the main source of income. There is a need to create alternative livelihoods in the event the Seasonal Labour Scheme ends, which will cause people to start exploiting natural resources again.
4. The major area of expenses is utility bills (60%) so there needs to be a lot of financial saving to offset this through investment in livestock or agricultural activities (SME).
5. Some of the data collected does not clearly identify population dynamics and pressures. These areas will need to be further clarified through the raw paper data collected and are discussed in Section 4.

## **Water, Health and Sanitation**

1. Must ensure 100% access to drinkable water by ensuring the remaining 105 households have access to water and improved access to drinkable water from 52% to 100% by end of 2021.
2. Alternative water sources should be encouraged especially given 100% of all houses have iron roofing, which is conducive for rainwater collection.
3. Main source of protein seems to be fish, but diabetes is still the highest form of disease as well as cardiac illnesses and high blood pressure. Ongoing awareness is needed of these health areas with economic incentives for necessary imported healthier food items.
4. Drainage of septic systems and sinks (greywater) is crucial. Adequate and appropriate sanitation is priority to addressing human waste pollution and managing *E. coli* presence in the village water system and surrounding ecosystems. Regular pumping of septic tanks every 2–3 years should also be enforced.

## **Climate change and community level of resilience**

1. Increase climate change awareness programmes in the area to address lack of understanding. There is a consistently low percentage (less than 50%) of understanding across all climate change questions.
2. Increase awareness programmes on climate preparedness and resilience, including disaster risk management and preferably a major project on Climate Mitigation and Adaptation.
3. Discussion on strengthening current communication tools with Ministries and communities would be beneficial as well as exploring other communication tools and including youth groups to assist with the community.

## **Governance and Resource Management**

1. Maintain current governance arrangement to support the establishment of SMA.
2. Awareness programme on resource conservation especially on management of coastal resources through enhanced appreciation on reef conservation and marine life conservation.
3. Clear demarcation of which Ministry and what regulatory framework is needed to manage and regulate coastal resources should be put in place by Ministry of Lands Survey and Natural Resources, MEIDECC and Ministry of Health.

## BACKGROUND

Tonga is one of 14 Pacific Island countries participating in the Global Environment Facility funded multi-year International Waters Ridge to Reef (IW R2R) project. The project is mainstreaming ‘ridge-to-reef’ by adopting climate-resilient approaches to integrated land, water, forest, and coastal management in the Pacific Island countries (PICs) through strategic planning, capacity building and piloted local actions to sustain livelihoods and preserve ecosystem services.

To contextualise the regional objectives within the national space, a Rapid Assessment of Priority Coastal Areas (RapCA) was conducted in six villages in the Hihifo district – Ha’avakatolo, Kanokupolu, Ha’atafu, Fo’ui, ‘Ahau and Kolovai.

Due to the lack of availability of comparable historical data, the study and its conclusions have relied primarily on new information to identify gaps and recommendations.

‘Ahau and Kanokupolu villages are located more than 10 kilometres from the central business district of Nuku’alofa, thus giving it the ideal land and seascape to test various parameters of the project, especially the interconnectivity of social, economic and environmental factors that contribute to the state of any ecosystem in Tonga. This interconnectivity between socio-economic and environmental parameters further mirrors the relationship between land ecosystems, coastal ecosystems, and reef ecosystems. It is, therefore, crucial to fully comprehend these diverse yet inter-dependent and intricate relationships between the communities and their coastal environment.

Table 1. Population data of Hihifo district between 1996 and 2016, data accrued from Tonga National Census Reports 2006 and 2016.

		1996	2006	2011	2016
Hihifo	Total	2404	2353	2368	2464
	Men	1176	1183	1160	1221
	Women	1228 (51%)	1174 (50%)	1208 (51%)	1243 (50%)

As shown in Table 1, the population of Hihifo district has slightly increased between 1996 and 2016 with a slightly higher female population count.

The elevation of the selected site is from 0.5 m to 2 m and has been reported to have experienced inundation over the years (MEIDECC 2010), thus making it very vulnerable to disasters and climate change impacts of sea level rising and king tides.

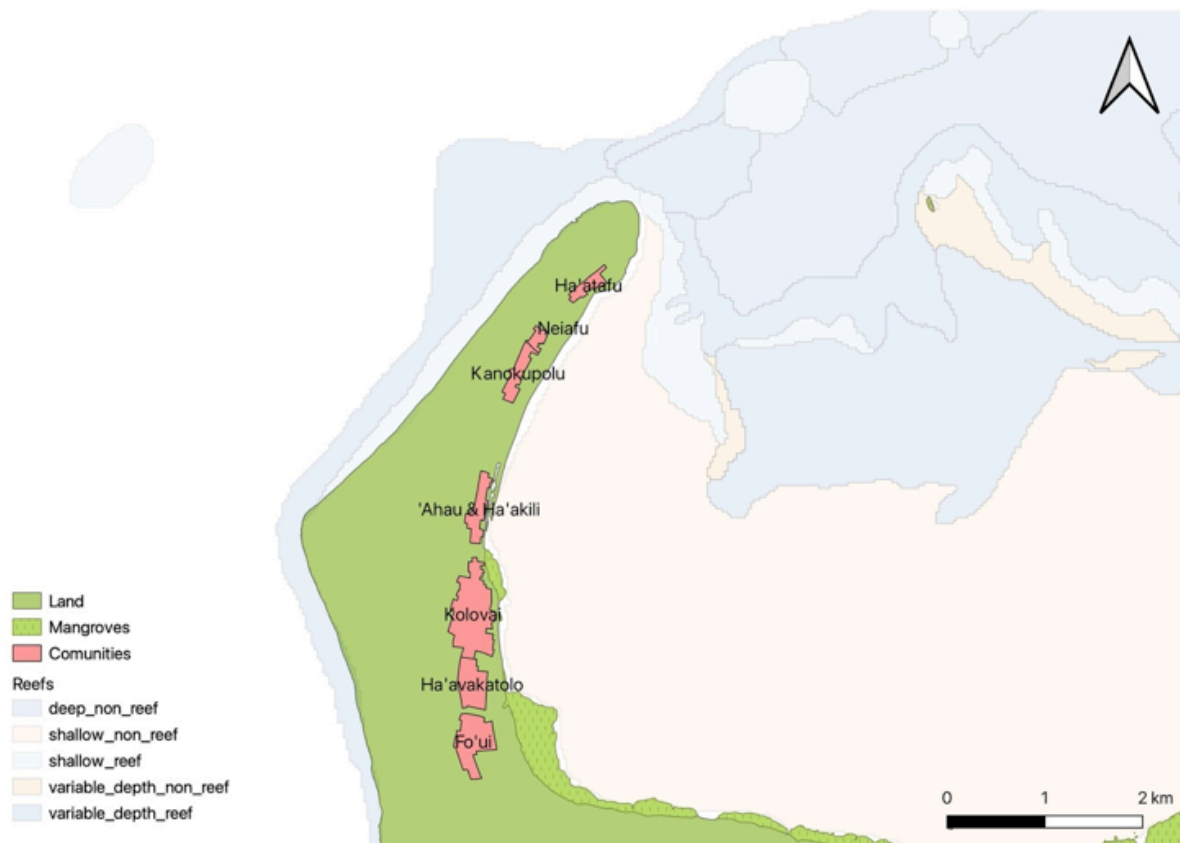


Figure 1. Geographical map of the Hihifo district with survey sites of Ahau and Kanokupolu

It is anticipated that the data obtained from the Social and Economic Household Survey (HHS) will be used as a yardstick to extrapolate on the same social and economic issues faced in the other four villages in the project sites. The report also assumed that, given the number of similarities in the social, economic, and political environments of the villages, the ridge to reef concept can still be applied. This is because socio-cultural and economic factors are similar, and that gender and social considerations are also assessed. These include establishing Coastal Zone Management Plans through identification of critical fisheries habitats and coastal areas at three priority sites in Tonga; increasing donor investment in stress reduction measures and approaches for coordinating and monitoring the effectiveness of stress reduction measures; and developing management models of the IWRM/IWCM Project.

The Social and Economic Analysis focused on four main areas of assessment to ascertain the status of various social and economic parameters that contribute to issues in the studied areas. The areas of assessment are:

1. Social and economic pressure on land space and resource habitats;
2. Water, health, and sanitation;
3. Climate change and the level of resilience in the community; and
4. Governance structures and resource management within the community.

In these discussions, gender inclusive approaches will be discussed, and gender analysis and gender comparisons will be undertaken. Social and economic pressure on land space and resource habitats constitute an important component of any social and economic analysis, as it defines the way people live in the land space and how their prioritised land usage contributes to the way they use the space and resources around them. It will also give insight on how they manage or exploit their natural resources for earning a livelihood, as well as the impact of such undertakings.

The component of water, health and sanitation is crucial to assessing the level of pollution in the areas while identifying social and economic parameters that exacerbate or decrease their impact in any given residential area. How communities access water resources will also determine their health status and how they manage sanitation issues in their areas. Having access to water is a basic human right and, given the scarcity of water in the studied areas, there is a need for regulators to take on the role of managing this scarce resource, preventing abuse from human activities and pollution, and ensuring that residents have equitable rights of access to this resource.

Climate change is a very real threat to Tonga, which the World Risk Report (UNU-EHS 2016) assessed as being the second most vulnerable country in the world to climate change<sup>2</sup>. It is thus another important parameter to assess as it defines the level of intervention and assistance that any plan needs to have as part of preparing these villages to combat and prepare for any natural disaster that might arise in the future. Their level of resilience is another indicator of how much work has been done to prepare them and knowledge is a powerful tool to making people act if they are aware of their level of vulnerability. The economic impact of climate change is far reaching, and the most vulnerable are poor people and women whose dependency on either agricultural produce or fisheries for economic and social livelihoods can be destroyed because of climate change.

Finally, the report looked at the governance and resource management issues in the studied areas. Given that governance structures are closely associated with the use of public goods and services, an assessment of existing legislative and regulatory framework was undertaken. Assessment of the governance structure and resource management includes the assessment of regulatory tools and frameworks that are in place to ensure equal access for men, women, youths, and the vulnerable people in Tonga. We also looked at people's views and opinions on the current governance structure within village boundaries that affect their daily activities and how it either supports or becomes a hindrance to people deploying activities to earn a living. This component also addresses resource management. The report assessed how communities use and prioritise key ecological resources. A ranking process was used in which communities considered the environmental importance of the resources, the ecological services they provide and how the community proposed to conserve these resources. This was intended to provide a validating platform to any of the conservation strategies the report might propose. Finally, this report reviewed existing management plans that govern and guide the sustainable use of these resources.

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<sup>2</sup> Lavaka, S. Radio 88.6 "IMF Review of Tonga's Vulnerability to Climate Change". 6th July 2020.



# 1. METHODOLOGIES

## 1.1 Regional Indicators:

Under the regional Ridge to Reef programme, monitoring indicators were developed for the RapCA surveys, for social and economic components as well as governance indicators. Altogether there were 15 indicators, 10 of which were from governance and 5 from social and economics. All these indicators were designed to cover and collect data on governance and socioeconomics (Table 2).

## 1.2 Google Earth

Google Earth was also utilised to obtain aerial images of the study sites.

## 1.3 Desktop review

A desk review was also conducted on the 15 monitoring indicators to ascertain data that will provide historical data compatibility between the socio-economic survey results and those that have been covered by other projects either by government ministries or NGO/CSO agencies. It was also noted that out of the 10 governance indicators, some of the information overlapped so they will be treated as one aspect of governance in the analysis component of this report.

## 1.4 Household Survey

Household surveys (HHS) were conducted from the 24<sup>th</sup> to the 28<sup>th</sup> of April 2020 at the villages of 'Ahau and Kanokupolu. Please refer Appendix 1 for survey details.

A team of 12 enumerators was trained over two days to undertake the HHS and, with support from the R2R IWCM team, the survey was completed within four days. Data was inputted by the R2R team prior to the government lockdown due to COVID-19 National Emergency.

Table 2. Outline of the indicators provided for the regional IWR2R programme, and the methodologies utilised under the RapCA assessments in Tonga. Full methodologies are included under Appendix A.

Monitoring Indicator	RAPCA Methodology Overview	Data Output
<b>Socio-economic indicators</b>		
SE1. Demographic	HHS Desk Review	<ul style="list-style-type: none"> <li>• Current population and gender distribution</li> <li>• Livelihood</li> <li>• Health</li> </ul>
SE2. Human Pressure on Habitats	HHS Desk Review	<ul style="list-style-type: none"> <li>• Fish</li> <li>• Sand</li> </ul> (Related to Environmental Report)
SE3. Pollution and Waste Disposal	HHS Desk Review	<ul style="list-style-type: none"> <li>• Water</li> <li>• Sanitation</li> <li>• Farming practices</li> </ul> (Related to Environment and Water Report)

Monitoring Indicator	RAPCA Methodology Overview	Data Output
SE4. Exploitation of Living Resources	HHS Desk Review	<ul style="list-style-type: none"> <li>• Fish</li> <li>• Agricultural produce</li> <li>• Seaweed</li> <li>• Coconut by products</li> </ul>
SE5.Coastal Protection	HHS Desk Review	<ul style="list-style-type: none"> <li>• Percentage of people that know of traditional conservation practices</li> <li>• Number of Current Conservation Plan</li> </ul>
<b>Governance Indicators</b>		
G.1. Legislation	Desk Review	<ul style="list-style-type: none"> <li>• # Of Legislation related to the focal areas in existence</li> </ul>
G2. Traditional governance	Desk Review	<ul style="list-style-type: none"> <li>• % Of community aware of traditional governance structure</li> <li>• % Of those that are effective and worth strengthening</li> </ul>
G3. Coordinating Mechanism	Desk Review	<ul style="list-style-type: none"> <li>• # Existed</li> <li>• % That are effective</li> <li>• % That are supported and strengthen</li> </ul>
G.4. Management Plan	Desk Review	<ul style="list-style-type: none"> <li>• # Existed</li> <li>• % That are effective</li> <li>• % That are financial sustainable</li> </ul>
G.5. Active Managements	Desk Review	As the above indicator
G.6. Monitoring and Evaluation	Desk Review	<ul style="list-style-type: none"> <li>• # Of M&amp;E in place</li> <li>• % That are effective</li> <li>• % That are financially secured and sustainable</li> </ul>
G.7. Stakeholder participation	Desk Review HHS	<ul style="list-style-type: none"> <li>• % Of community consultation</li> <li>• % Of community impact</li> <li>• % Of follow up information sharing</li> <li>• % Of tracer studies undertaken</li> </ul>
G8. CBO and NGO activities	Desk Review	<ul style="list-style-type: none"> <li>• # Of project in related focal areas</li> <li>• % That are sustainable</li> <li>• % Of community impact</li> </ul>
G9. Knowledge and Training	Desk Review	<ul style="list-style-type: none"> <li>• % Training in relation to focal areas</li> <li>• % That has community impact</li> <li>• % Of following up training</li> <li>• % Tracer studies undertaken</li> </ul>
G10. Risk Management	Desk Review	<ul style="list-style-type: none"> <li>• # Of Risk Management Plan in place</li> <li>• % That are effective</li> </ul>

## 1.5 Team Members

The report acknowledges the partnership between various stakeholders who supported this undertaking. Enumerators were from various NGOs and educational institutions. Refer to Appendix 2 for list of enumerators. Auxiliary staff were from Ministry of Lands and Survey the Ministry of Fisheries. Refer to Appendix 3 for list of support staff.

## 2 RESULTS

The results of the HHS were broken down into five sections for analysis. The survey results were integrated with the desktop review and aligned with the social and governance indicators provided under the terms of reference as outlined below.

### 2.1 Social and Economic Pressure on land space and resource habitat

#### 2.1.1 Demographic

The HHS showed a total population of 622 residents within 126 households in 'Ahau and Kanokupolu, with the oldest recorded age of 88 years and the youngest child at 7 months old. Average members per household was 4 persons.

#### 2.1.2. Education

Survey responses showed 65% of the population has received or were currently engaged in secondary education, with 23% in Government Primary schools. Higher tertiary education was recorded as being received by 12% of the residents (Figure 2). These results show that more than the half population have completed or completed secondary education, while 12% have moved on to tertiary institutions indicating the importance of education to communities.

