



# Household survey of Special Management Area communities in Tonga

Assessment for the monitoring  
and evaluation of the SMA programme







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**by Tonga Ministry of Fisheries (MoF) and  
Vava'u Environmental Protection Association (VEPA)**



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The survey design was completed by Dr Siola Malimali, Poasi Ngaluafe, Hulita Fa'anunu, Lavinia Vaipuna and Molisi Fifita (MoF); Supin Wongbusarakum, Franck Magron and Jean-Baptiste Marre (SPC); and Mele Tauati and Joelle Albert (FAO).

Enumerators were selected from MoF and the Vava'u Environmental Protection Association (VEPA), and were trained both in person and through online workshops by project partners.

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# Summary

Special Management Areas (SMAs) are part of a community-based fishery programme in Tonga, where designated communities are granted legal rights to manage their coastal fishery resources. The programme is supported by the Ministry of Fisheries (MoF) under the Fisheries Act 2002, and by Coastal Fisheries (Community) Regulations 2009. Since 2002, 54 SMAs have been designated within Tonga's four main island groups: Tongatapu, 'Eua, Ha'apai and Vava'u.

This report presents the findings of a household survey conducted in SMA communities in February and March 2021. The purpose of the survey was to evaluate the socio-economic impacts and community perceptions of the SMA programme based on each SMA's age and island group. This report does not provide an extensive gender analysis, but a request for data can be made to MoF's Chief Executive Officer.

In total, 275 household surveys were conducted by trained enumerators from MoF and the Vava'u Environmental Protection Association (VEPA). Sixty responses came from "old" SMAs (10–15 years old), 129 from "middle-aged" SMAs (5–9 years old) and 86 from "young" SMAs (1–4 years old). The number of households surveyed from each island group were: 16 from 'Eua, 122 from Tongatapu, 96 from Ha'apai and 41 from Vava'u. Survey respondents included 140 men and 135 women, of which 43 were youth (aged between 15 and 34 years).

Household income comes primarily from remittances from overseas families and from employment, with fishing for reef fish ranked as the third main income source. In old SMAs, however, fishing is the primary income source (20 responses). Handicraft-making is the most important form of income for women aside from remittances.

Fishing and harvesting activities consist primarily of reef fishing (72% of active fishers) and gleaning for invertebrates (68% of active fishers), while pelagic fishing is less important (26% of active fishers). Among the four island groups, households in Ha'apai are the most engaged in fishing and harvesting (64%), with Tongatapu the least involved (28%). Men dominate fishing activities, including gleaning, while female youth were the least engaged group.

Seafood availability (reef fish, invertebrates and pelagic fish) is vitally important for food security across all island groups, with 196 households engaged in providing their own catch, 160 sharing seafood, and 111 buying or purchasing fish and seafood. Households in Tongatapu buy more fish and seafood (103 households) than households in the other island groups. Other important food items include crops, meat and tinned fish. Crops are the most important food item in terms of consumption frequency. Fishing and harvesting activities provide both consumption for individual households and economic activities, with only a few households reportedly fishing or harvesting for income only.

Households showed overwhelming support of the SMA programme (89%) and believed that it will provide fish and seafood for future generations. Natural disasters, climate change and unsustainable practices, including overfishing, pollution and waste management, are the biggest threats to the SMA programme, community resilience, marine habitats and species health. Perceived management weaknesses included inadequate enforcement and lack of awareness of rules and regulations. Adaptive community activities could include developing alternative livelihoods for non-fishery activities and strengthening knowledge and awareness on climate change impacts.

Furthering the SMA programme and ensuring that all communities have the support and resources they need is an ongoing priority for MoF and partner organisations. Shared management of coastal areas between communities was mostly not supported, with only 29% agreeing to combine SMAs and share management with other communities. In contrast, including landlocked communities in the SMA programme was supported by 66%.

## Recommendations

***Livelihood activities, adaptation and resilience*** – Utilising niche potentials (e.g. culture and the environment), value-adding or starting new non-fishery livelihood activities can substantially increase adaptation and resilience to climate change and other major disruptions. Further consultation is needed to identify and evaluate these activities, but aquaculture has been identified by MoF as a potential option to increase food security, diversify income sources, and support conservation efforts. The latest national SMA workshop in 2021 recommended further examination of key species and actions, feasibility studies, impact assessments, and building public awareness for aquaculture.

***Awareness, knowledge exchange and communications*** – Sharing information on the SMA programme, rules and regulations or about climate change is a key activity to increase capacity of SMA communities to manage their resources and cope with major changes. Running awareness programmes with schools and engaging youth ambassadors were highlighted as potential engaging activities. Transparency and communication between all relevant stakeholders need to improve, including between SMA and

non-SMA communities, town officers, MoF, other government agencies, non-governmental stakeholders and donors. Participants of the 2021 national SMA workshop proposed to strengthen communication skills, and to use existing social gatherings to share information (kava, weaving, church or youth groups).

***Strengthening SMA management and careful planning of upscaling strategy*** – There is a considerable need for planning and addressing how communities should be equipped to manage SMAs, including providing them with basic management skills, training them to collect and record environmental and resource data (catch data, environmental impact), and supporting access to the necessary resources to manage a marine area. The future upscaling of the SMA programme, particularly if introducing shared management, needs careful planning and extensive consultation, outlining threats and benefits, and specific targets and responsibilities. This will enable current SMA communities that are reluctant to share the management of their SMAs to consider the potential benefits of cooperation with other communities. It is also important to evaluate in which cases shared SMA management might not work. A legal analysis might also be necessary to ensure that policies and legislation support new management approaches, and social and environmental needs.

## 1. Background and content

Tonga's Special Management Area (SMA) programme was designed and implemented by the country's Ministry of Fisheries (MoF), following consultations with communities in 2002 under the Fisheries Act, and further regulated in 2009 by the Fisheries Coastal Community Regulations.

The SMA programme was initiated in response to the decreasing abundance and health of nearshore fish species, and to the overwhelming responsibility and tasks of MoF for managing fisheries resources throughout Tonga's nearshore waters. The reduction in marine resources and marine species has been well documented in Tonga since the 1990s (Gillett 2009), and most recently in 2019 through extensive marine surveys across the island groups for the Special Management Area report (Smallhorn-West et al. 2020). This report provides an overview of the socioeconomic aspects of the SMA programme, including perceptions on habitat health, species diversity and reef fish abundance.

Communities in Tonga also face varying and increasing threats from natural disasters and climate change, including an increase in the strength and frequency of tropical cyclones. Ha'apai and Tongatapu have both experienced multiple category 4 (and above) cyclones within the past 10 years, with increasing impacts from storm surges (Weather.com 2018). These direct impacts to communities not only damage infrastructure and increase risks to safety, but also weaken the health of marine habitats and marine resources, thereby threatening the food security of families living in coastal areas, and reducing their resilience.

Measuring the social adaptive capacity of communities is critical to ensuring that support to communities is directed at their actual needs. This capacity can be measured by five factors: 1) livelihood diversity and flexibility to adapt to new conditions; 2) access to different resources; 3) access to information, learning and knowledge; 4) governance and institutions that enable local adaptation; and 5) individual or collective agency or ability to make decisions and act to pursue their goals and protect their values (Wongbusarakum 2021).