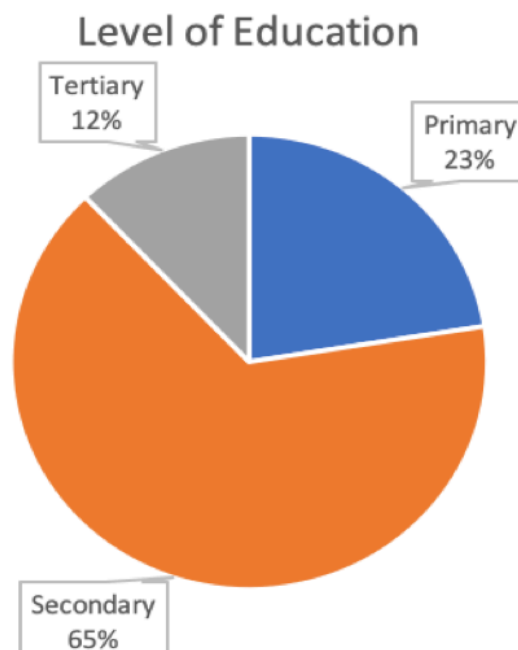


Figure 2. Levels of education undertaken (past or current)

## 2.1.3 Housing

Houses were constructed primarily with wood (papa) 58%, concrete (sima) 9%, cement (piliki) 32% and palm fronds (Tonga) 1% (Figure 3).

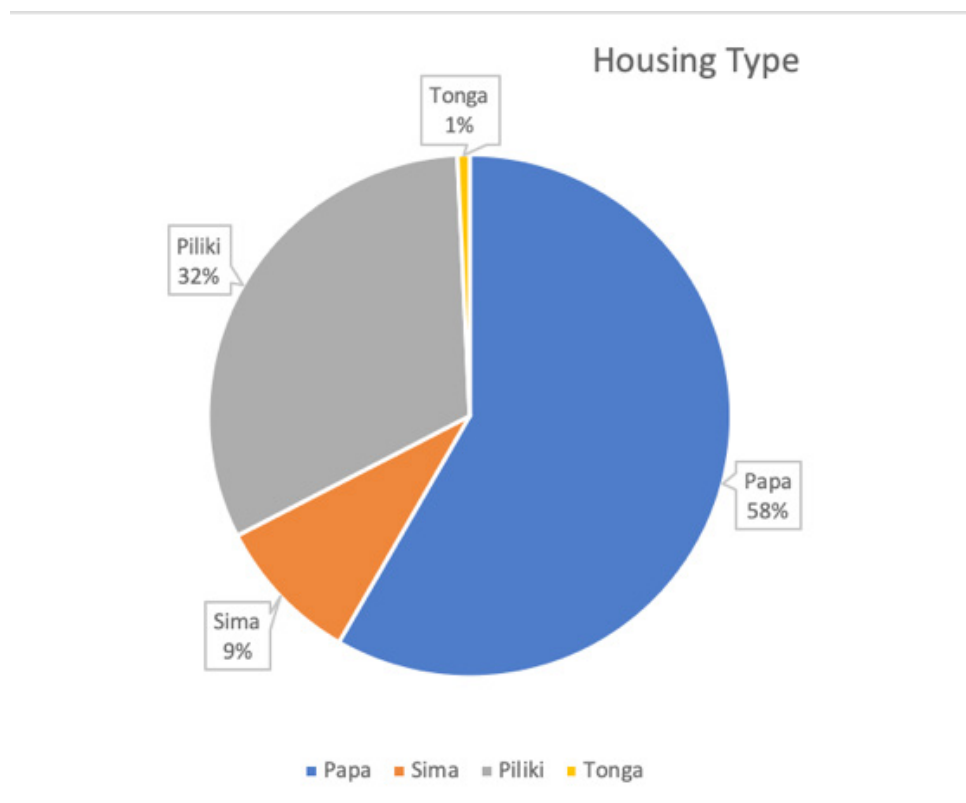


Figure 3. Types of construction material used for houses. Papa (wood), Sima (concrete), Piliki (brick) and Tonga (palm fronds).

## 2.1.4 Source of Power

Tonga Power Board provides 98% of household power with 2% of households having their own generator or solar panel power stations.

## 2.1.5 Livelihood and source of income

Household responses showed high levels of income availability with only 5% of people responding as unemployed. The overseas seasonal workers, small to medium business enterprises and civil servant positions accounted for most of the income.

Resource-reliant activities such as commercial fishing and deep-sea fishing activities accounted for only 9% of the income sources, however inshore fishing (intertidal mudflats and coral reefs) was slightly higher at 10%. Other sources of income such as remittances were identified by 15% of responses (Figure 5).

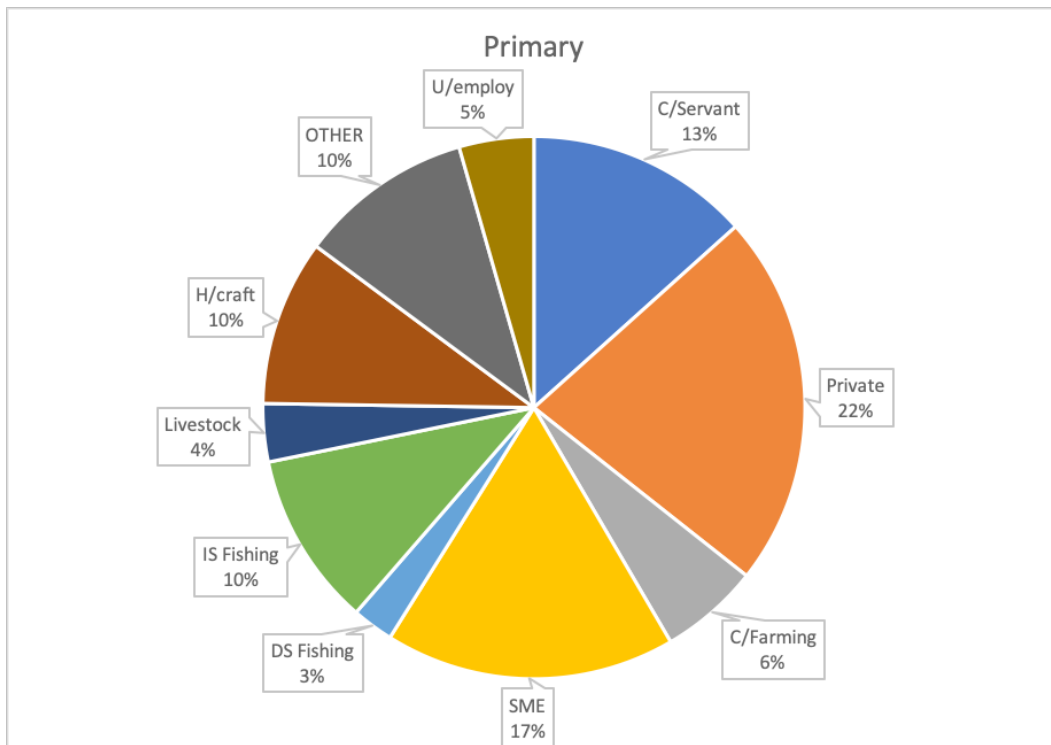


Figure 4. Indication of primary forms of employment across the households surveyed.

Figure 5 shows the relative importance that is placed on the different sources of income, or the wide range of income earning that men and women were engaged in, with the majority considering private employment, remittances and civil service as the most important income sources.

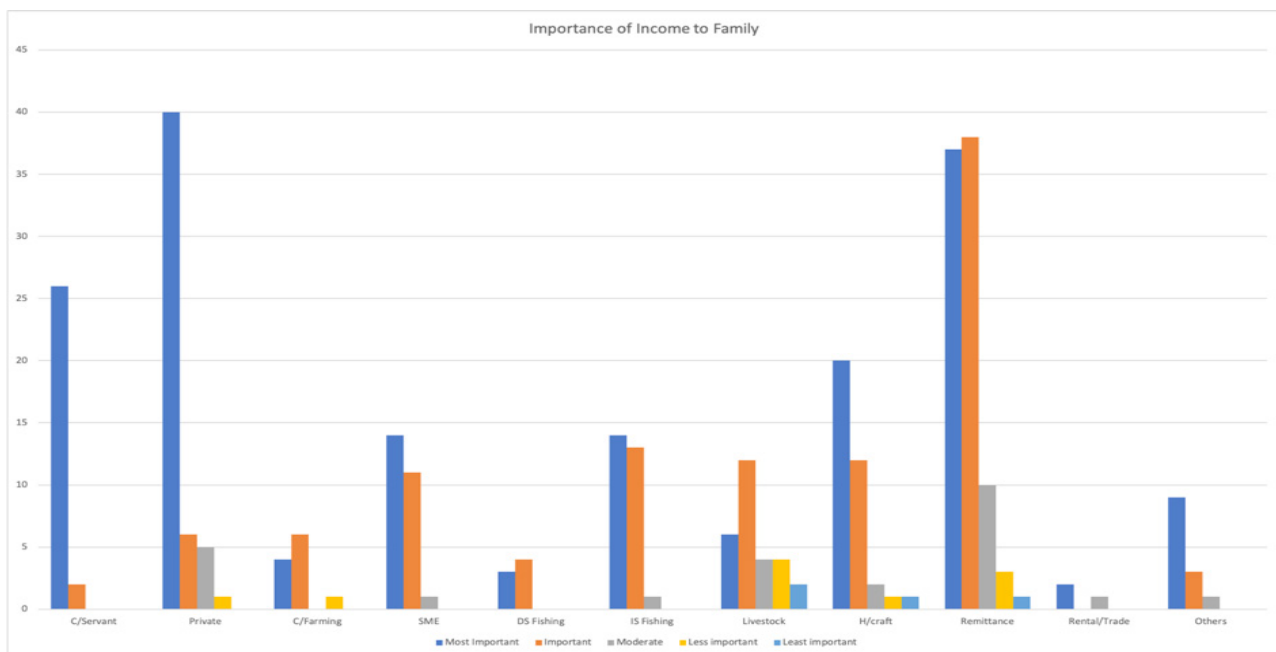


Figure 5. Importance of main source of income to family

Concerning regular expenses (Figure 6), payment of utility bills was the top priority at 74% (89 out of 120 responses), clothes was ranked second at 73% while purchasing food was third at 45%. School fees ranked fourth at 43% of income.

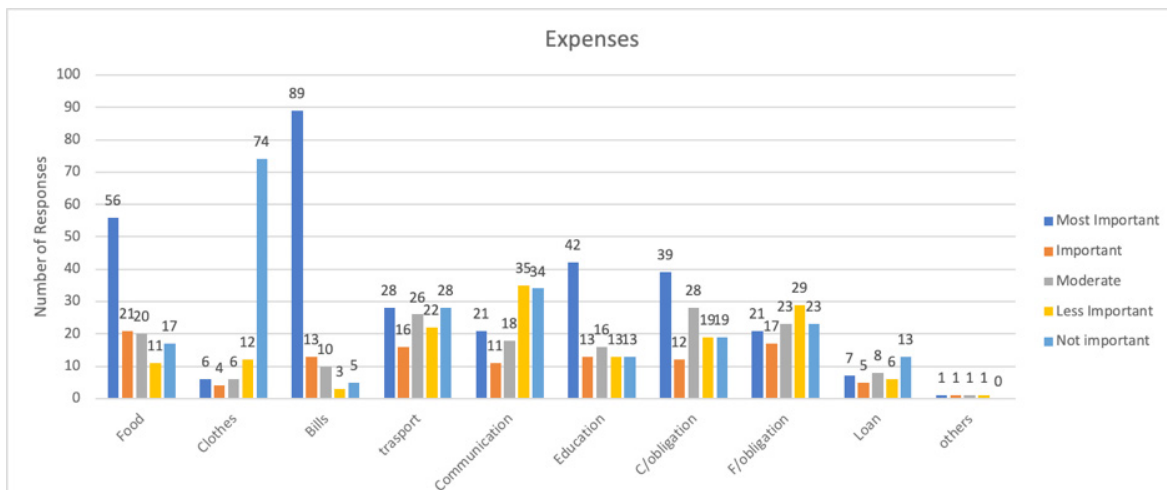


Figure 6. Indication of priority expenses

## 2.1.6 Lands and land use

Land ownership was high, with hereditary ownership of bush allotments (97%) as under the Lands Act 1988, and only 1% of respondents indicating that they leased lands for personal use. Only 2% of respondents used their land for purposes other than agriculture. Organic farming ranked high at 88%. Another 10% of respondents indicated using chemical fertilisers, however, the nature of the chemicals was not identified under this survey.

Main agricultural produce recorded were root crops (33%), including taro, sweet potato, and yams; fruits (28%); and vegetables (10%). Also, 28% of responses showed that flowers were grown within the land plots.

Household animals included a high proportion of pet dogs (77%), with pigs being the primary livestock animal (64%), of which 47% were considered “free roaming” (Figure 7). Households may own more than one animal and many households may own both pigs and dogs.

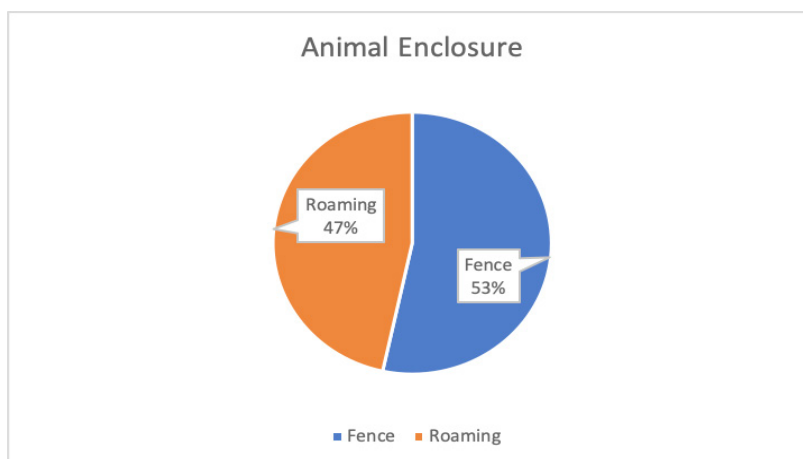


Figure 7. Results of survey on animal husbandry and enclosures.

## 2.1.7 Assets

Most of the households surveyed owned motorised land transport vehicles – car or van – (87%), with a lower ownership of motorised boats (3%). (Figure 8). Information on agricultural assets such as ploughs, and tractors was not collected during the household surveys.

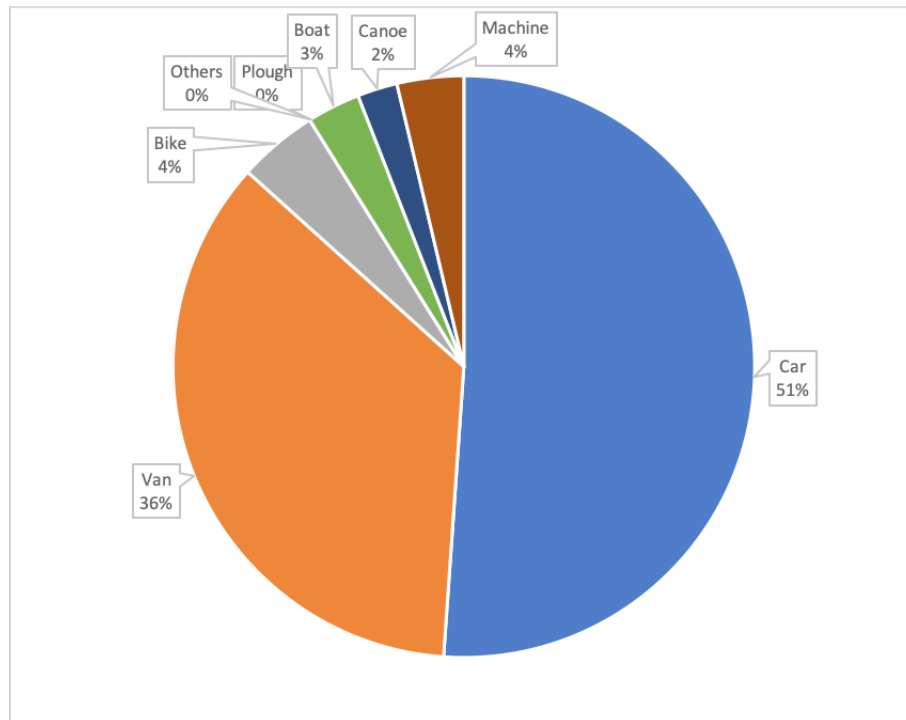


Figure 8. List of land and marine assets owned by the residents

## 2.1.8 Community-based perceptions on income equality

Income availability and equality within the community was regarded as acceptable (74% of respondents), with 20% believing that their household income is much lower than that of others, and only 2% believing that their income is much higher than that of other households. Perceptions were based on cost of food, school fees and disposable income.

## 2.1.9 Feeling about economic livelihood over the past 15 years

Most respondents (68%) indicated that their economic activities had improved over the last 15 years, and with 15% believing the economic abilities had decreased and 17% feeling that they remained the same.

## 2.2 Water, Health, Sanitation and Pollution

### 2.2.1 Water

Water is a critical resource for households and can be collected either by harvesting rainwater in tanks (plastic or cement) or through the groundwater sources; 93% of households are utilising the groundwater supplies and 92% responded that they have rainwater tanks. Groundwater supplies can be inundated with saltwater due to the low-lying nature of the water lenses and rising sea levels and/or over pumping, however most households showed they do not believe, or have not noticed, that there are increases in salinity (Figure 9).

A slight majority of responses (54%) believe there is enough access to fresh water supplies, however 14% believed that there was not enough access.

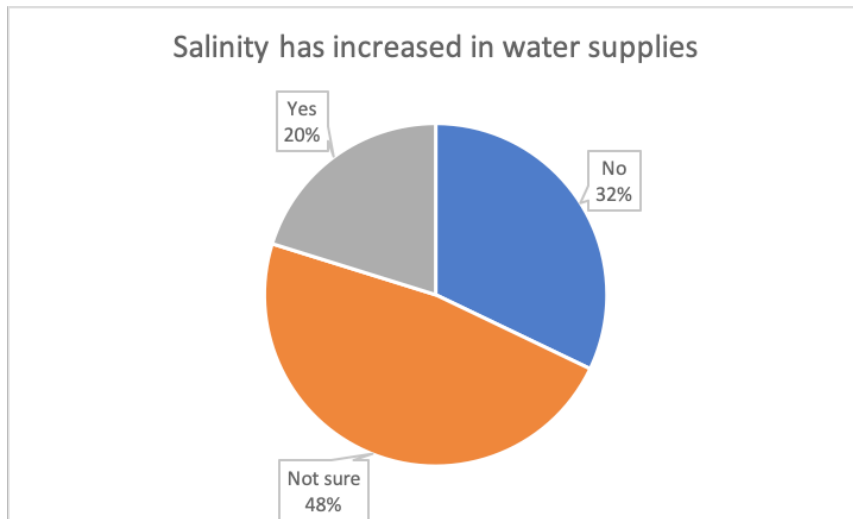


Figure 9. Household perceptions on salinity increase in the water supplies over the past 15 years.

### 2.2.2 Sanitation and Drainage

Survey responses on sanitation and grey water drainage showed that most households have flush toilets, while 3% of households indicated having traditional systems such as pit toilets (Figure 10). However, in term of sewage management, 89% utilise a septic tank, while 11% are discharging straight to soils (Figure 11). The status of the septic system infrastructure was not identified under the HHS to know if the system is containing and managing all the household sewage sufficiently.

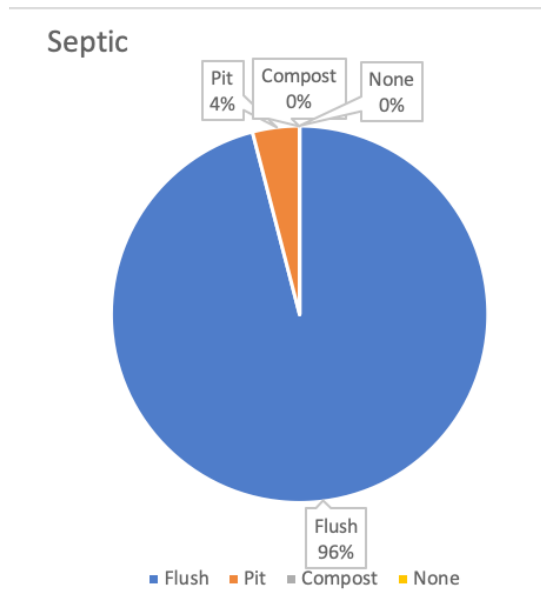


Figure 10. Household responses to type of septic syst



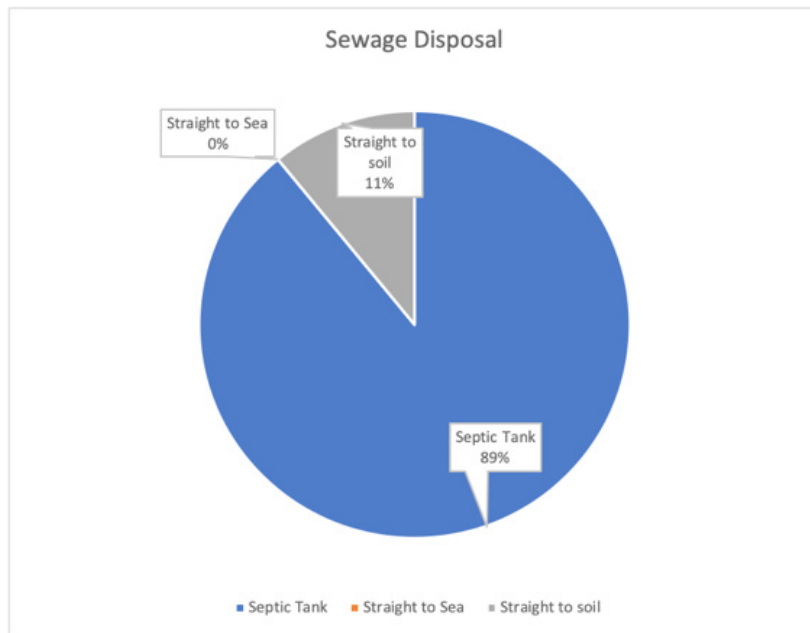


Figure 11. Household responses to sewage management practices.

Only 18% of households indicated having a sink for greywater and only 5% had a drain.

### 2.2.3 Health

Non-communicable diseases are identified as being one of the major impacts to community health and rely on significant hospital and health resources. Diabetes and high blood pressure are two of the most prevalent health impacts identified, with 23% of responses indicating that they are currently healthy (Figure 12).

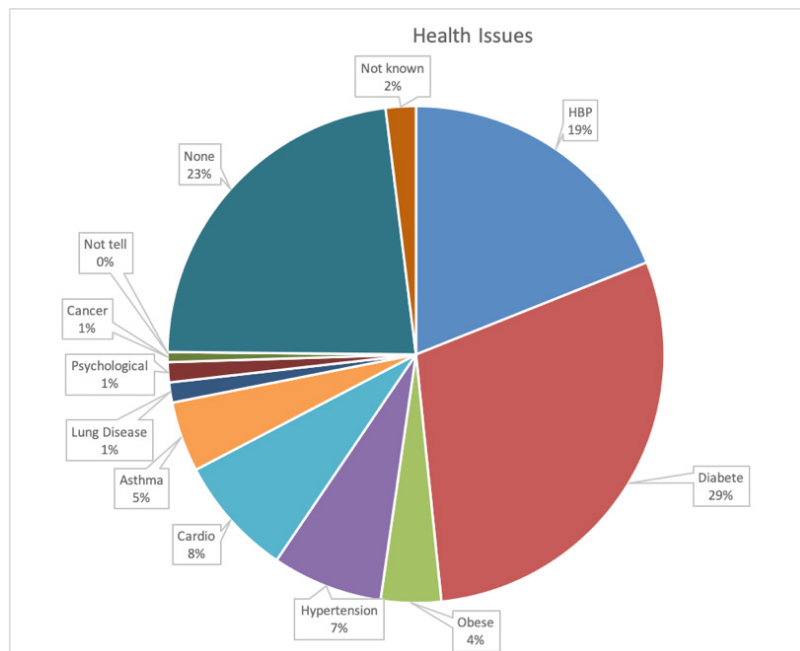


Figure 12. Pie chart showing the percentage of non-communicable diseases and other health issues across the households surveyed.

## 2.2.4 Diet

Fish (50%) and invertebrate marine species (36%) were identified as the most important proteins available to communities, with meat being less important or beneficial (16%). Fresh seafood was considered the healthiest for dietary consumption (67% of respondents), while over 80% of respondents indicated that fatty imported meat such as mutton/lamb flaps (sipi) was not considered important to their dietary health. However, other studies suggest they still consume a large quantity of it (Watson and Treanor 2016). Imported turkey tails, which are also very high in fat, ranked second in importance to fish (Carolan 2017) (Figure 13).

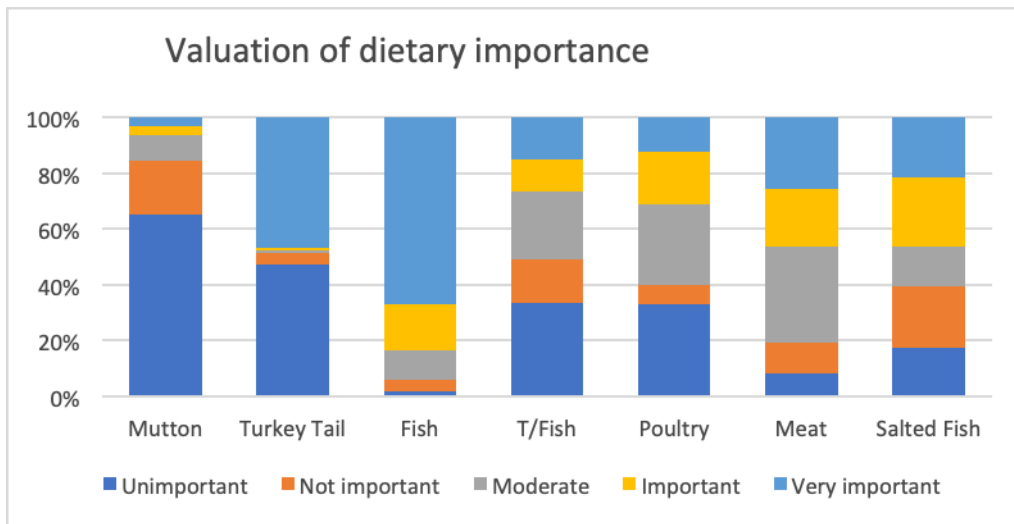


Figure 13. Valuation of dietary importance across the households surveyed

Figure 13 reflects how people view the importance of different types of protein in their diet in addition to purchasing power and their ability to cook meat. It shows that fish still retains the highest dietary importance with turkey tails being second. High dependency on seafood (46%) was reported during the HHS, however another 37% of responses indicated that they do not depend on seafood (Figure 14).

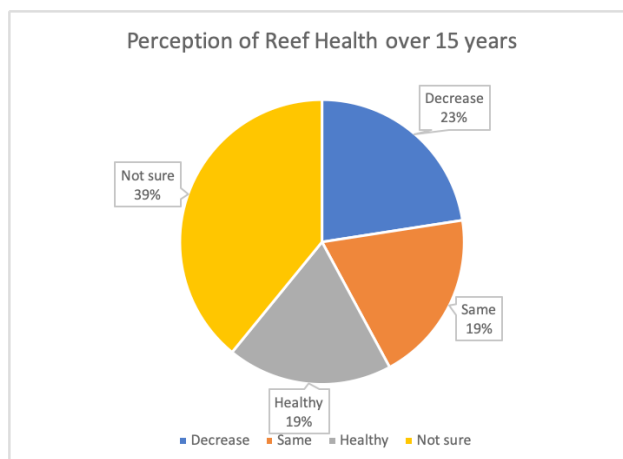


Figure 14. Community level of dependency on the importance of available seafood as a dietary factor

Special Management Areas (SMAs) are implemented through the Ministry of Fisheries and managed legally by the coastal communities with the objective of restoring and replenishing marine resources to previous abundance. Community responses are mixed in terms of their perceptions and

understanding of the potential benefits of resource management, with 45% not sure or not having enough information to make an informed decision, 43% agreeing that the SMA will increase seafood availability and 12% not believing in the SMA benefits.

As the SMA objectives are directly related to the health and status of the coastal habitats such as coral reefs, the survey sought to identify people's perceptions on the changes to the coral reefs over the last 15 years (Figure 15) and on the changes in abundance of marine invertebrates such as sea cucumbers (Figure 16). Responses were mixed with the majority indicating they were not sure.

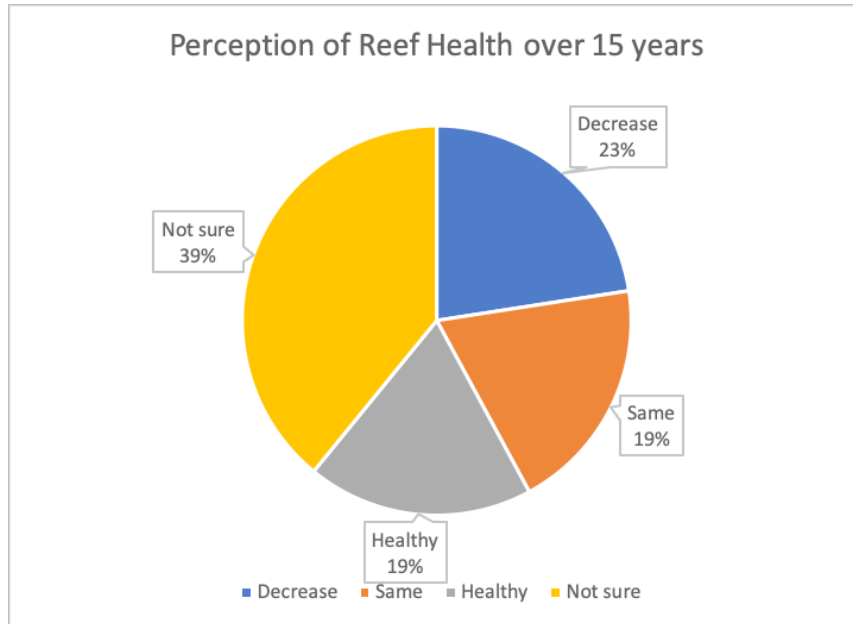


Figure 15. Household perceptions on change in coral reef habitat health over the past 15 years

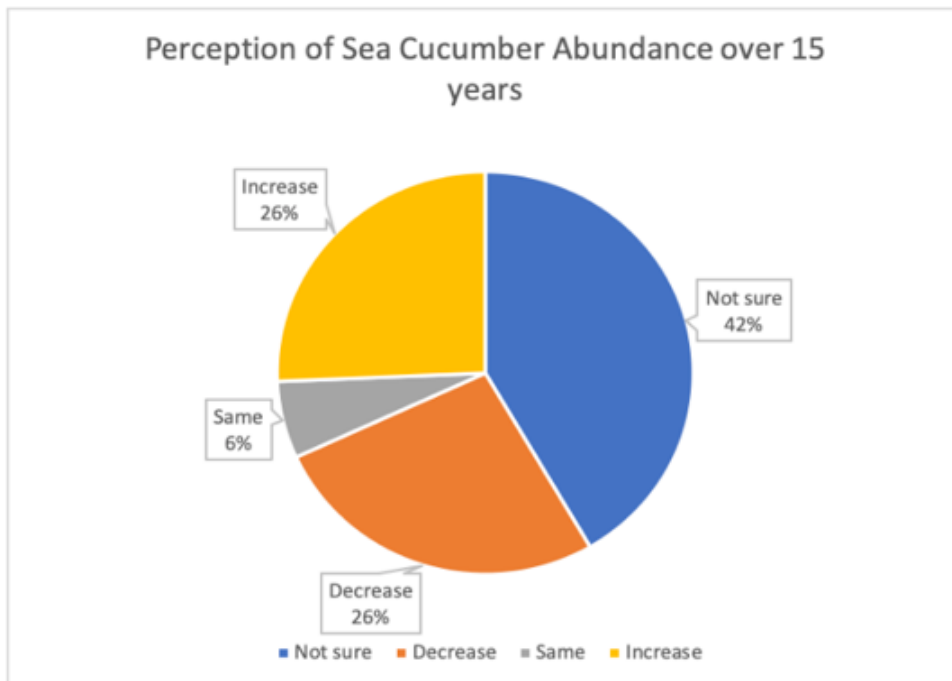


Figure 16. Household perceptions on abundance of sea cucumber over the past 15 years

## 2.3 Climate Change and Community Level of resilience

### 2.3.1 Understanding of Climate Change

Knowledge of the concept of climate change was ambiguous; the results do not ascertain if there are areas of climate change that are better understood by the community than others, apart from an initial perception on climate change (Figure 17) and the availability of information relating to the cause and impacts of climate change (Figure 18). There could be differences in perceptions of men and women on their knowledge of climate change and its impact, however, this information was not gathered and a gendered assessment of perceptions on climate change cannot be done.