SMAs are currently in coastal communities throughout Tongatapu, 'Eua, Ha'apai and Vava'u, with only Niuatoputapu and Niuafou'u (in the Niua group) not yet participating in the SMA programme. Figure 1 shows Tonga's island groups.

To establish an SMA, communities wishing to partake in the management of their marine resources apply directly through a letter to MoF. If a community's request is approved, funding is then sought to support the development of a Coastal Community Management Plan (CCMP) and Coastal Community Management Committee (CCMC), which consists of 10 community members, including men, women and youth. Each application process is supported by the District Officer and an officer from MoF. Land districts are under the Lands Act and are designated by the Minister for Lands. District Officers are elected officials (every four years) and oversee the Town Officers within each land-based district (Government of Tonga 1988).

Each SMA includes at least one fish habitat reserve (FHR) that acts as a no-take area. The outer boundary is delimited by either an ocean water depth of 50 m, or 2500 m from the high tide water mark, or at the minister's discretion under the Fisheries Act (Government of Tonga 2002).

Only individuals who are registered with the CCMC – either a fishing vessel owner or fisher (including women, youth and children) – may fish from within the SMA but not inside the fish habitat reserve. The Fisheries Coastal Community Regulations 2020 allow for subsistence and yacht fishing permits to be granted by the CCMC for people outside of the SMA community; however, MoF is unaware of any instances in which such permits have been granted.

Since 2002, 54 SMAs have been gazetted throughout the island groups, with the overarching objective of the SMA programme to improve the management of coastal fisheries resources, and with a view to ensuring that all coastal communities are engaged in the SMA programme (Latu 'Aisea, Ministry of Fisheries, pers. comm.). The programme also aims to identify ways to expand SMAs to include other communities such as those that are landlocked or without direct access to an SMA.

The management and effectiveness of an SMA is the responsibility of both the CCMC and MoF, with support from various donors and non-governmental partners. However, support for SMAs can often be intermittent, and actions should be taken to ensure that SMAs undertake at least some management and monitoring activities on a regular basis.

MoF is undertaking activities for broadscale monitoring and evaluation of the SMA programme. For example, the Third National Special Management Area workshop was held in 'Eua in May 2021 to identify gaps in knowledge, training, resources and support for existing SMAs, and to better enable MoF, communities and stakeholders to strengthen and expand the SMA programme. Landlocked communities, which do not have direct coastal access or are situated behind a current SMA community, have also been surveyed to assess the potential broader impacts from the SMA programme (VEPA 2021). This survey contributes to the overall aim of assessing the programme to determine future actions.

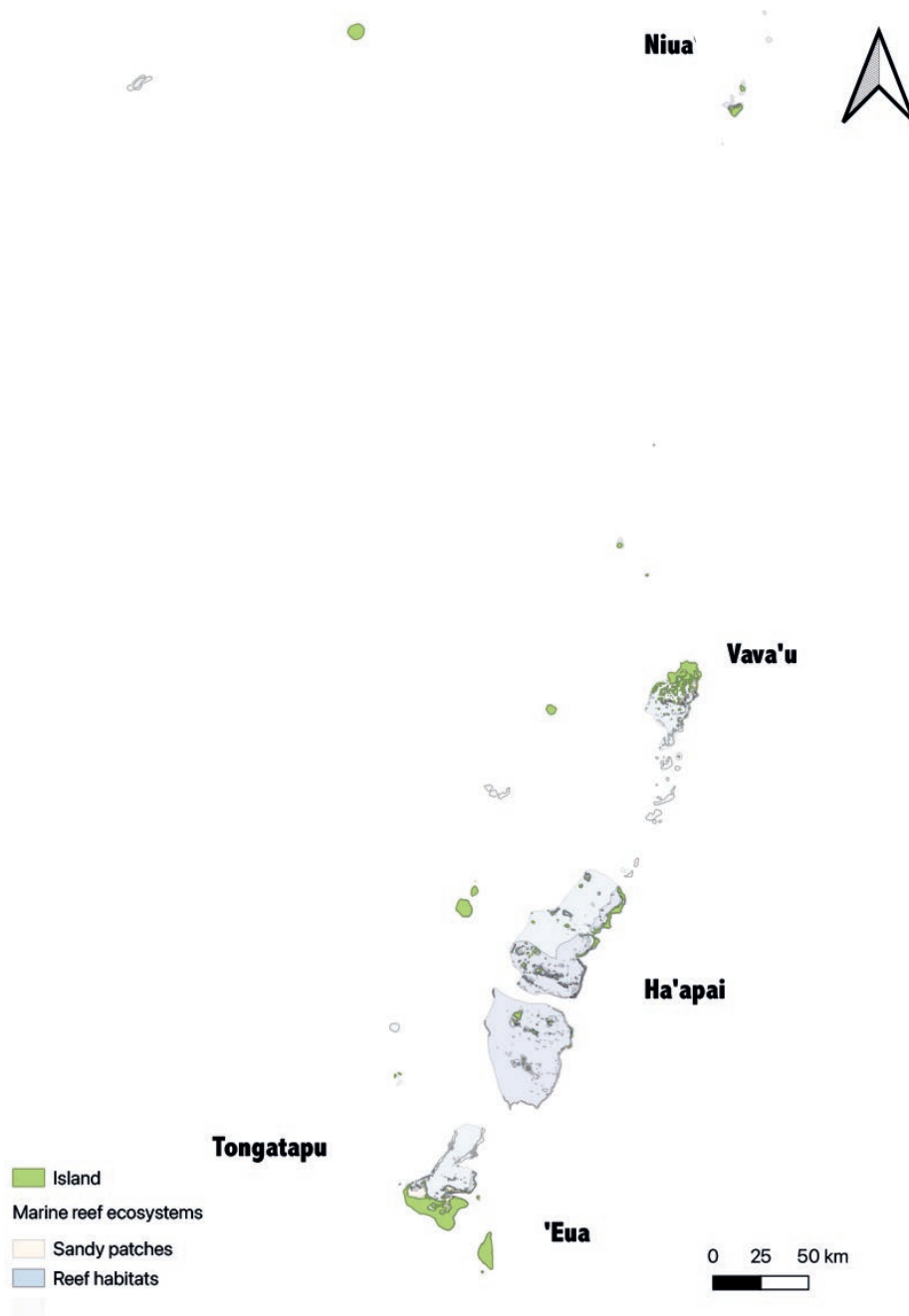


Figure 1. Tonga's four island groups: Tongatapu, 'Eua, Ha'apai and Vava'u, with Niuatoputapu and Niuatoputapu to the far north of the archipelago.

## 2. Methodology

The household survey questions were designed in cooperation with MoF, the Pacific Community, and the Food and Agriculture Organization of the United Nations, and included questions for both SMA and landlocked communities. Only SMA questions are included in this report (Annex 1).

A stratified sampling was used for the SMAs. The total sample size was calculated based on a 95% confidence level and a 5% confidence interval. SMA sites were then divided into four groups based on the length of their existence (i.e. how long they have had the status of an SMA).