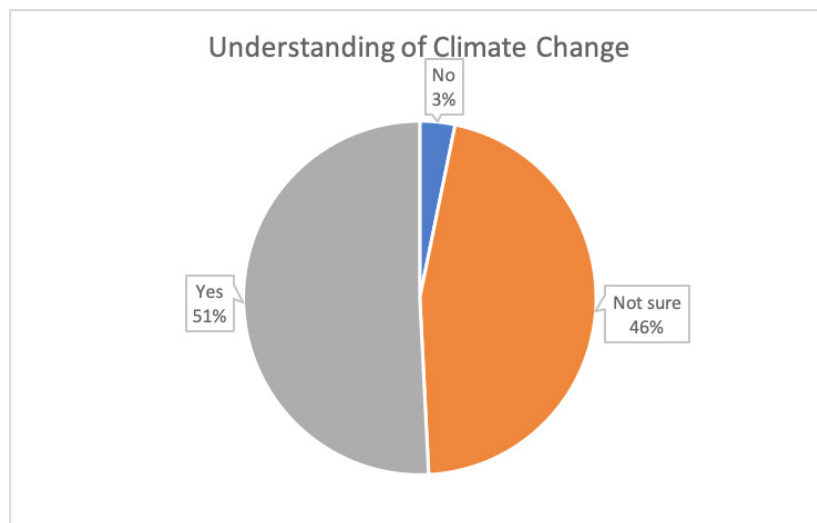


Figure 17. Responses on family knowledge on climate change.

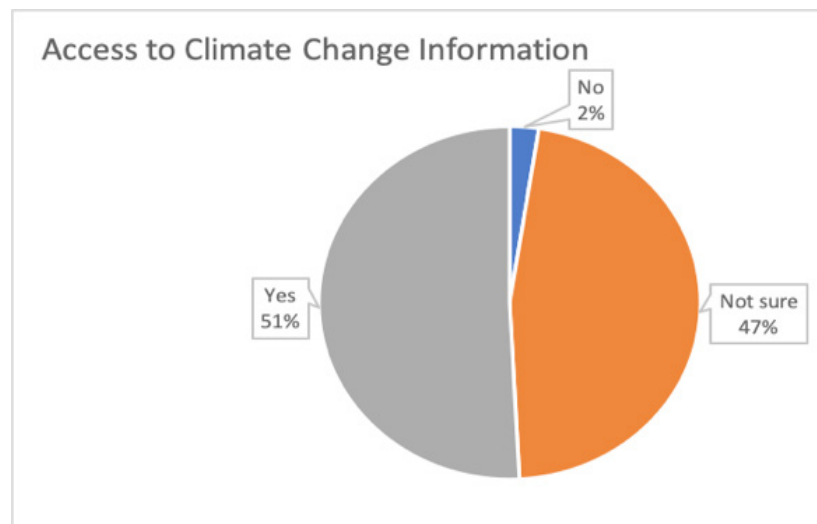


Figure 18. HHS results for access to information on climate change

Community respondents did indicate that there is some measure of preparedness in relation to climate change, however most of the community was unsure or indicated that they were not prepared (2%; Figure 19). This question and responses did not indicate what the community is unsure of. This should be further explored to inform the design of awareness and knowledge-based communications.

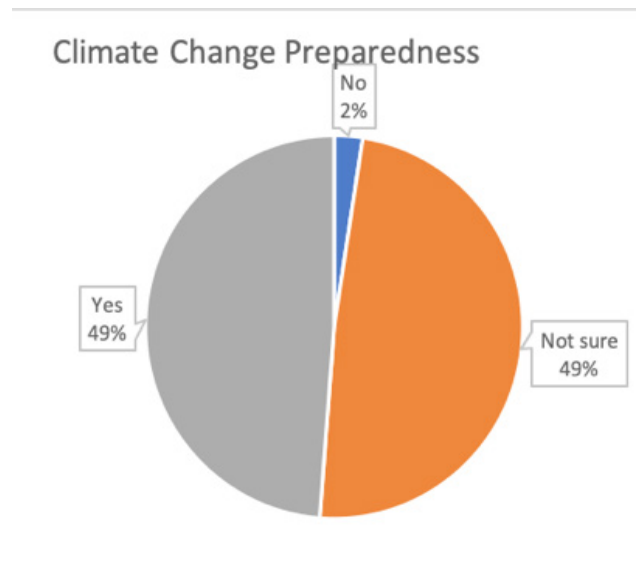


Figure 19. Household responses on level of preparedness across community.

### 2.3.2 Historical trend of Climate Change.

Community perceptions are split on whether changes in natural disasters and weather patterns have occurred over the last 15 years. Respondents considered cyclone strength (Figure 20); whether sea levels have increased (45% agree, 43% unsure and 11% not increased); and if changes to the degradation of lands have occurred (44% increased, 44% not sure and 12% no increase).

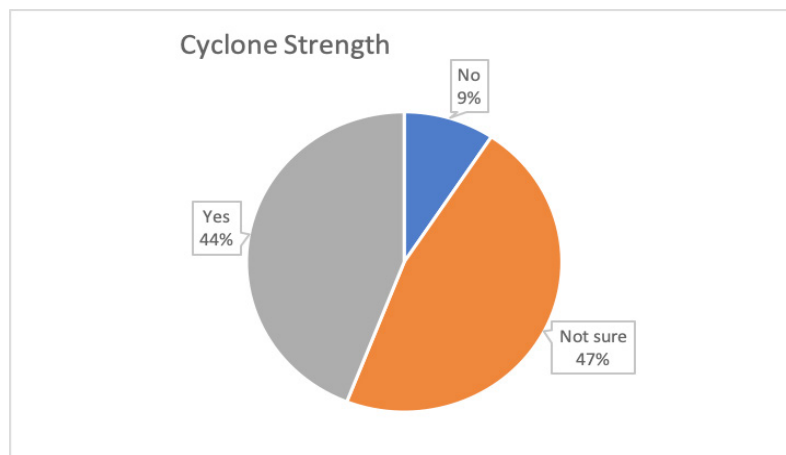


Figure 20. Results from HHS on whether the strength of cyclones has increased over the past 15 years.

Questions on changes in rainfall, including longer drought periods (Figure 21) and/or increased heavy rainfall periods (Figure 22) also showed that the community perceptions are split as to the changes observed.

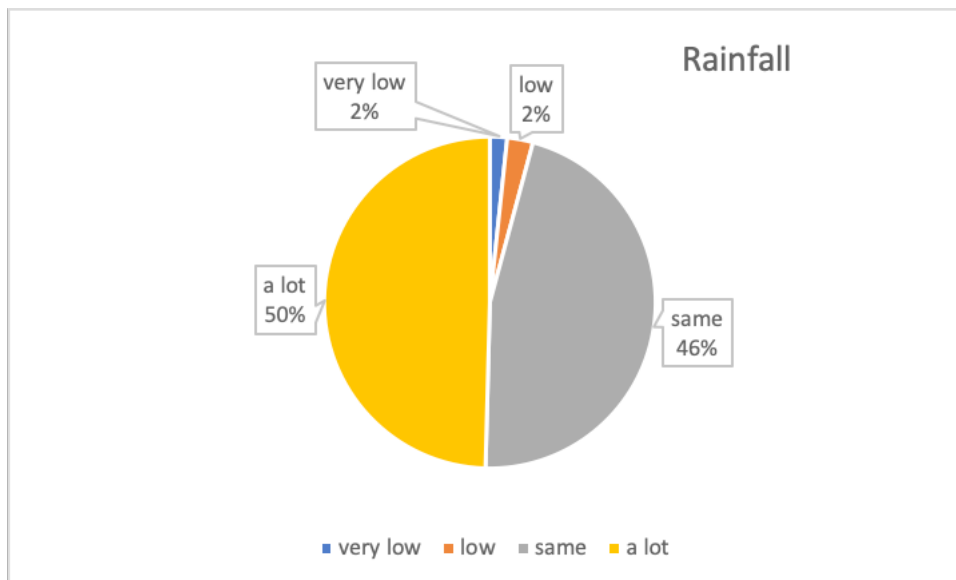


Figure 21. Household perceptions on rainfall level over the last 15 years.

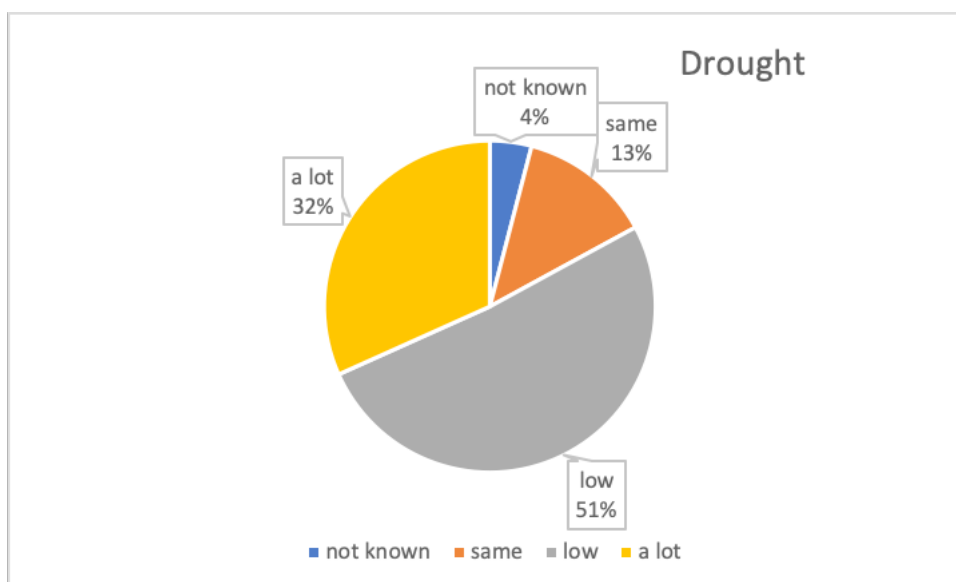


Figure 22. Household perceptions on drought periods over the last 15 years.

### 2.3.3 Importance of Communication Tools for Response and Resilience preparedness

Community preparedness for natural disasters is directly related to knowledge and awareness. Communication tools used currently include social media (Facebook) and Government websites, and radio and text messages through the phone providers Digicel and Tongan Communications Corporation (TCC). Traditional mechanisms for preparedness and how to prepare for natural disasters has not been included in this assessment but could have had a lot of relevance on how men and women understand and prepare for natural disasters differently.

Reponses from communities showed that there is a large amount of uncertainty (46%) on “being prepared” for tsunami and cyclones (Figure 25), with only 51% and 50% (respectively) responding as feeling prepared. Similarly, responses showed that household members were not confident (52%) or would not be able to (34%) recover and only 14% felt that they could recover.

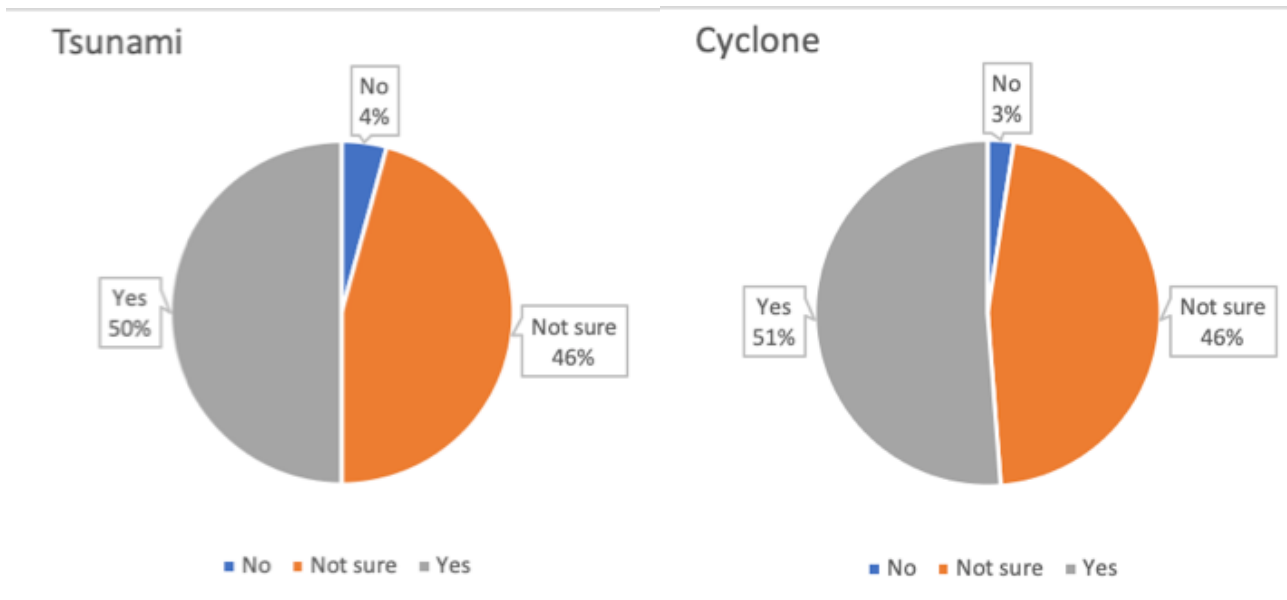


Figure 23. Household responses on family preparedness for tsunamis and cyclones.

## 2.4 Governance and Resource Management.

### 2.4.1 Regulatory Environment in IWCM especially in Kolovai District

A brief desktop assessment of current regulatory frameworks relevant to the aspect of Integrated Water and Coastal Management was conducted to ascertain regulatory gaps and areas for intervention (Table 5).

Table 3. Outline relevant Regulatory Frameworks for Integrated Coastal Water Management

Resource	Regulatory Framework
	<b>Existing Regulations</b>
<b>Land</b>	<ol style="list-style-type: none"> <li>1. Land Act 1927,</li> <li>2. National Spatial Planning and Management 2012</li> <li>3. Building Control and Standard Act 2002</li> </ol>
<b>Water</b>	<ol style="list-style-type: none"> <li>1. There is no comprehensive law in Tonga dealing with the ownership, management, and protection of water resources, even though the need for such legislation was clearly highlighted in most of the conversation related to water</li> <li>2. Provision is made in relation to pollution of water in several laws and these laws involve a range of government agencies.</li> <li>3. In the 2002 Review of Tonga’s Environmental Laws<sup>3</sup>, it recommended the following key features for the proposed Water Bills <ul style="list-style-type: none"> <li>• ownership of the water resource by the Crown;</li> <li>• the right of the Crown to control the water resources;</li> <li>• the rights of the Water Board and other State utilities to access water resources;</li> <li>• the regulation of other means of access to the water resources and the rights to use the resources;</li> </ul> </li> </ol>

<sup>3</sup> Powel, G. 2002. Analysis of environment-related legislation in Tonga: IWP Pacific Technical Report (International Water Project) No. 32. ISSN 1818-5614 p.1.

Resource	Regulatory Framework
<b>Water</b>	<b>Existing Regulations</b>
	<ul style="list-style-type: none"> <li>• determination of matters involving competing claims to the water resource;</li> <li>• imposing water restrictions and drought control measures;</li> <li>• regulation of any activity likely to affect the water resources;</li> <li>• powers to order the cessation of any activities likely to affect the water resources; and</li> <li>• offences in relation to water pollution and contamination and for other breaches of this law.</li> </ul> <ol style="list-style-type: none"> <li>4. The current proposed Water Bill will be submitted to Parliament on the week starting 22<sup>nd</sup> June 2020<sup>4</sup></li> <li>5. The Ministry of Health has clear responsibility in relation to water quality in accordance with its Enabling Act. A range of matters are provided for in this regard. However, the Act does not specify the water quality standards that are to be applied and does not deal with the publication of test results</li> <li>6. The Water Board has the function of supplying water in its areas of authority. The Ministry of Health retains this responsibility in rural areas. Both these functions are currently performed under appropriate legislative arrangements.</li> <li>7. There is no provision in any relevant law dealing with community participation or public awareness in this context, however.</li> <li>8. There is no right of access to information about water standards and the results of water testing, even though there are no grounds for keeping such information confidential. Indeed, it is in everyone’s interest that such matters are known, and that current information be made public.</li> <li>9. The Department of Environment may play a role in relation to Tonga’s water resources the Environment Management Act 2005 makes no specific reference to identified responsibilities relevant to the nation’s water resources. <ul style="list-style-type: none"> <li>• Water Board Act 2000</li> <li>• Health Service Act 1991</li> <li>• Public Health Act 1992</li> <li>• Aquaculture Management Act 2003</li> <li>• Town Regulation Act (Cap.44)</li> <li>• Road Act (Cap. 155)</li> <li>• Public Health (Refuse dumping grounds) Regulation</li> <li>• Garbage Act 1991</li> </ul> </li> </ol>

<sup>4</sup> Hon. Minister of Lands and Natural Resource, Tonga Communication Corporation, Local News, 18th June 2020



Resource	Regulatory Framework	
<b>Coastal Wetland</b>	<p><b>Existing Regulations</b></p> <ol style="list-style-type: none"> <li>1. Bird and Fish Act 1934 (amend 1974)</li> <li>2. Marine and Pollution Act 2004.</li> <li>3. Aquatic Management Act 2003</li> <li>4. Fisheries Management Act 2002</li> <li>5. Land Act 1903</li> <li>6. Park and Reserve Act 1988</li> <li>7. Land (Removal of Sand) Regulation 1936</li> <li>8. Bird and Fish Preservation (amendment) Act 1989</li> <li>9. Fishery Management Act 2002</li> <li>10. Environment Management Act 2005</li> <li>11. Environment Impact Assessment 2003</li> <li>12. Animal disease Act (Cap .128)</li> <li>13. Plant Quarantine Act (Cap. 127)</li> <li>14. Noxious Weed Act (Cap. 128)</li> <li>15. Rhinoceros Beetle Act (Cap.131)</li> </ol>	
	<b>Mangrove</b>	<ul style="list-style-type: none"> <li>• Aquaculture Management Act of 2003</li> <li>• Aquaculture Management (Amendment) Act 2005</li> <li>• Aquaculture Regulations 2008</li> <li>• Birds and Fish Preservation Act [Cap 125]</li> <li>• Birds and Fish Preservation Amendment Act No 20 of 1989</li> <li>• Constitution of Tonga</li> <li>• Civil Law Act [Cap 14]</li> <li>• Environmental Impact Assessment Regulations of 2010</li> <li>• Environment Management Act No. 27 of 2010</li> <li>• Forests Act [Cap 126]</li> <li>• Forest Produce Regulations [Cap 126A]</li> <li>• Hazardous Wastes and Chemicals Act No 28 of 2010</li> <li>• Land Act [Cap 132]</li> <li>• Land (Occupation by Aliens) Regulations [Cap 132A]</li> <li>• Land (Quarry) Regulations [Cap 132E]</li> <li>• Land (Removal of Sand) Regulations [Cap 132D]</li> <li>• Land Timber Regulations [Cap 132B]</li> <li>• Marine Pollution Prevention Act of 2002</li> <li>• Park and Reserves Act [Cap 89]</li> <li>• Petroleum Act. [Cap 135]</li> <li>• Petroleum (Amendment) Act 20 Of 1997</li> <li>• Petroleum Mining Act [Cap 134]</li> <li>• Petroleum Mining Regulations</li> <li>• Roads Act [Cap 155]</li> <li>• Shipping Act [Cap 136]</li> <li>• Waste Management Act 2005</li> </ul>

Resource	Regulatory Framework
	Existing Regulations
	Relevant Management Plans
<b>Fisheries</b>	<ol style="list-style-type: none"> <li>1. Fishery Management Plan 2007</li> <li>2. Deep Water Fisheries Management Plan 2014 – 2016</li> <li>3. Tonga Fishery Sector Plan 2016- 2022</li> </ol>
<b>Environment</b>	<ol style="list-style-type: none"> <li>1. Environment Management Plan for the Kingdom of Tonga 2009</li> <li>2. Joint National Action Plan</li> <li>3. Disaster Risk Management Plan</li> <li>4. Tonga Energy Road Map</li> <li>5. National Infrastructure Investment Plan</li> <li>6. Fangaúta Stewardship Management Plan</li> </ol>
<b>Agriculture</b>	<ol style="list-style-type: none"> <li>1. Tonga Agriculture Sector Plan 2015 -2021</li> </ol>
<b>Infrastructure</b>	<ol style="list-style-type: none"> <li>1. Urban Development Plan 2012</li> </ol>

## 2.4.2 Tonga Water Bill 2009

In the area of the water regulatory platform, there is a real need for the enactment of the Water Bill to govern and regulate the use of water in Tonga. Water being such a precious resource, the delay in passing the long-awaited bill is not favouring water conservation efforts. It is also affecting water distribution and management in community, especially when communities are not fully aware of how to manage their water resources, due to the absence of a regulatory framework in place.

## 2.5 Inclusion and Gender Indicator

For inclusion and transparency in governance, communities agreed that consultation should happen prior to establishing a SMA in their community. There also appears to be a lack of gender-based assessment of the IWCM project – there should be some gender indicators of involvement as often women can drive community development and social inclusion programmes. This study also indicated the prominence of women who are managing the household whilst the men are away from their families.

There is need for sex disaggregated data on the use of resources, roles in development and management, participation in decision making mechanisms, gender livelihood sources and forms of employment held. There was no assessment for people with disabilities. Given Tonga’s international obligations and national commitments, there should also be an indicator to include people with disabilities in assessments.

### 2.5.1 Participatory and co-management

Most of the communities (48%) agreed to the establishment of a SMA although the same number of persons (48%) were not sure whether families in communities should be involved in the SMA establishment. The HHS also confirmed that 76% of the participants agreed that SMAs would increase the protection of reef and fish and 53% agreeing that fish sustainability will increase with SMAs. Only a few of the community members were aware that there was open competition for marine resource

in their area, and 37% believed that the SMA would increase the conflict between the fishers in the village and other villages, while 22% indicated that conflicts would increase among the villagers. Thus, the need to have awareness on SMAs covering not only villagers directly impacted but also all adjacent communities that use the resources to address potential conflict that may arise.

What transpired from the HHS was that the community understood that there is competition for the same resource amongst the villagers and those from other communities. They need the SMAs to protect their marine and coastal resources, with 55% believing that SMAs would support resource conservation and 66% approving of the current committee to implement the SMAs.

The HHS further confirmed that 69% (87) of the families interviewed agreed that they would support the establishment of a SMA with 73% (93) agreeing that the SMA Plan will support the SMA objectives. A high number of participants (66%) agreed to be part of the SMA management, with 73% (95) agreeing that SMAs would improve their livelihood in terms of availability of resources and 75% (98) agreeing that SMAs would improve their health.

On traditional knowledge, 95% had no recollection of traditional methods for protecting coastal areas and a low number of respondents 36% (45) knew where the boundary to their SMA fishing area was located.

## 2.6 Risk Management

Less than half of the population agreed that the communities should establish a SMA. The HHS confirmed (75%) that SMAs would increase protection of reef and fish and 53% agreed that this would support resource conservation. Over 70% of the communities agreed that SMAs would improve livelihood, improve health, and provide security for local fishers as well as from external fishers.

However, there is also a consensus (although less than 50%) that SMAs can increase conflicts between local fishers and external fishers. Hence, it would be necessary to perform a risk analysis to ascertain ways to mitigate social risks.

### 2.6.1 Resource Management

The communities provided a ranking of their most important resources and identified the ecological services these resources provided for them. They also discussed how they could conserve these resources (Table 6).

Table 4. Community assessment of highly valued resources, indicating percentage rank of their importance, Ecological Benefits and the conservation approached identified by the communities

Name of Resource	Level of Importance to Community (%)	Ecological benefits (ranked by numbers of mention)	Conservation Approaches
Fish	69%	<ul style="list-style-type: none"> <li>support fish food chain</li> </ul>	<ul style="list-style-type: none"> <li>SMAs</li> <li>Install public notices around conservation management areas</li> <li>Use only seasonal fish traps</li> <li>Reduce fishing</li> <li>Stop illegal fishing</li> </ul>

Name of Resource	Level of Importance to Community (%)	Ecological benefits (ranked by numbers of mention)	Conservation Approaches
<b>Mollusca/ Crustaceans</b>	50%	<ul style="list-style-type: none"> <li>• Food and income source</li> </ul>	<ul style="list-style-type: none"> <li>• SMAs</li> <li>• Enforce species size control especially for undersize catches</li> <li>• Establish a spawning ground</li> <li>• Re-stock the reef</li> <li>• Establish seasonal fishing of certain species to stop exploitation</li> <li>• Establish sign boards informing about species conservation and littering</li> <li>• Stopping pollution in coastal area</li> </ul>
<b>Coastal Plant</b>	55%	<ul style="list-style-type: none"> <li>• Stop soil erosion</li> <li>• Fresh Air</li> <li>• Healthy ecosystem</li> <li>• Land protection</li> <li>• Marine habitat protection</li> <li>• Protection / buffer against Sea Level rise and Climate Change</li> <li>• Nursery and foraging ground for some of the marine life such as Kuka and Tupa</li> <li>• Carbon sink</li> </ul>	<ul style="list-style-type: none"> <li>• Replanting of coastal areas</li> <li>• Stopping coastal deforestation</li> <li>• Notices to stop destruction of Coastal habitats</li> <li>• Community to start policing access to coastal areas</li> </ul>
<b>Seagrasses</b>	30%	<ul style="list-style-type: none"> <li>• Food for marine life</li> <li>• Nursery habitat for marine life</li> </ul>	<ul style="list-style-type: none"> <li>• stop pollution of the coastal area</li> <li>• management act to protect marine life</li> <li>• SMAs</li> <li>• Fish farming</li> </ul>
<b>Sea Cucumbers</b>	30%	<ul style="list-style-type: none"> <li>• Maintain the health of coastal sediments</li> <li>• Clean-up sandy areas</li> </ul>	<ul style="list-style-type: none"> <li>• Seasonal harvesting</li> <li>• Management Act to regulate harvesting</li> <li>• SMAs</li> </ul>

Name of Resource	Level of Importance to Community (%)	Ecological benefits (ranked by numbers of mention)	Conservation Approaches
<b>Mangroves</b>	43%	<ul style="list-style-type: none"> <li>• Protect marine ecosystem</li> <li>• Breeding ground for marine resources</li> <li>• Nursery area for marine life</li> <li>• Filter sediments</li> <li>• Protect against coastal erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Replanting of mangroves</li> <li>• Management Act to regulate cutting of mangrove</li> <li>• Ban the cutting of mangrove</li> </ul>
<b>Sand</b>	50%	<ul style="list-style-type: none"> <li>• Buffer against waves</li> <li>• Stop soil erosion</li> <li>• Home for marine life</li> <li>• Protect marine lives</li> <li>• Beautify coastal areas</li> <li>• Hold land together</li> <li>• Home for Mehingos (Tellin Shells)</li> </ul>	<ul style="list-style-type: none"> <li>• Enforce sand mining Act</li> <li>• Board/Poster to ban sand mining</li> <li>• Stop all form of sand mining</li> </ul>

### 3 DISCUSSION

The results of the surveys showed varying degrees of socio-economic, environmental and governance knowledge in the survey population. Socio-economic, environmental and governance knowledge did not include traditional knowledge and customary practices which would identify the gender difference in these different knowledge fields. However, it also gives an indication that whilst there is clear quantitative data, the qualitative data will potentially need further verification to address enumerator bias. Enumerators have a large role to play when ‘interpreting’ the responses received as well as those inputting the data.

The data, when transposed to Excel, varied in completeness of information and/or full responses from households. This included total population numbers and gender split by households.

It must also be understood that the HHS questionnaire was based on the surveys conducted previously by Ministry of Fisheries for the Special Management Areas (SMA) and was adapted and broadened to encompass the information collected for the RapCA.

#### 3.1 Social and Economic Pressure on land space and resource habitat

There was a decrease in the population noted in the HHS (622 persons) compared to the 2016 National Census (725 persons). This could be due to members migrating overseas for employment. However, both the 2016 Census and the 2020 HHS confirmed the number of households, 126, has remained the same over the past 4 years.

Access to electricity has a very positive indication with 98% of the population having access to light. However, there was no indicator on how sustainable this access is; whether they own the power meter or access their neighbours' one. The biggest commitment to expenditure shows that priority commitment is paying bills, which take the biggest portion (74%) of the household budget, with food and school fees in second and third place respectively. Sustaining payment for electricity would thus be a challenge in the event that remittances were to drop, given that this is currently the highest source of income for 65% of households.

The 2016 Census found that the main employment, for both men and women in which more than 50% of both surveyed villages were engaged, was permanent jobs with wages/salary<sup>5</sup>. However, in 2020, the HHS findings show that 22% of the people are now earning a livelihood from the private sector; 13% as civil servants and 17% from small to medium enterprises, with only 5% of respondents indicating being unemployed.

There is a need for alternative livelihood development and intervention in the community, with a potential to invest further in skills to build capacity of the community (mainly women and youths) to do more on handicrafts, livestock and small to medium enterprises. A combination of these three areas made up more than 50% of livelihood and employment or income source. With small interventions, there is a high probability that we could improve their savings and lower their dependency on remittances as well as encourage their investment in resource conservation, for example, replanting local produce and livestock and development of coastal integrated management plans.

Both 'Ahau and Kanokupolu are on Government land, hence most properties are secured for life. The HHS showed that 97% of the households have land ownership under the Lands Act 1988 whereby the eldest male at the age of 21, is allotted land. 88% reported using organic farming, which suggests there is a very high chance of continuing this good practice to safeguard the land. Mrs. Mafileo Masi of the Chemical Division of the Department of Environment stated<sup>6</sup> that no POPs (Persistent Organic Pollutants) are allowed into Tonga, so there is a very good chance that pursuing organic farming in Tonga has a very high prospect of being successful. It also means that agricultural activities may have less negative impact on coastal marine ecosystems<sup>7</sup>. Only 10% of respondents reported using chemicals and the remaining 39% use mixture of both chemical and organic farming.

The HHS did not carry out an in-depth assessment of animals. Apart from dogs appearing to be the dominant animal, with 76% confirming ownership of one or more dog, 62% confirmed having a pig and 16% confirmed having a cow. Farm animals like pigs and cows may pose a larger threat to gardens and other resources. As to animal management, most villagers (47%) allowed their animals to roam the village. This has serious implications for resource management as dogs could become a threat to people's life if they are not confined within the owner's property. Pigs can destroy people's gardens. They also dig for food in coastal areas, thus threatening the balance of life within coastal ecosystems. It is known in Tonga that some of the pigs are excellent fishers along coastal villages. Their digging along the coastal shore has destroyed coral reef ecosystems and upset the food web balance. Animal waste, while good for agricultural use, can affect water resources in high concentrations.

Residents appear to be more affluent than in 2014, when the Pacific Adaption to Climate Change study reported there were only three personal vehicles and one boat<sup>8</sup>. The HHS confirmed that more than 78% of the population own private vehicles, with seven families owning a boat or canoe. Some participants (18%) reported having fishing gear such as fishing hooks, net, etc. These tangible

<sup>5</sup> Tonga Department of Statistic 2020, Nukunuku and Ahau Village Profile Manual. P9

<sup>6</sup> Executive Steering Committee Meeting Seminar, Kanokupolu, 12 June 2020.