1. SMAs aged less than 1 year
2. SMAs aged 1–4 years old
3. SMAs aged 5–9 years old
4. SMAs aged 10–15 years old

SMAs aged less than one year, were excluded from the study because results may not be observable in such a short time. The total sample was stratified to represent the remaining three groups. Within each stratum, participating villages were selected randomly regardless of which island group they were located in, and then confirmed by MoF. Final adjustments of the sample sizes were made to increase the total number of SMA households in the oldest group, as this was considered to be the group with the most observable effects. The list of selected SMAs, together with the associated sample size, are presented in Table 1. It is important to note that some questions were only asked to respondents directly engaged in fishing activities, a subsample of 120.

Table 1. Sampling data of SMA communities, showing total number of households surveyed and proposed sample size of each selected community.

Island	Village	SMA age (years)	Total no. of households (based on 2016 census)	Proposed number of households to be surveyed
Tongatapu	'Atata	SMA 10–14	31	6
	'Eueiki	SMA 10–14	12	3
	Kolonga	SMA 5–9	216	55
	Lapaha	SMA 5–9	334	73
	Nukuleka	SMA 5–9	45	12
	Ha'atafu	SMA 1–4	47	9
'Eua	Houma	SMA 1–4	55	16
Ha'apai	'O'ua	SMA 10–14	25	12
	Felemea	SMA 10–14	31	13
	Ha'afeva	SMA 10–14	57	20
	Kotu	SMA 5–9	30	10
	Nomuka	SMA 5–9	81	16
	'Uiha	SMA 1–4	76	15
	Lofanga	SMA 1–4	32	11
Vava'u	Ovaka	SMA 10–14	20	6
	'Utungake	SMA 1–4	57	16
	Hunga	SMA 1–4	39	11
	Ofu	SMA 1–4	26	8
<b>Total</b>			<b>1214</b>	<b>312</b>

Maps of Tongatapu and 'Eua (Fig. 2), Ha'apai (Fig. 3) and Vava'u (Fig. 4) show the locations of SMAs used in the household survey, and the age category of the SMA (old 10–14 years, middle-aged 5–9 years, and young 1–4 years).

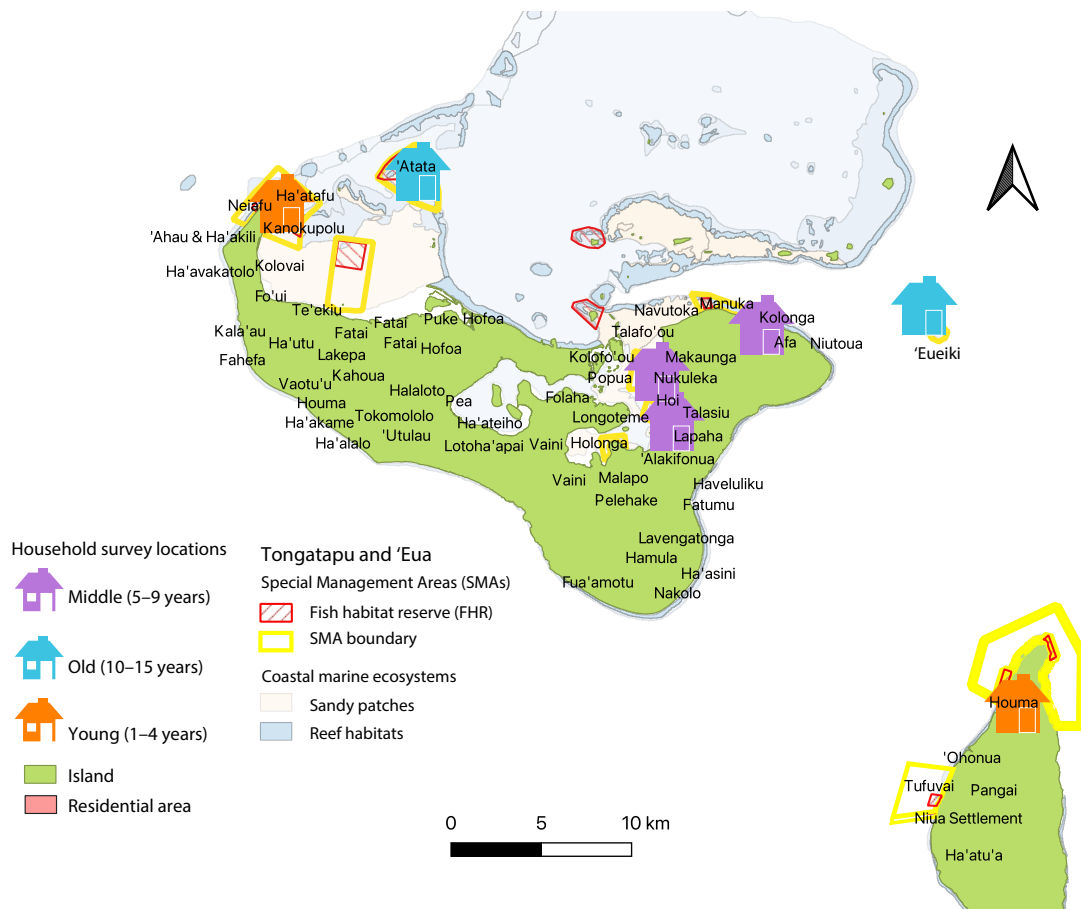


Figure 2. Tongatapu (larger island) and 'Eua, showing household survey locations and the age of SMAs. The boundaries of all current SMAs are shown.

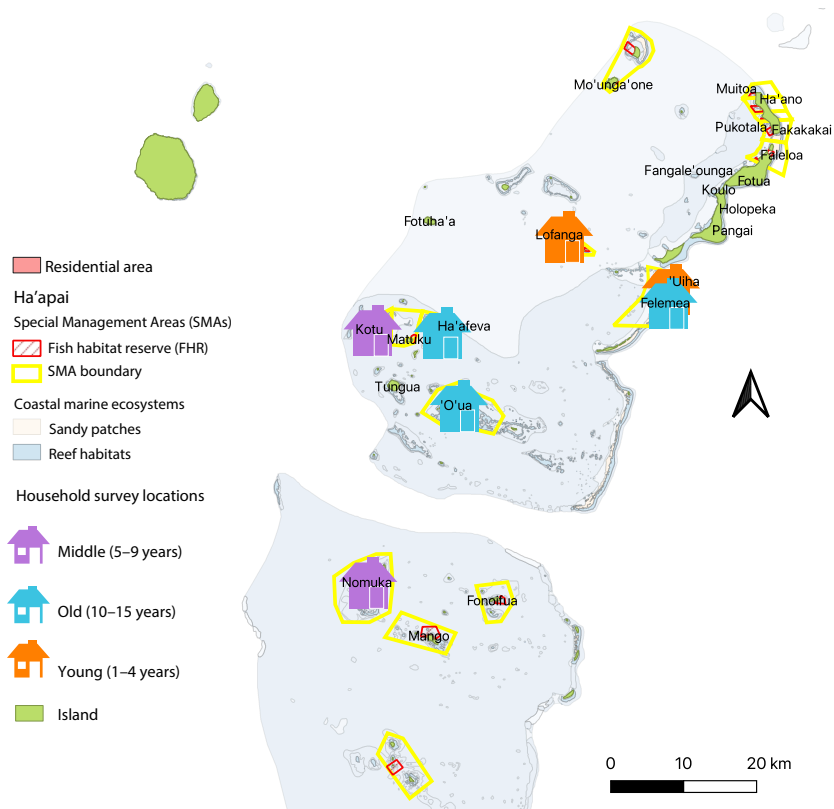


Figure 3. Ha'apai island group, showing household survey locations and the age of SMAs. The boundaries of all current SMAs are shown.

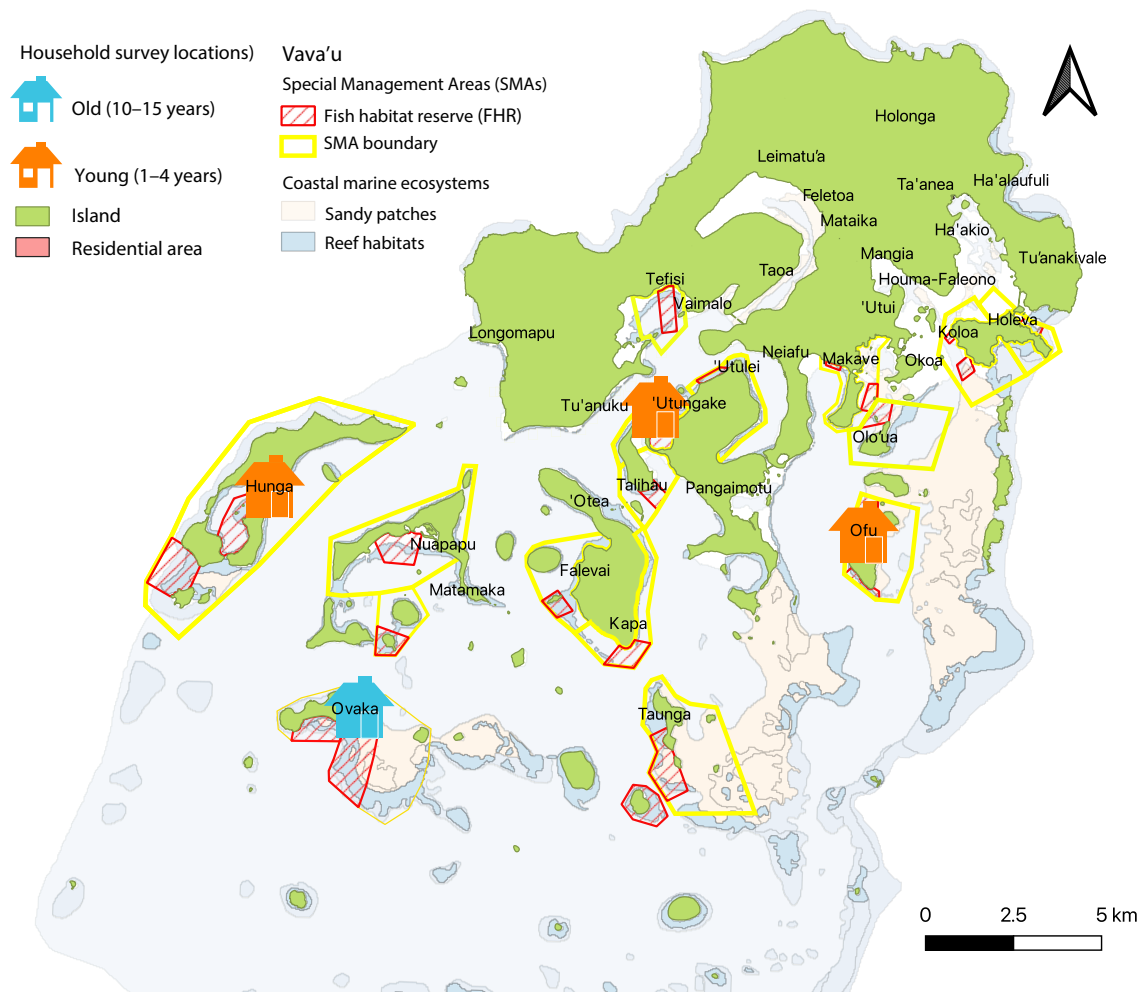


Figure 4. Vava'u island group showing household survey locations and the age of SMAs. The boundaries of all current SMAs are shown.

Household survey questions were designed to cover the SMA programme's overarching objectives, which are to:

- examine the effects of SMAs on food security;<sup>1</sup>
- examine the effects of SMAs on household well-being;
- better understand the vulnerability of communities to natural and climate-based hazards;
- examine the management effectiveness of SMAs; and
- gather other information on perceived threats to coastal and marine resources.

Cross-cutting themes on gender equality and social inclusion have been mainstreamed into the overall questionnaire, and have guided the above objectives to strengthen a people-centred approach.

Enumerator training for the household surveys was conducted virtually in February 2021, and opened by MoF's Chief Executive Officer, Dr Tu'ikolongahau Halafihi, in Sopa, Tongatapu with virtual support from SPC and FAO. In total, 17 enumerators were engaged in conducting the survey (Appendix 1).

The surveys were conducted using Survey Solutions software on Samsung tablets, which were provided by the Pathways to Sustainable Oceans Project. Each enumerator asked questions to the head of the household or a representative of the household who had knowledge of the SMA programme. A specific effort was made to ensure that participants included women and youth (aged 15–34 years); however, for this survey, respondents had to be over the age of 18 years. Responses were entered directly into the tablet by the enumerator.

The compiled survey data were checked for errors by selected representatives from MoF before being uploaded onto the host website at SPC and accessed for analysis. Analysis was conducted using Microsoft Excel. Results are described in Section 4, based on the identified objectives above. Data analysis explored differences in SMA age, island groups, gender and participant's age. Generalised linear models were run in R (R Core Team 2013) to check which factors contributed to apparent differences. Results from statistical analyses are described in Annex 2.

<sup>1</sup> Food security is defined as "all people, at all times, have access to sufficient, safe and nutritious food that meets their dietary needs and food preference for an active and healthy lifestyle" (adapted from FAO 2008).



### 3. Household survey results

In total, 275 household surveys from the proposed target of 312 households were completed in February and March 2021. Two households declined to participate in the survey and 35 households did not have a representative that was knowledgeable of the SMA programme (Table 2).

Table 2. Data showing the proposed number of household surveys by island group and total number of completed surveys.

No. of household surveys	‘Eua	Ha’apai	Tongatapu	Vava’u	Total
Proposed no. of households to be surveyed	16	97	158	41	312
Did not agree to participate			-2		-2
Did not have knowledge of SMA programme		-1	-34		-35
<b>Total no. of participant households</b>	<b>16</b>	<b>96</b>	<b>122</b>	<b>41</b>	<b>275</b>

The distribution of responses according to SMA age, island group and respondents’ gender are shown in Table 3. Middle-aged SMAs had the highest number of household surveys completed (47%), followed by young SMAs (31%) and old SMAs (22%).