<sup>7</sup> SPREP, 2014. Socio-economic assessment of Hihifo district: the pilot site for Pacific Adaptation to Climate Change in Tonga. P9

<sup>8</sup> *ibid.* p14.

indicators show that the people in these communities are quite affluent in comparison to the last 6 years, when more than half of the population (66%) earned less than TOP200<sup>9</sup> per month, which indicated a low income<sup>10</sup>. Most of this affluence could be attributed to the high number of people going overseas on the Labour Mobility Scheme and sending remittances back home.

Despite the tangible wealth, only 74% felt that they were economically secure in line with other families, while 20% thought that they were either poor or very poor in comparison. The rest did not provide answers. When asked about economic livelihood, only 50% believed that it had improved and 37% felt that it has decreased over the past 15 years, with the rest either feeling no change or being uncertain. This indicated people's economic perception as well as what they might do if they perceived that they were not economically secure to undertake day-to-day responsibilities. It could affect the way they exploit or conserve their natural resources if this sudden source of wealth suddenly ceased, they would exploit their surrounding natural resources to sustain the kind of lifestyle they have got accustomed to.

### 3.2 Water, Health and Sanitation

Water is a crucial resource, and it is a basic human right to have access to drinkable water. The HHS showed that 93% of respondents received water from the village water source and that 92% had water tanks. Both statements do not confirm whether having access to a water source meant that there was a water tap at each of these 117 houses or whether the 92% having water tanks meant that these tanks were in working order. In fact, only 54% confirmed they had access to drinkable water. This is a pressing issue and there is a real need to ensure that the remaining 48% of the population has access to drinkable water as soon as possible. Access to safe drinking water also impacts on people's health. There is a high number of cases of non-communicable diseases such as diabetes (35%), which have a direct relationship to what people eat and drink. Proper access to drinking water could help decrease the number of cases of NCDs if people have less need to drink processed and sugar-filled beverages.

The HHS responses concerning diet showed that a very high proportion (83%) of the population consumed fish or marine resources as part of their daily meals and 64% fully understood the dietary significance of sea food. Unfortunately, they could not link the importance of the seafood with marine ecosystem conservation. There was a clear lack of knowledge in the community about their reef and its status. Whether they are not aware or do not care, there is a real need to raise awareness of coastal ecology as well as the ecological services they provide for the people of these two communities.

Sanitation and drainage play a critical part in any society, especially when considering integrated coastal management. 94% of households own a flush toilet, which is an increase of 2% (13 households) since a survey in 2016<sup>11</sup>. The focus is on the remaining six households that have a pit toilet and the family that has no access to any toilet facilities, and presumably uses the beach/lagoon/nature. Inadequate sanitation facilities contribute to nutrient pollution of the coastal environment and is a health issue. The HHS also confirmed that 84% of the population has septic/sink drainage with a secured and sealed compartment. The remaining 16% drain directly to the soil or have no drainage at all, posing an environmental issue.

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<sup>9</sup> Ibid.p18

<sup>10</sup> Ibid)

<sup>11</sup> Tonga Department of Statistic 2020, Nukunuku and Ahau Village Profile Manual. P11

Contamination of the underground water lens poses a serious threat to the communities. The Minister of Lands and Natural Resources confirmed that at both 'Ahou and Nukunuku the water lens was infected with *E-coli* as measured by bore tests carried out by the Ministry in 2019<sup>12</sup>. Fortunately, the Minister of Health confirmed that his Ministry has re-conducted tests for both villages on Tuesday the 9<sup>th</sup> of June 2020 and confirmed that there is now no presence of *E-Coli* bacteria in their water<sup>13</sup>. Sanitation must be managed, and it has a very negative impact on the health and livelihood of people in the area. There are also 3 hospitality businesses in the vicinity and the threat of *E. coli* can easily hamper their operation if Health and Sanitation standards are not met.

### 3.3 Climate Change and Community Level of resilience

'Ahou and Kanokupolu are situated on a very low elevated spot with the highest point being less than 2 m above sea level, making them highly vulnerable to tidal surges, increasing sea level rise and coastal erosion.

The impact of any intervention is also judged by the response from the community and should reflect their level of preparedness to climate change. If we are not reaching and making an impact in at least 50% of our target audience, then we are not adding value to the funds which we are investing in the project. The HHS showed that 54% of the 126 families have no confidence in their level of readiness in the event of a tropical cyclone or tsunami (only 43% stated readiness). In fact, when asked what they would do in case a tropical cyclone would affect them, only 50% of families knew what to do and the remaining 48% were either not sure or (43%) or did not know what to do. When further asked about the rate of resilience if a disaster occurred, only 14% believed that they would be able to recover.

What would happen to the remaining 86% of the communities is a very big concern that needs immediate response from either MEIDECC or R2R IWCM. This is a real area for intervention and there needs to be a monitoring system in place to ensure the programme tracks progress in all areas under the socio-economic indicators.

### 3.4 Understanding of Climate Change and its impacts

The HHS confirmed that 51% (66 respondents) of those interviewed understood what climate change is. Another 48% of the respondents indicated that they had no idea what climate change really meant. The HHS also confirmed that only 48% of respondents have access to climate change information, leaving 52% of the population surveyed as being not sure or having no access to any climate change information. This is a very poor response given that many projects have been implemented in the Hihifo area together with various community consultations, which invariably highlighted the significance of climate change to their livelihood. It also highlights the need for consistent capacity building and awareness and making use of existing traditional systems for information dissemination and ensuring the increased understanding of climate change.

It is crucial that an assessment of the message or tools used for delivery be conducted and a consideration for using existing systems for information dissemination as current approaches do not seem to be working. An improved communication strategy should be deployed with clear but specific information to relay messages which are relevant to specific communities, making them feel that it personally affects them. Communication is the key to ensuring a high level of understanding as well as maintaining post-consultation interest.

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<sup>12</sup> Tonga Parliament Session, June 18, 2020, Radio Tonga New. 7pm

<sup>13</sup> *ibid*



When looking back at the historical perspective of these communities, especially over the past 15 years there is a consistent affirmation of natural disasters happening more frequently and of increasing strength. However, when asked whether they had notice water salinity as having increased over the past years, around 43% were not sure with 17% thinking that it has remained the same and 40% agreeing that it had become saltier. When asked about the sea inundation, 58% were either not sure or felt that there was no change. However, from aerial images (Figure 17) one can easily see that land reclamation by the community members in front of the surveyed villages was in response to sea inundation.

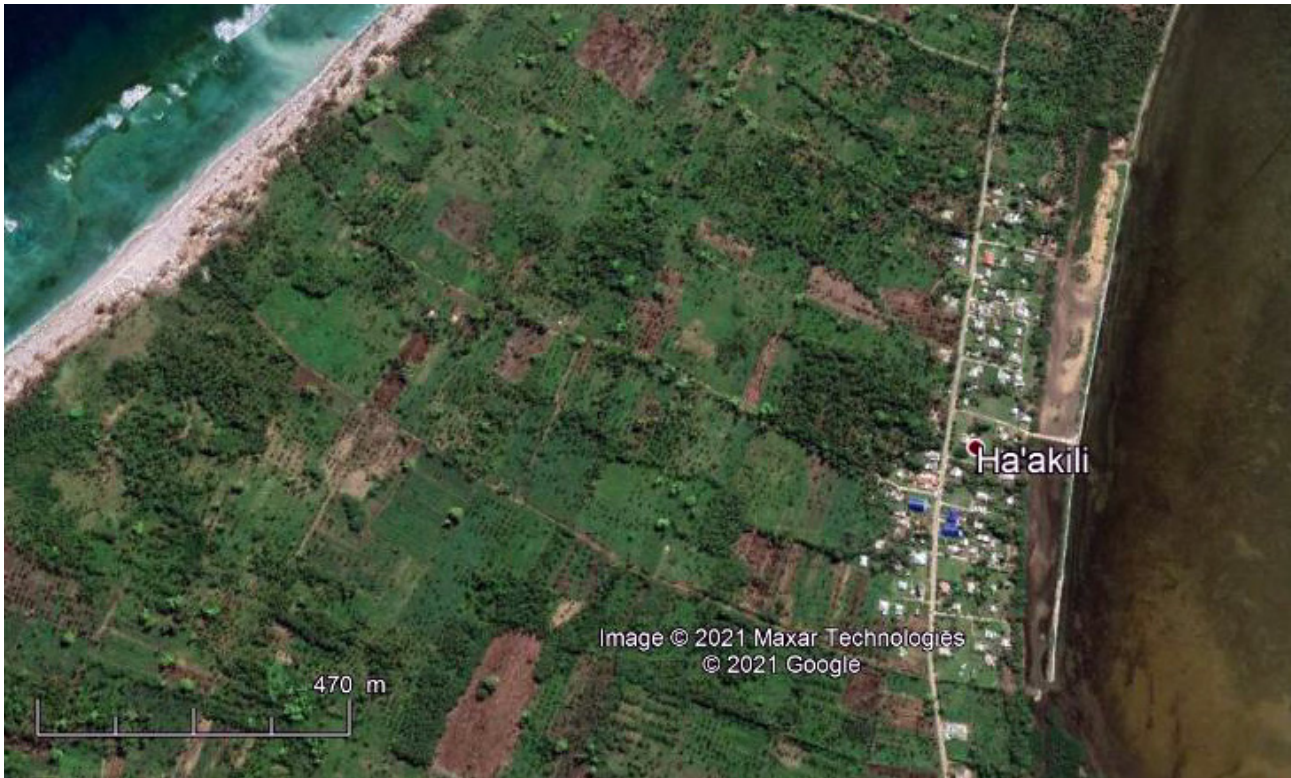


Figure 24. Satellite Google Map of 'Ahau – showing the high concentration of sedimentation across the village's coastal shore, and reclaimed land in front of the village (arrow).

A closer observation of the satellite map reveals the high sedimentation along 'Ahau village, which should give clear indication of the impact on coral reefs in the surrounding area. However, when asked, only 23% thought that the health of the reefs in the village vicinity has decreased, while 19% said that it was healthier and 19% believed that it has stayed the same. The others (39%) had no idea.

### 3.5 Governance and Resource Management.

While Tonga has extensive legislation, compliance, and enforcement of these can be weakened due to limited resources, capabilities, and social pressures. Clear roles and mandates of legislations would be beneficial during project implementation and information sharing between Ministries and communities (Table 7).

Table 5. Outline of Identified Regulatory Frameworks relevant to R2R Integrated Coastal and Water Management.

Resource	Regulatory Framework			Current Ruling Regulatory Framework
	Existing Regulations	Responsible Actors	Key responsibilities/Key features	
Land	Land Act 1927	Ministry of Infrastructure (MOI)	Land owns by Crown Hereditary estates	
	1. National Spatial and Planning Management Act 2012	Planning, Urban Management Act (PUMA)	Tax allotment	
	Building and Control Standard Act 2002	National Emergency Operation Committee (NEOC)	Lease/sub lease (99yrs vs 3yrs)	
		District Emergency Management Committee (DEMC)	Tenure for women and vulnerable groups	
		Village Emergency Committee (VEC)	Informal settlement and landless people	
			Expropriation (government securing private lands for public purposes)	
	Relocation (no current law-case by case)			
Water	Building Control and Standard Act 2002	Ministry of Infrastructure	Design of a proper septic	
	Building Control and Standard Regulation 2016	Ministry of Infrastructure	Design of a proper septic	
	Tonga Water Board Act 2000	Tonga Water Board	Authority to declare and acquire water supply area	

Resource	Regulatory Framework			Current Ruling Regulatory Framework
	Existing Regulations	Responsible Actors	Key responsibilities/Key features	
Water	Ministry of Health Act 2006	Ministry of Health	Approved of any Spetic Design under the building control regulation 2016	
	Public Health Act 196/1988	Ministry of Health	<p>To provide a public health service of the Ministry Health Act and oher relevant legislation, and having specific responsibilities with respect to potable water, food hygiene, building standards, disease control, prevention of pollution, waste disposal, health and safety at work and such other matters as the Minister shall decide.</p> <p>Part II defines summary offences including improper keeping of animals, birds or fish, wrong construction of wells or water storage</p>	
	Water Supply Regulation 1963/1884	Ministry of Health	Each Town Officer shall form a committee by popular vote for the purpose of assisting the village water scheme and to carry out all the necessary work to provide water, particularly for the functions and activities in relation to the health of the people of the village and the village schools (reg. 2). They shall provide voluntary labour and all assistance possible to help in the provisions of water and sanitation for the village, raise money for water works, and follow instructions of the staff	
	Public Health Act 196/1988	Ministry of Health	The Act consists of 53 sections divided into 8 Parts; Administration (I) ; Contagious and Infectious Diseases (II); Slaughtering of Animals for Food (III); Diseased and Unfit Food (IV); Sanitary Superintendence and Nuisances (V); Public Water Supply (VI); Private Tanks and Wells (VII); General Provisions (VIII)	

Resource	Regulatory Framework			Current Ruling Regulatory Framework
	Existing Regulations	Responsible Actors	Key responsibilities/Key features	
Water	Sanitation Superintendence Regulation 1929/1988	Ministry of Health	These Regulations provide rules for the construction and maintenance of latrines and cesspits and deposit human faeces. It that it shall not be a breach of these Regulations if a person not within easy distance of any such sanitary convenience deposits human faeces in a place at least 100 yards from any human habitation, highway, path, well, stream bed, cistern or place frequented by human beings. No cesspit shall be constructed until the position for it is fixed by an authorized officer of the Ministry of Health.	
	Water Resources Bill 2012	Ministry of Lands and Natural Resources	General Management of water resources in Tonga	
	Public Health (Mosquito Control) Regulation 1938/1988)	Ministry of Health	These Regulations provide various norms for the storage of water in order to prevent creating conditions that favour mosquito. Stagnant water shall be sufficiently drained or treated with petroleum or other suitable oil. Tanks and vessels used for storage of water shall be covered with mosquito gaze or treated with petroleum or other suitable oil. Guttering and pipes connected with the roofs of all houses and other buildings shall be kept clean and in good order	
Coastal Wetland	Bird and Fish Act, 1934 (amend 1974)	Ministry of Land and Natural Resources	Protection of Mangrove in any area	
	Marine and Pollution Act, 2004.	Ministry of MEIDECC	Marine pollution prevention and response	

Resource	Regulatory Framework			Current Ruling Regulatory Framework
	Existing Regulations	Responsible Actors	Key responsibilities/Key features	
Coastal Wetland	Aquatic Management Act 2003	MAFFF	Notice of intention for those intending to use chemical, pesticides, pharmaceutical and bioremediation and such substance that can be restricted or prohibited. Comprehensive law dealing with all conservation, management and sustainable utilisation and development of Tonga Fisheries	
	Fisheries Management Act 2002	Ministry of Fisheries	Development within the littoral Zone (subsection 22. (1).e. regulate and prohibited the cutting and taking of any timber, stone or sand from anywhere	
	Land Act 1903	Ministry of Lands and Natural Resources	Disposal of litter in any public place	Now superseded by the National Spatial Planning and Management Act 2014
	Park and Reserve Act 1988	MEIDECC/ Ministry of Fisheries	Setting up of Marine parks.  Prohibited taking sand from foreshore within the limit of the harbour, or from any government	
	Land (Removal of Sand) Regulation, 1936	Ministry of Lands and Natural Resources	Provision under Section 7 – prohibit within designated areas without any prior consents any construction activity, discharged of effluents or the permanent cutting, damage or removal of any mangrove	

Resource	Regulatory Framework			Current Ruling Regulatory Framework
	Existing Regulations	Responsible Actors	Key responsibilities/Key features	
Coastal Wetland	Bird and Fish Preservation (amendment) Act 1989	MEIDECC/ Ministry of Fisheries	Make provision under Section 59 for the Minister to make regulations, amongst other things, prescribing fishery management and conservation measures and schemes for limiting entry into all or only specified fisheries. The Ministry as well to progressively prepared and keep under review plans for the conservation, management and development of marine living resources	
	Fishery Management Act, 2002	Ministry of Fisheries		
	Environment Management Act 2005	MEIDECC	Established Department of Environment to ensure the protection and proper management of the environment and the promotion of sustainable development.	
	Environment Impact Assessment 2003	MEIDECC	Provides framework for development planning aims to prevent the making of arbitrary decisions with regards to land, marine coastal areas and resource use.	