Tongatapu had a proportionally higher number of surveys conducted for middle-aged SMAs (104 respondents, 81%) and Ha’apai for older SMAs (45 respondents, 75%). This is due to how the SMAs were implemented by MoF, and the financial and human resources available at that time. ‘Eua communities only started implementing the SMA programme within the last five years.

Responses by gender were 140 men (51%) and 135 women (49%) within the household (Table 3).

Table 3. Location of completed SMA household surveys by age of the SMA and by the gender of respondents.

Island Group	Community	Young (1–4 years) 86 households		Middle-aged (5–9 years) 129 households		Old (10–14 years) 60 households		
		Men	Women	Men	Women	Men	Women	
Tongatapu	‘Atata					4	2	
	‘Eueiki					3		
	Kolonga			17	35			
	Lapaha			22	18			
	Nukuleka			8	4			
	Ha’atafu	4	5					
‘Eua	Houma	6	10					
Ha’apai	O’ua					7	5	
	Felemea					6	7	
	Ha’afeva					10	10	
	Kotu			6	4			
	Nomuka			10	5			
	‘Uiha	9	6					
	Lofanga	8	3					
Vava’u	‘Ovaka					3	3	
	Utungake	6	10					
	Hunga	9	2					
	Ofu	2	6					
<b>Total</b>			<b>44</b>	<b>42</b>	<b>63</b>	<b>66</b>	<b>33</b>	<b>27</b>

### 3.1 Overview of SMA communities

SMA communities chosen for the household survey – including remote communities on outer islands in Tongatapu (‘Atata and ‘Eueiki), Ha‘apai (‘O‘ua, Kotu, Ha‘afeva, Lofanga and Nomuka) and Vava‘u (‘Ovaka, Hunga and Ofu) – are situated on land with coastal areas as shown in Figures 2, 3 and 4. The largest SMA community surveyed was Lapaha (334 households) and the smallest was ‘Eueiki (12 households).

Employment and income activities show remittances from relatives overseas as being the highest income source for 56 households, with salaried employment ranking second. Resource use activities, including fishing for reef fish, were ranked as third, with 46 households responding. Gleaning and pelagic fishing were less of an income activity, ranking as seventh and ninth, respectively (Table 4). Households in older SMAs ranked fishing for reef fish as the highest primary income source.

Table 4. Highest income-earning activity for households. Data are shown by age of SMA. Total number of respondents is shown for each income activity under the column “All”. Ranks are based on total number of respondents.

Highest income-earning activity	Young	Middle	Old	All	Rank
Money from relatives (remittances)	19	25	12	56	1
Salaried/waged employment	18	21	9	48	2
Fishing for reef fish	10	16	20	46	3
Handicraft making	13	18	7	38	4
Farming/growing crops	11	24	1	36	5
Own/family business	8	13	7	28	6
Fishing for other (pelagic and bottom) fish	4	3	1	8	7
Other	1	4	2	7	8
Gleaning shells and invertebrates	2	3		5	9
Livestock		2	1	3	10

Table 5 presents responses to the highest income-earning activity by gender, and shows that women benefitted from remittances (35 respondents) and handicraft making (29 respondents). Fishing for pelagic species as an income activity is conducted by eight respondents, all of whom were men. Women were more engaged in their own business or family business operations than men (17 respondents).

Table 5. Household income-earning activities by gender for the ranked activities shown in Table 4. Data shown are the number of respondents engaged in the income-earning activity.

Source of income	Women (135)	Men (140)	Number of respondents
Money from relatives (remittances)	35	21	56
Salaried/waged employment	23	25	48
Fishing for reef fish	12	34	46
Handicraft making	29	9	38
Farming/growing crops	11	25	36
Own/family business	17	11	28
Fishing for other (pelagic and bottom) fish		8	8
Other	4	3	7
Gleaning shells and invertebrates	2	3	5
Livestock	2	1	3



The second highest income-earning activities (Table 6) also show remittances as being a key income source for households, although handicraft making – which is mainly done by women – was the second highest. Income from reef fishing activities ranked sixth (20 respondents).

Table 6. Household responses to the second highest income-earning activity. Data shown by age of SMA and ranked by total number of respondents.

Second highest income-earning activity	Young (86)	Middle (129)	Old (60)	Number of respondents	Rank
Money from relatives (remittances)	27	37	17	81	1
Handicraft	15	17	25	50	2
Farming/growing crops	16	9	12	32	3
Other	9	10	10	27	4
Salaried/waged employment	8	10	7	24	5
Fishing for reef fish	7	5	13	20	6
Livestock	5	5	7	15	7
Own/family business	5	5	5	14	8
Fishing for other (pelagic and bottom) fish	3	2	3	7	9
Gleaning shells and invertebrates	3	0	2	4	10
Coastal tourism-related activities	1	0	0	1	11

Other income-earning activities that ranked fourth as a moderate supply of income to households are shown in Table 7, including five responses for no other income sources.

Table 7. Responses from households regarding other income-earning activities.

Activity	Number of respondents	Activity	Number of respondents
None	5	Sea cucumber fishing	1
Pandanus/weaving	4	Stealing (kaiha'a)	1
Pension	4	Donations	1
Kava (planting/selling)	2	Renting equipment	1
Fruit picking	2	Maintenance	1
Selling cakes/food	2	Plantation work	1
Selling wood/coconuts	1	Sports	1

### 3.2 Fishing and fishing practices

From the 275 respondents, 120 (73 men and 47 women) had been involved in fishing activities (fishing, harvesting, processing or selling) at least once a month for the past five years. Fishing activities included, in order of importance, reef fishing (86 respondents), gleaning activities (82 respondents) and pelagic and bottom fishing (31 respondents) (Fig. 5).

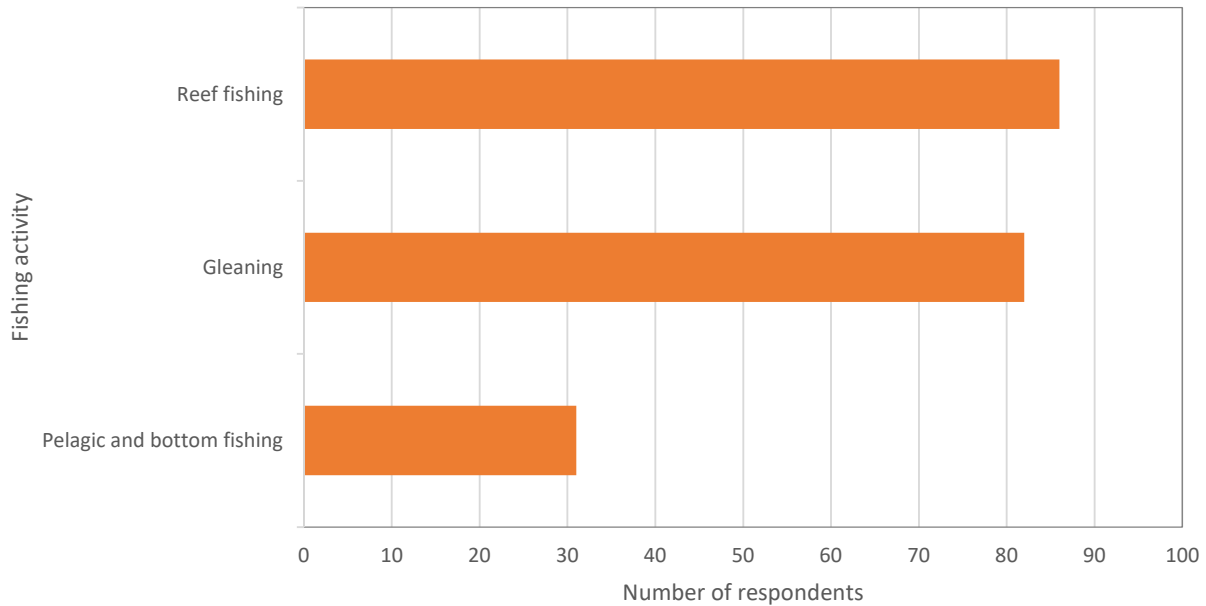


Figure 5. Respondent active engagement in different fishing activities in the past five years. Respondents may be engaged in more than one activity; total number of respondents is 120.

Ha’apai had the highest number of respondents directly engaged in fishing activities (64%), followed by Vava’u (46%) and ‘Eua (38%). Tongatapu had, proportionally, the least number of respondents engaged in fishing (28%). Respondents in Ha’apai were the most reliant on fishing and gleaning activities, with a few respondents conducting slightly more pelagic fishing. Respondents in ‘Eua seemed to be particularly dependent on gleaning activities (Fig. 6).

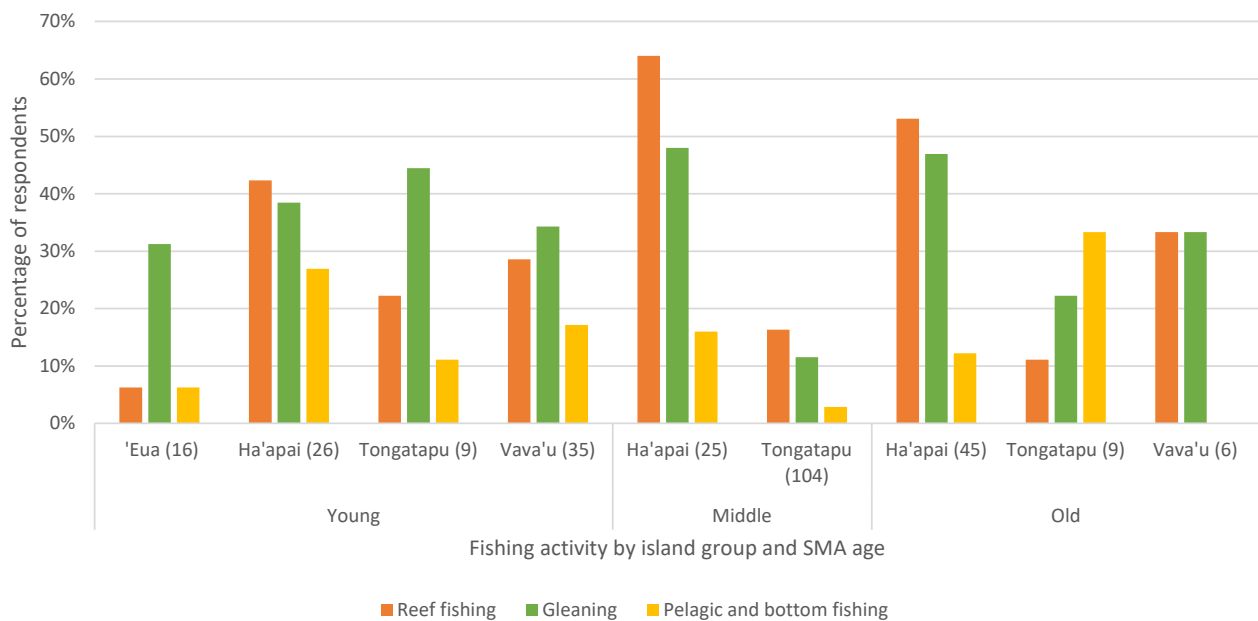


Figure 6. Respondent engagement in harvesting and fishing activities for reef fishing; pelagic and bottom fishing; and gleaning (for invertebrates). Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 275.

A related question asked about the involvement of household members in fisheries according to members' age and gender (men, women, male youth and female youth). Reef fishing was conducted by more people (222) than other fishing and harvesting activities. This was followed by reef gleaning (193), and pelagic and bottom fishing (117) (Table 8).

Table 8. Number of individuals engaged in fishing and gleaning activities. Data shown by gender and by those aged over 34 years, and male and female youth aged 15–34.

Fishing method		'Eua	Ha'apai	Tongatapu	Vava'u	All
Reef fishing	Men	12	73	54	24	163
	Women	1	10	15	7	33
	Male youth		14	6	4	24
	Female youth			1	1	2
	<b>Total</b>	<b>13</b>	<b>97</b>	<b>76</b>	<b>36</b>	<b>222</b>
Pelagic fishing	Men	2	57	25	8	92
	Women		3	2		5
	Male youth	1	15	2	2	20
	Female youth					
	<b>Total</b>	<b>3</b>	<b>75</b>	<b>29</b>	<b>10</b>	<b>117</b>
Gleaning	Men	9	60	31	12	112
	Women	2	19	14	6	41
	Male youth		16	5	4	25
	Female youth		9	4	2	15
	<b>Total</b>	<b>11</b>	<b>104</b>	<b>54</b>	<b>24</b>	<b>193</b>

Female youth aged 15–34 are the least engaged in fishing and harvesting activities, with only 3 engaged in reef fishing and 15 in gleaning. Male youth are engaged across all three fishing methods. While women (aged >34 years) are engaged in fishing (reef fishing 33, pelagic fishing 5 and gleaning 41), the results show that men are the most dominant participants in all three activities (reef fishing 163, pelagic 92 and gleaning 112) (Table 8).

Based on the subsample of respondents directly involved in fishing activities (n = 120), 52 respondents thought that since the establishment of the SMA, the number of household members engaged in fishing and harvesting (52), or trade of marine species (56) had increased. A similar proportion of respondents thought that these activities had not changed (49 and 42). Seventeen respondents felt that the number of people involved was less for both fishing and selling (Table 9).

Table 9. Changes in the number of household members involved in fishing and harvesting activities, including selling and/or trading marine species, since the establishment of SMAs.