It was apparent from the HHS that there is high support from communities for prior consultations so their voices could be inputted into any management plans that would affect their livelihood and the social cohesion in their communities.

Almost all governance questions received very positive responses from the community on matters relating to their participation and the establishment of a formal structure to minimise resource abuses and supporting resource conservation and management.

There are existing legislative frameworks that should be sufficient for management and conservation but there appears to be a lack of enforcement of these legal frameworks because sometimes there are no regulations<sup>14</sup> in place to give the Act the necessary full power of enforcement. There is also an apparent lack of coordination<sup>15</sup> amongst partnering ministries that share the responsibility of implementing the regulatory framework. The Ministry of Fisheries has identified that the lack of

<sup>14</sup> Ministry of Fisheries, Deep Water Management Plan, 2007 p17.

<sup>15</sup> McCue, 2014 p31

coordination also reduced the opportunity for effective co-management, thus creating silos of duties and preventing participatory and consultative frameworks<sup>16</sup>. Finally, the issue of ‘Lack of Awareness’ was identified by McCue<sup>17</sup> as another stumbling block. This also links to the issue on communication identified under the Climate Change components. There is a need for clear demarcation of roles and responsibilities that could be supported by existing regulatory frameworks. However, in the absence of a framework (such as the Tonga Water Bill) relevant ministries should make a record of regulatory references and share this information so that everyone can enjoy true participatory co-management in a consultative framework.

Existing management plans should also support implementation as most, if not all, of these management plans involve communities during consultations. Community involvement should be gender inclusive where men, women and youth are included. Gender inclusion means that the different areas of interest of work and priorities of the different community groups are addressed. They can be implemented as part of a “take back message” from the Government that it values the voice of the public, and the management can be a co-management tools to ensure collaboration as well as improve community empowerment to take ownership of its plan and lead the implementation.

Table 6. Existing National Sector and Management Plans that could support IWCM

Management Plans		
<b>Fisheries</b>	Fisheries Management Plan 2007	Ministry of Fisheries
	Deep Water Fishery Management Plan 2014–2016	
	Tonga Fishery Sector Plan 2016–2022	
<b>Environment</b>	Environment Management Plan for the Kingdom of Tonga, 1990	MEIDECC
<b>Agriculture</b>	Tonga Agricultural Sector Plan 2015–2021	MAFF
<b>Energy</b>	Environment Management Plan-Kingdom of Tonga: Upgrade of Grid in Preparation for Renewable (Tongatapu) 2015	Tonga Power Limited

Communities also had opportunity to identify and ranking resources according to their importance as well as by the (%) ecological benefits they provide. They were also invited to propose conservation and environmental management approaches. Whilst the importance of each resource varies according to each respondent, there is a clear lack of comprehension of what “Ecological Service” means to the population. There is thus little information available to create an exhaustive list of the true ecological services that the various resources may provide. Again, this is an area for intervention as residents need to fully understand the coastal resources they own as well as the ecological services they provide. They also need to be supported in identifying conservation strategies when there is a need for it. There is also a need for practitioners to fully understand how people view their resources, what they understand as they have used these resources for generations and understand the changes and the threats from years of experience. Thus, the need for an approach that considers the local knowledge of men and women and their uses of resources. A better understanding of people’s perception and their relationship o resources can help in setting up management interventions that work.

The conservation approach was also limited to a few similar responses, which mostly identified SMA approach and enforcement of the law to regulate the exploitation of resources. Good strategies

<sup>16</sup> Ministry of Fisheries, Deep Water Management Plan, 2007 p17

<sup>17</sup> McCue, 2014 p31

suggested were the use of Boards and Pamphlets as communication tools to inform the public if communities implement a banning, protection or limiting of access to certain resource around their coastal areas. It must be noted that nongovernmental organisations (NGOs) can be of much assistance in implementing community components of projects. They do have the reach, the human resources, and the community presence to implement what might be a challenging task for government partners. This is especially true when it comes to capacity building (training) and mentoring. Most of the communities had also worked with many NGOs in various thematic areas, hence it is value adding to include NGOs and community-based organisations (CBOs) as part of the implementing stakeholders (Table 9).

Table 7. List of CBOs and NGOs that are implementing and have implemented IWCM related project at Hihifo

List of CBO and NGO that involves in projects in the Kolovai Districts		
Name	Thematic Area	Scope of interventions
<b>Tonga Trust</b>	Women in Agriculture	Support through training and provision on seedlings
	Women in Development	Mostly home gardening training and provision of seedlings
	4CA (Child Centred Adaptation)	Supporting Primary school students, Climate Champions and using seedling funds for small climate adaptation related project
	Disaster Response	Rotary Club provided Disaster Responses support (tools and water) to affected family after disasters
	Home Garden	Provide support for home garden for mothers to supplements process food
	Green Energy Project	Provide training on energy management and cost saving strategies by using more energy renewable options such as solar or using of firewood
<b>Tonga Skills</b>	Four skills development training	2 x Business training for marketing local produces and using organic productions
		2x training on post Gita: smart farming solution, Disaster Resilience produce
<b>Civil Society Forum of Tonga</b>	Governance and Financial Literacy	How to ensure good governance and using of proper financial literacy tools and marketing strategies to score donors
<b>Tonga Water Board</b>	Water resource Management	Governance structure and management approach
<b>GEF SGP</b>	Bee Harvesting Project	Funding for establishment of a Beehive Project that will support use of organic farming especially on commercial farming – to increase yield.
<b>Tonga Health</b>	NCD Tracking	In collaboration with Fisheries, track NCD using HHS Questionnaires to capture data.
<b>Commonwealth Youth</b>	Tracking Implementation of Tonga Strategic Development Framework	Community Training and workshops  Un-packing Tonga Strategic Development Framework 20-2025 and guiding community on how they can ensure government is implementing our Strategic Framework according to the UN 17 Sustainable Development Goals with a specific goal on good governance (National Outcome C) and Climate Change (National Outcome F)



## 4 CONCLUSIONS AND RECOMMENDATIONS

The land and communities at both 'Ahau an Kanokupolu are under a lot of stress with a high correlation between population and pollution due to sanitation issues, lack of drinkable water and lack of governance structures to ensure equal access to resources, resource conservation and distribution. Access to resources need to consider the different uses and access by men, women, youths to ensure different gender needs and priorities are met.

There is a clear acknowledgement from the HHS that limited resources will mean conflict and that it needs to be managed within the local vicinity as well as with neighbouring villages. The nature of the coastal zone is dynamic and valued by everyone in the community – governance is crucial to guarantee solidarity amongst communities and residents and should include traditional governance mechanisms that could compliment work on governance that could address conflict.

Government should stop establishing new policies and regulations about communities' resource conservation. There is a need to implement currently established ones and those that are obsolete should be reviewed and enforced. Moreover, there should be sufficient budget allocated to communities for Monitoring and Evaluation to ensure that there is value for money invested. Indicators and Monitoring and Evaluation procedures used must demonstrate that there are positive and proven impacts seen on the lives of those in the communities as well as improved resource conservation in the surrounding coastal ecosystems of Kolovai District.

Regulatory frameworks should be clear, and demarcation of specific responsibilities should be identified and communicated to the communities, so that they are sure of which authority they need to contact when and if they need support.

There is a serious need for developing a new range of comprehensive and relevant communication tools that will deliver the correct message to the people of these communities. The result of the HHS shows that the investment in climate change awareness made in past years is not showing the long-lasting impact we had anticipated. The Hihifo district has been the recipient of many projects from both Government and NGOs (Table 9), so we would expect the communities here to be more familiar with climate change, resource conservation and water management.

### Recommendations

Based on the above conclusions, the following recommendations are submitted for consideration:

- i. Design accelerated resource conservation strategies to cater for high demand of resources in the future e.g., SMAs and MPAs. These strategies should be gender and socially inclusive.
- ii. Encourage the use of organic farming and reduce the use of chemicals (pesticides and fertilisers) to safeguard coastal waters.
- iii. Conduct a survey of metal roofing on houses to ensure that it meets the current WHO health standards for rainwater harvesting for human use. Concurrently, assign or seek funds to provide water tanks to households that have no access to drinking water, by the end of 2021.
- iv. Encourage alternative livelihoods to reduce heavy reliance on remittances and Seasonal Labour work, through the implementation of Small to Medium Enterprises (SME) skills with minimal support from projects or Government. Alternative livelihoods pursued to consider the different gender resource use mechanisms in place.

- v. Encourage households to invest in livestock or agricultural activities (SME) to offset the major expenses of paying bills.
- vi. Reduce the importation and consumption of unhealthy sources of protein and fat through encouraging the production of local livestock and animal husbandry.
- vii. Limit the consumption of high-sugar and fat containing processed foods through boosting agricultural activities and resource management, creating local employment and income in the process. The boosting of agricultural activities should consider the different areas of interest and practical areas of work that men, women, and youths can engage in.
- viii. Improve waste management and human health by ensuring proper access of households to toilet and sewerage facilities, to reduce grey waters contaminating the water lens and coastal habitats. Develop a novel and attractive approach to communicate climate change awareness to communities, to ensure that they become resilient to the impacts of climate change through adequate knowledge of the implementation of correct adaptation strategies. Maintain current governance arrangements to support the establishment of SMAs.
- ix. Conduct awareness programmes on the conservation and management of non-charismatic marine resources such as sea-cucumbers, seagrass, and mangroves to enhance community appreciation of the ecological services that they provide for the environment and human well-being. Inclusion Indicators should be included in IWC monitoring work. Awareness programmes should be gender and socially inclusive using all forms of media and be practical for men, women, youth, and all other members of the community.

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## APPENDICES

### Appendix 1: Household Survey Questionnaires adapted from the SMA socio-economic surveys

TEAM NO.: \_\_\_\_\_

Household Survey on the Socio-Economic status of SMA (Special Management Areas) communities

#### Introduction:

Hello (Mr/s: \_\_\_\_\_). I am (Mr/s: \_\_\_\_\_). I am here on Ministry of Fisheries and Ministry of Lands and Natural Resources, in relation to a Household Survey, in anticipation of the establishment of your SMA, which was already established for Kanokupolu and anticipated for 'Ahu. Information shared will help to make a report for those development donors for your village especially in relation to your coastal and marine resources.

Date: \_\_\_\_\_ Village: \_\_\_\_\_

Block No: \_\_\_\_\_ House No: \_\_\_\_\_ Contact No: \_\_\_\_\_

Name of Interviewee		Male/ Female: _____ Age: _____
Are you the Head of this House (Mark the correct Ans)	Yes <input type="checkbox"/>  No <input type="checkbox"/>	If not the HEAD, answer the following? _____ Who is the HEAD of the family? _____ What is your relationship to the Head of the House? _____

#### Part 1: Home details

HH1. What is the numbers of other people who currently live in this house?

Status	Date of Birth	Marital Status	M-Male F-Female	Highest level of education (Primary school, College, Degree)

Use name or status at home ( e.g Father. Mother, daughter, son, grandparents, grandchildren)

HH2. Details of the house and other things at home ( tick on the box below).

<b>1. Type of houses</b>			
Wooden House <input type="checkbox"/>	Concrete/Brick House <input type="checkbox"/>		
Wooden House + Roof made of Plaited Coconut leaves <input type="checkbox"/>	Tongan House <input type="checkbox"/>		
<b>2. Roofing types</b>			
Roof made of Plaited Coconut leaves/ canvas. <input type="checkbox"/>	Iron roof <input type="checkbox"/>		
Wooden Roof <input type="checkbox"/>	Tile roof <input type="checkbox"/>	Solar roof <input type="checkbox"/>	
<b>3. Water Collectors</b>			
Water Pump, pipes <input type="checkbox"/>	Underground water, well <input type="checkbox"/>		
Iron Water Tank <input type="checkbox"/>	Plastic Water Tank <input type="checkbox"/>		
Concrete Water tank/ Brick Water Tank <input type="checkbox"/>	No water collector. <input type="checkbox"/>		
<b>4. House Foundation Type</b>			
Concrete floor <input type="checkbox"/>	Soil Floor <input type="checkbox"/>	Wooden pole, Concrete, iron. <input type="checkbox"/>	
<b>5. TOILET AND COLLECTION OF WASTE</b>			
Flush <input type="checkbox"/>	Bit <input type="checkbox"/>	Compost <input type="checkbox"/>	No Toilet <input type="checkbox"/>
HOW LONG BEFORE TOILET IS PUMP	1 Year. <input type="checkbox"/>	2 Years <input type="checkbox"/>	Over 3 Years. <input type="checkbox"/>
Septic <input type="checkbox"/>	Sink <input type="checkbox"/>	Drainage <input type="checkbox"/>	
Where drain waste from toilet and sink <input type="checkbox"/>	Enclosed septic/drainage <input type="checkbox"/>	Drain to Sea <input type="checkbox"/>	Drain directly to soil <input type="checkbox"/>

<b>6. ANIMAL AND AREA OF CONFINEMENT:</b>						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pig	Cow	Horse	Dog	Fence	Tied up	Roam
Any Fish Farm <input type="checkbox"/>						

<b>CROPS:</b>					
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit tree	Roots	flowers	Veggies	Fence	Not Fence
<input type="checkbox"/>			<input type="checkbox"/>		
Organic			Chemicals		

HH3. Where do you get your electric energy from? (Please tick your answer/s on the boxes below.)

No electric	<input type="checkbox"/>	Government electricity	<input type="checkbox"/>
Village Generator	<input type="checkbox"/>	Individual generator	<input type="checkbox"/>
Village Solar	<input type="checkbox"/>	Individual solar panel	<input type="checkbox"/>

HH4. Types of transportations at home. (Please tick your answer on the boxes below)

**Land Equipment**

Car  Van/Truck  Bike  Plough

Other things: \_\_\_\_\_  
(Please list them down)

**Sea Equipment**

Canoe  Boat with engines  Boat only  Others:

Fishing Equipment's: \_\_\_\_\_  
(Please list them down)

HH5. What are diseases that may frequently affect your home members? (Please tick your answers on the boxes below, no more than 3)

Disease	High blood pressure	<input type="checkbox"/>	Stroke	<input type="checkbox"/>	Heart disease	<input type="checkbox"/>
	Diabetes	<input type="checkbox"/>	Asthma	<input type="checkbox"/>	Lung disease	<input type="checkbox"/>
	Obese	<input type="checkbox"/>	Cancer	<input type="checkbox"/>	Mental illness	<input type="checkbox"/>
	No need to tell	<input type="checkbox"/>	Don't know	<input type="checkbox"/>	No disease	<input type="checkbox"/>
	Other diseases: _____					



## Part 2. Way of life

HH6. What are the basic jobs or full-time jobs your family have? (Please tick your answer on the boxes below and please put 1 or 2 on the last column.)

HH7. What are other working areas (number 2) that your family members worked at a specific time? (Please put your answer on the boxes below and the last column use number 2 if it's some other working place.)

For example:

Basic jobs= 1

Other jobs: 2

Tick	Work details	Only for a time	Whole year	Number (1/2)
<input type="checkbox"/>	Work: _____ (Specify: ex: Teacher, Engineer, Carpenter, Tourism, Government.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Work: _____ (Specify: ex: Teacher, Engineer, Carpenter, Tourism, Government.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Work: _____ (Specify: ex: Teacher, Engineer, Builder, Tourism, Government.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Farming: _____ (Specify: ex: Mulberry, Pandanus, Vegetable, Vanilla, Kava .)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Farming: _____ (Specify: ex: Mulberry, Pandanus, Vegetable, Vanilla, Kava .)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Fishing: _____ (Specify type: ex: coral fish, sea cucumber.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Fishing: _____ (Specify type: ex: coral fish, sea cucumber.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Livestock: _____ (Specify? ex: chicken, pigs, cows.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Handicrafts: _____ (Specify type: ex: Weaving, Carving)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Other: (please explain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<input type="checkbox"/>	Other: _____ (please explain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Other: _____ (please explain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Other: _____ (please explain)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	Not working or retired from work (Please circle one)	Not Applicable.		