	Higher	Don't know	Same	Lower
Household members who fish and/or harvest (120)	52	2	49	17
Household members who sell and/or trade marine species (120)	56	5	42	17

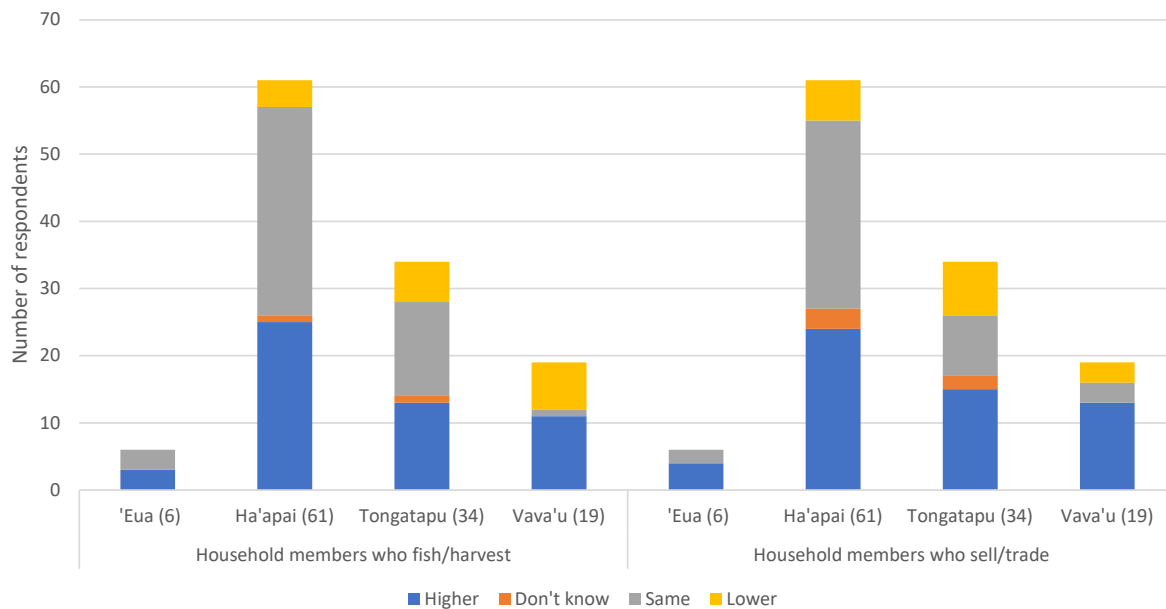


Figure 7. Perceived SMA impacts on the number of household members who are involved in fishing, harvesting, or selling and processing. Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 120.

The cost of fish and seafood is perceived by respondents directly involved in fisheries to have increased since before the SMA was established, as reported by 54.7% of those surveyed (76 respondents, 45 men and 31 women). In addition, respondents felt that the cost of purchasing fish and seafood has increased, as reported by 59.7% of those surveyed (83 respondents, 47 men and 36 women). The commercial value of species caught is considered to be higher, as reported by 52.5% of respondents (44 men and 29 women). Finally, 23% of respondents (19 men and 13 women) believe that the value of species caught was the same (Fig. 8).

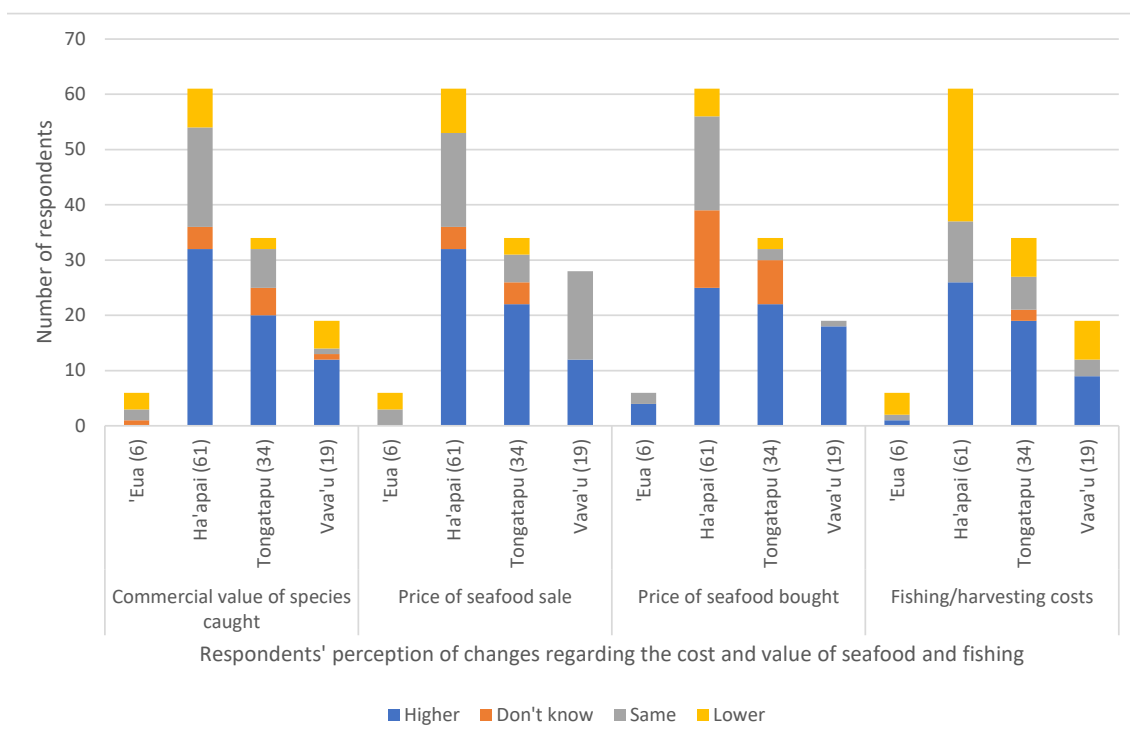


Figure 8. Perceived SMA impacts on the costs and expenses for seafood and fishing trips. Numbers in brackets correspond to sample size (by island group); total number of respondents is 120.

### 3.3 Food security and fish supply

Households can obtain fish and seafood by either harvesting it themselves, or are gifted and/or share with families and friends, or purchase seafood from local fish markets or MoF.<sup>2</sup> Fishing for household consumption is the primary means by which respondents obtain seafood (196 responses), followed by purchasing seafood (164 responses), and being given or sharing seafood with others (160 responses). Households in Ha'apai purchased proportionally less seafood than communities in other SMAs (Table 10).

Table 10. Household responses on ways of obtaining fish and seafood. Total number of respondents is 275 per fishing activity.