HH8. What is your family annual incomes a year? Income basis, others/income time basis. (Estimate from 1-4 but please use the keys below.)

Estimate:

- 1= Family income basis: provide highest income to the family.
- 2= second income basis which provide the second highest income
- 3= third income basis: provide the third highest income to the family
- 4= least income basis: provide the least income for the family.

# Number	Income	Time basis	Full Time	Priority (1-4)
	Work: _____ Specify e.g., Teacher, Engineer, Carpenter, Tourism, Government organisation.			
	Work: _____ Specify e.g., Teacher, Engineer, Carpenter, Tourism, Government organisation.			
	Work: _____ Specify e.g., Teacher, Engineer, Carpenter, Tourism, Government organisation.			
	Farming: _____ Specify ex. Paper Mulberry, Pandanus, vege- table, Vanilla, Kava.			
	Farming: _____ Specify ex. Paper Mulberry, Pandanus, vege- table, Vanilla, Kava.			
	Farming: _____ Specify ex. Paper Mulberry, Pandanus, vege- table, Vanilla, Kava.			

Fishing: _____ Specify ex. Coral fish, Sea cucumber			
Fishing: _____ Specify ex. Coral fish, Sea cucumber			
Livestock: _____ Specify ex. Chicken, pig, cow.			
Handicraft: _____ Specify ex. Weaving, Carving, Tapa making			
Remittance: _____ From which country:			
Equipment for hire: What are they?			
Others: _____ (Specify/ describe)			
Others: _____ (Specify/ describe)			
Others: _____ (Specify/ describe)			

HH9. Please list priority expenditure that you spend your money for in a month. (Put them in order from 5-1, 1=highest, 5= smallest.

Expenses	Order of Priority
Food & drink	
Clothes	
Bills (electricity, water, internet)	
Transportation	
Communication	
School	
Churches obligations	
Family Obligations (Wedding, Funeral, Birth-day etc.)	
Others (please name them):	

HH10. List different livestock that you keep.

Livestock	Tick if you keep it at home	Numbers
Cow		
Horse		
Pig		
Goat		

Chicken		
Others:		

HH11. Do you have any land or lease any land for farming? (Please circle your answer).

Frequently use for farming                      No Land

HH12. How big is it?                              ..... (acreage)

HH13. Numbers of people at your home who often fishing on your marine coastal area.

<b>Names</b>	<b>Male- M Female-F</b>	<b>Fish from shallow water</b>	<b>Others: Clams etc.</b>	<b>Deep sea Fish and other things.</b>

According to the highest catch.

HH14. Do you consider doing other work next year apart from the one that you have frequently been doing this year?

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Maybe</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know.</b>

HH15. If you lose your work or your income basis job, would you be able to get another job to replace it?

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Maybe</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know.</b>

HH16. Comparing to the past 15 years, Is there any changes in your family income? What short of things makes the changes?

My family income is improved in compare with the past.

My family income is kept stable.

My family income has been decreases as years goes by.

HH17. Compare with other family in your village, what is your view of your family income level?

Much lower	Lower	About the Same	Slightly better	Much better	Do not know

### Part 3: Governance & Management (Think of your village that is about to establish Special Management Area)

HH18. Are you aware that your coastal shoreline is about to marked as a Special Management Area?

Strongly disagree	Disagree	Not sure	Agree	Strongly agree	I don't know

HH19. I am satisfied with the committee who are taking care of the Special Management Area.

Strongly disagree	Disagree	Not sure	Agree	Strongly agree	I don't know

HH20. The SMA committee will be very helpful in running and monitoring the management plan for SMA.

Strongly disagree	Disagree	Not sure	Agree	Strongly agree	I don't know

HH21. My family agrees to join in making plans to manage Special Management Area.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH22. The plans made for the management of the Special Management Area helps accomplished the aims of the SMA.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH23. I'll be engaging in the taking care of the SMA's.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH24. The SMA will help the village through managing fishing on our coastal shoreline.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH25. SMA's would be very helpful to the village through mitigation of the problem cause by the climate change.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH26. SMA helps develop better standard of life for family.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH27. SMA will help develop a healthier life for family.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH28. What do you think SMA's safety standard, and its regulation will improve its (SMA) security for the village people in the future?

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH29. What do you think of the SMA's safety standard and regulations will improve SMA's security of village from the outsiders in the future? (For example. People from the surrounding villages, tourists etc.)

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH30. Overall, what is your general view about the establishment of your village SMA?

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH31. Is there any traditional method of managing the coastal shoreline?

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HH32. Do you had any idea that may cause a development on your working for your SMA to gain better result?

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## Part 4. Dietary.

HH33. What are type of food that your family often consume in a week?

Type of food	Everyday	Twice or three times a week.	Once a week	No
Fish				
Other sea food				
Chicken				
Meat				
Tin can				
Others				

(Meats such as: beef, mutton, pork)

HH34. What are type of food that your family mostly needed to consume? (Level 5-1: 5= very little, 1= highest)

Type of food	Level
Fish	
Other sea food	
Chicken	
Meat	
Tin can	
Others	

(Meats such as: beef, mutton, pork).



HH35. What is reason why your family eat that kind of food?

<b>Reasons</b>	
Cost of food.	
Family Income standard	
Taste/preferences	
Easy/difficult to get.	
Important to health	
Others (please write down):	

HH36. How and where is your main source for getting sea food from the sea? (Level 1-3: 1=highest, 3=smallest).

Tick	Method	Fish	Clams	Level (1-3)
	Fished by me			
	Fished by a family member			
	Get from a fisherman in the village			
	Get from a fisherman from other villages			
	Market: _____			
	Shop: _____			

HH37. How many times do you eat tin fish a week? Please use the scale below.

Never	Once a week	Twice a week	sometimes	Few days	Almost everyday

HH38. Please estimate how many tin fish do you have a day?

<b>Tin fish size</b>	<b>Number of tin fish per day.</b>
Small	
Medium	
Large	

HH39. My family can fish from the sea for daily food.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH40. We had the same chance to fish for food as the other families in the village.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Not sure</b>	<b>Agree</b>	<b>Strongly agree</b>	<b>I don't know</b>

HH41. How reliable it is for your family to get daily food from the sea? Please use the scale below.

<b>Not very reliable</b>	<b>Not reliable</b>	<b>reliable</b>	<b>Very reliable</b>	<b>Strongly reliable</b>	<b>Do not know.</b>

HH42. How reliable it is for your village to having daily food from the sea? Please use the scale below.

<b>Not very reliable</b>	<b>Not reliable</b>	<b>reliable</b>	<b>Very reliable</b>	<b>Strongly reliable</b>	<b>Do not know.</b>

HH43. What do you think of the fish cost when selling at your village?

<b>Very Cheap</b>	<b>Cheap</b>	<b>Average</b>	<b>expensive</b>	<b>Too expensive</b>	<b>Do not know.</b>

HH44. In the next 20 years, how important it is to still have fish and shellfish to meeting family needs?

Not important	Important	Very little important	Very important	Strongly important	Do not know.

HH45. Please circle the healthy level of each of these foods. (1=unhealthy. 5=healthy)

	Unhealthy				Healthy
	1	2	3	4	5
Mutton	1	2	3	4	5
Turkey	1	2	3	4	5
Fish	1	2	3	4	5
Tin Fish	1	2	3	4	5
Chicken	1	2	3	4	5
Pork	1	2	3	4	5
Pig	1	2	3	4	5
Salted fish	1	2	3	4	5

HH46. Marine species (such as fish and shellfish) on our intertidal zone have been over fished.

Strongly disagree	Disagree	Not sure	Agree	Strongly agree	I don't know

HH47. It is a problem in my village when fisherman from other villages fished on our coastal shoreline.

Strongly disagree	Disagree	Not sure	Agree	Strongly agree	I don't know

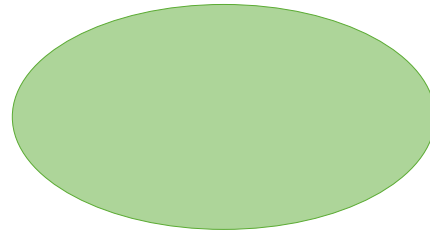
HH48. Where do you think are borders of the SMA area in your village?

Wish to mark it	Do not wish to mark it.	I don't know.
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HH49. Do you think that it is a good idea of making a part of the sea for the conservation of the marine species?

Yes	No	I don't know.
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HH50. Can you please mark on the map an area where you think is better for conservation of fish or is prohibited for fishing (spawning ground)?



Wish to mark it	Do not wish to mark it.	I don't know.
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## Part 5. Climate Change.

HH51. Our family's water supply is in good condition.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH52. Nowadays our water pump is saltier when comparing to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH53. There is an increase in coastal run off in comparing to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH54. Sea level rise increase nowadays in compared to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH55. There is a frequent overflow of sea on to the land nowadays in comparing to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH56. There is a frequent occurrence of Cyclone at the mean time in comparing to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH57. Tropical cyclone intensity is stronger nowadays in comparing to the past 15 years.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH58. We are aware of how climate changes.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH59. We are trying to adapt or prepared ourselves for climate changes.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH60. We are aware of the reasons why climate changes occurred.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH61. If a tsunami comes, we know what to do.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH62. My family knows what to do if Cyclone occurs.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH63. My family have access to the climate warning.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH64. My family can be prepared very fast when there is a warning of bad weather.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH65. After cyclone or Tsunami, my family can be able to recover very fast.

<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly agree</b>

HH66. Compare to the past 15 years, what is the highest level of rainfall in your village?

<b>Very little</b>	<b>Little</b>	<b>No change</b>	<b>High</b>	<b>Very high</b>	<b>Don't know</b>

HH67. Compare to the past 15 years, what is the level of drought in your village?

<b>No change</b>	<b>Normal sunlight</b>	<b>Very little sunlight</b>	<b>drought</b>	<b>Excessive drought</b>	<b>Exceptional drought.</b>

HH68. What is the level of difficulties faced by your home/ this village in according to the effects or climate changes?

No difficulties	Little difficulties	High difficulties	Very high difficulties	Don't know

## Part 6. The ideas of establishing of Special Management Area.

HH69. Please show what do you think about each sentences below. (✓).

	Very inconvenient	Inconvenient	Don't know	Convenient	Very convenient
a) My family agrees with the village idea of having Special Management Area.					
b) My family agrees with the idea of discussion before starting a Special Management Area.					

HH70. Please show what you believe in relating to these sentences. (✓).

	Strongly don't believe	Don't believe it	Don't know	Believe it	Strongly believe it
a) My family will be joining in establishing the Special Management Areas.					
b) My family supports the idea of Special Management Area.					

## Part 7. Result of sea food.

HH71. Please show what you believe in relating to the sentences below.

	<b>Really don't believe it</b>	<b>Don't believe it</b>	<b>Don't know</b>	<b>Believe it</b>	<b>Strongly believe.</b>
a) For the last 5 years our stable food has been changes.					
b) There will be a change on our stable food from the sea due to the establishing of Special Management Area.					
c) It is clear to us the importance of fish.					

## Part 8. Ocean Resources.

HH72. Compare to the past 15 years, what is the situation of coral reef at your shoreline?

<b>Very unhealthy</b>	<b>Unhealthy</b>	<b>No change</b>	<b>Healthy</b>	<b>Very healthy</b>	<b>Don't know.</b>

HH73. Compare with the past 15 years, what is the fish situation (on the reef) on your shoreline.

<b>Dramatic decrease</b>	<b>decrease</b>	<b>No change</b>	<b>Increase</b>	<b>Large increase</b>	<b>Don't know.</b>

HH74. Compare with to the past 15 years what are the situation of clams (clam, lobster) on your shoreline?

<b>Dramatic decrease</b>	<b>decrease</b>	<b>No change</b>	<b>Increase</b>	<b>Large increase</b>	<b>Don't know.</b>

HH75. Comparing with the past 15 years, what is the situation of sea cucumbers on your shoreline?

<b>Dramatic decrease</b>	<b>decrease</b>	<b>No change</b>	<b>Increase</b>	<b>Large increase</b>	<b>Don't know.</b>



HH76. Compare with the past 15 years what is the situation of the sea grass in your shoreline?

<b>Dramatic decrease</b>	<b>decrease</b>	<b>No change</b>	<b>Increase</b>	<b>Large increase</b>	<b>Don't know.</b>

HH77. Compare with the past 15 years, what is the situation of mangroves on your shoreline?

<b>Dramatic decrease</b>	<b>decrease</b>	<b>No change</b>	<b>Increase</b>	<b>Large increase</b>	<b>Don't know.</b>

HH78. In the normal months, how many days do your family fished from any marine species?

<b>Fishing basis</b>	<b>Not fished</b>	<b>Sometimes</b>	<b>some days</b>	<b>Half a month</b>	<b>Almost every day of the months.</b>
Shallow fishing					
Deep fishing					
Crab, Shrimp, lobsters.					
Types of clams					
Types of sea cucumbers.					

HH79. When you fished for fish or clams, what type of fish or clams that you aimed for?

HH80. Please marked on the map where you fished for any fish or clams.

<b>Fishing area</b>	<b>Type of fish/ clams</b>	<b>Mark on the map</b>
Coral reef/ shallow water		Circle your fishing area and write "R" inside the area
Deep sea		Circle your fishing area and write 'D' inside the area.
Type of Crabs/Lobster		Circle your fishing area and write 'S' inside the area.
Types of clams (gleaning)		Circle your fishing area write 'C' inside the area.
Types of sea cucumbers		Circle the fishing area write 'B' inside the area.

## Part 9. Results relating to the work (or fishing).

HH81. What do you think of these sentences? Please tick your answer on the boxes below.

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly Agree</b>
a) My family life is improved through establishing of Special Management Area.					
b) It is a good method of establishing Special Management Area to conserve fishing in this village.					
c) SMA's helps to protect different marine lives in our shoreline.					
d) Fish Habitat Reserve helps replenishing of fish in the Special Management Area					
e) Do you understand the importance of keeping the no fishing area is to protect the reefs?					

HH82. Do you know of any problems faced by the fishermen when fishing on the fishing area?

'YES  'NO

If yes, please continue to number 83. (a)

If no, please continue to number 83 (b & c).

HH83. Please mark whether you believe or not regarding these sentences. (v)

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Don't know</b>	<b>Agree</b>	<b>Strongly Agree</b>
a) The problem will be reduced if we established Special Management Area.					
b) Establishing of SMA's will cause many problems or argues between the village fishermen.					
c) Establishing of SMA's may cause a problem or argue between the village fishermen and those from other villages.					

## Appendix 2: List of Enumerators

Table 8. Team members with their roles and respective Ministries that undertook the fieldwork for the RapCA surveys.

Name	Team #	Village	Organisation
Susitina Ta'ai	1	Matahau	Natural Resources Division
Nikolasi Heni	1	Lakepa	Natural Resources Division
Bruno Banaii	2	Kolofo'ou	Tonga Tertiary Institute
Kitione 'Aisea	2	Kolofo'ou	Tonga Tertiary Institute
Atela Taufa	3	Kolomotu'a	-
Mele Mafi	3	Kolomotu'a	USP
Tevita Tulikaki	4	Pili	-
Ana Kama	4	Pili	USP
Latu Kama	5	Ma'ufanga	USP
Sateki Ika	5	Halaleva	Tonga Tertiary Institute
Alisi Ituvai	6	Ma'ufanga	Ma'a Fafine Tonga
Ofa Tulikaki	6	Pili	Ma'a Fafine Tonga

The field team was also heavily supported by the following personnel whose logistical and field support benefitted the socio-economic survey team:

## Appendix 3. List of additional support and logistics team for the socio-economic assessments

Table 9. List of additional support and logistics team for the socio-economic assessments

Silia Leger	MLNR/NRD/R2R
Melenaite Esera	MLNR/NRD/R2R
Kaati Hakaumotu	MLNR/NRD/R2R
Seina Kara	MLNR/NRD/R2R
Kilisitina Moala	MLNR/NRD/R2R
Ange Pale	MLNR/NRD/R2R
Pelenatita Kara	Socio-Economic Consultant