Island group	Own catch (275)		Shared/given (275)		Bought (275)	
	Yes	No	Yes	No	Yes	No
'Eua	12	4	8	8	14	2
Ha'apai	78	18	78	18	20	76
Tongatapu	71	51	48	74	103	19
Vava'u	35	6	26	15	27	4
<b>Total</b>	<b>196</b>	<b>79</b>	<b>160</b>	<b>115</b>	<b>164</b>	<b>111</b>

Most households on Tongatapu purchased seafood, particularly in middle-aged SMAs on Tongatapu. Catching their own fish and seafood was also important, especially in older SMAs. In contrast, communities in Ha'apai consistently relied less on bought fish, and more on caught or shared fish. Vava'u communities seemed to rely similarly on the different ways of obtaining seafood (Fig. 9)

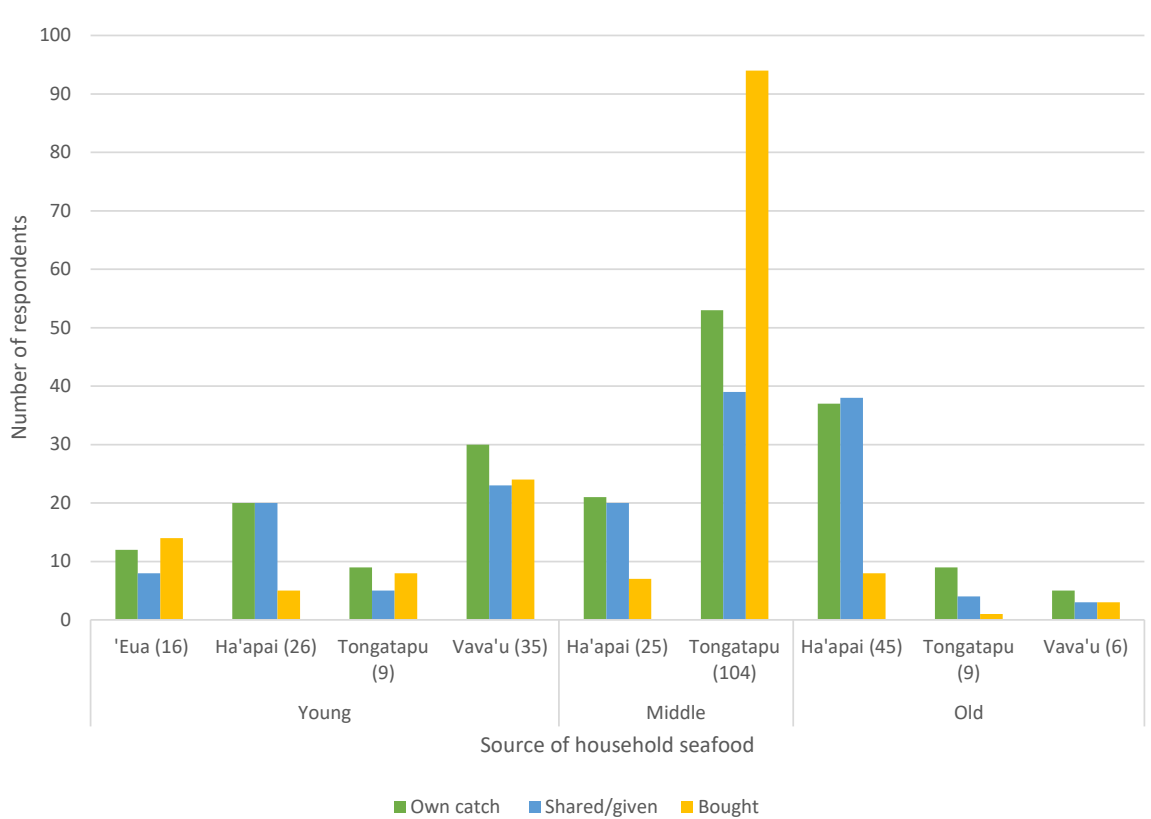


Figure 9. Household sources of fish and seafood. Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 275.

Most respondents across the four island groups felt that the way they obtain fish and other seafood has not changed since the SMA programme began, particularly regarding seafood that is purchased. Households in Tongatapu purchase more seafood than those from other island groups (99%, 103 responses) and most of them (52%, 54 responses) report that they have not seen an effect of the SMAs. However, from those who catch their own fish, an important number of respondents in Tongatapu (51%, 36 responses) and some in 'Eua (42%, 5 responses) felt that they consume more seafood that they catch themselves since the establishment of the SMA.

<sup>2</sup> MoF sold pelagic fish and deep-water snapper at a subsidised rate from fishing vessels for Covid-19 relief.

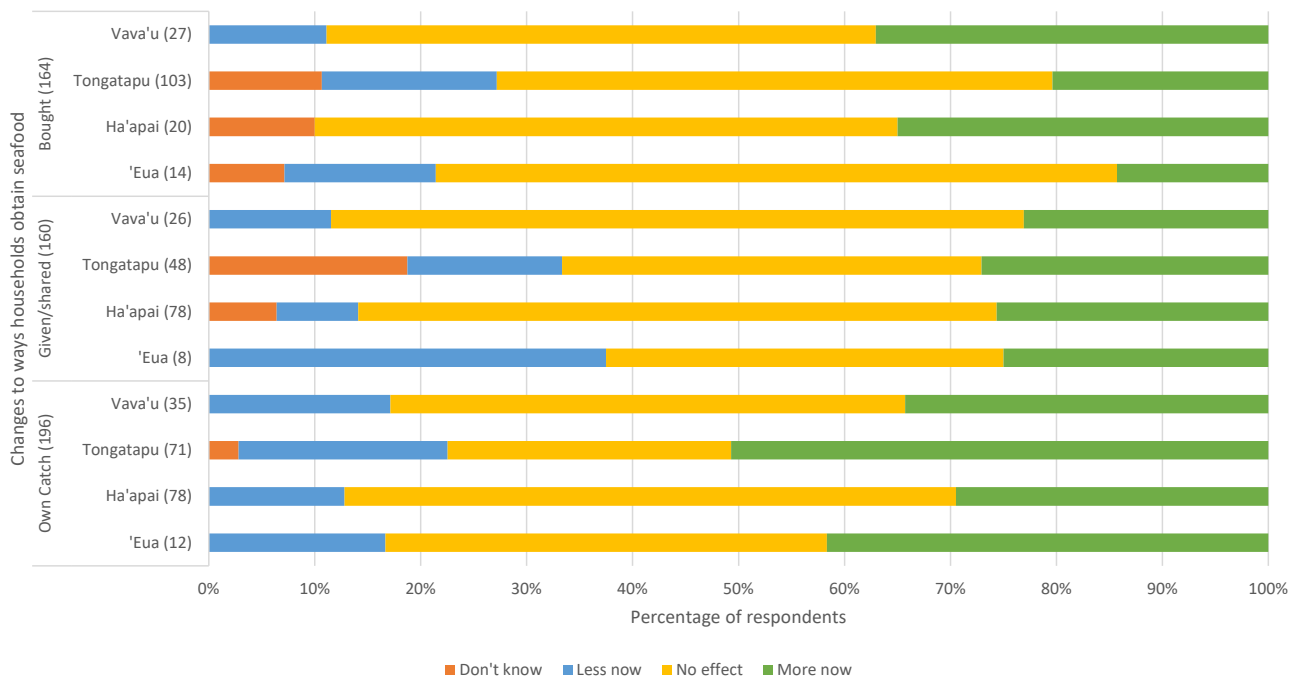


Figure 10. Perceived effect of the SMA programme on the way fish and seafood resources are obtained. Numbers in brackets correspond to sample size by island group, and by number of respondents for own, bought and given seafood; total number of respondents is 275.

Food security is based on fishing, farming and livestock rearing activities that provide protein and produce for consumption, and economic benefits through sales. Households across all SMAs that engaged in reef fishing, catch seafood primarily for household consumption, or for both household consumption and income (Fig. 11).

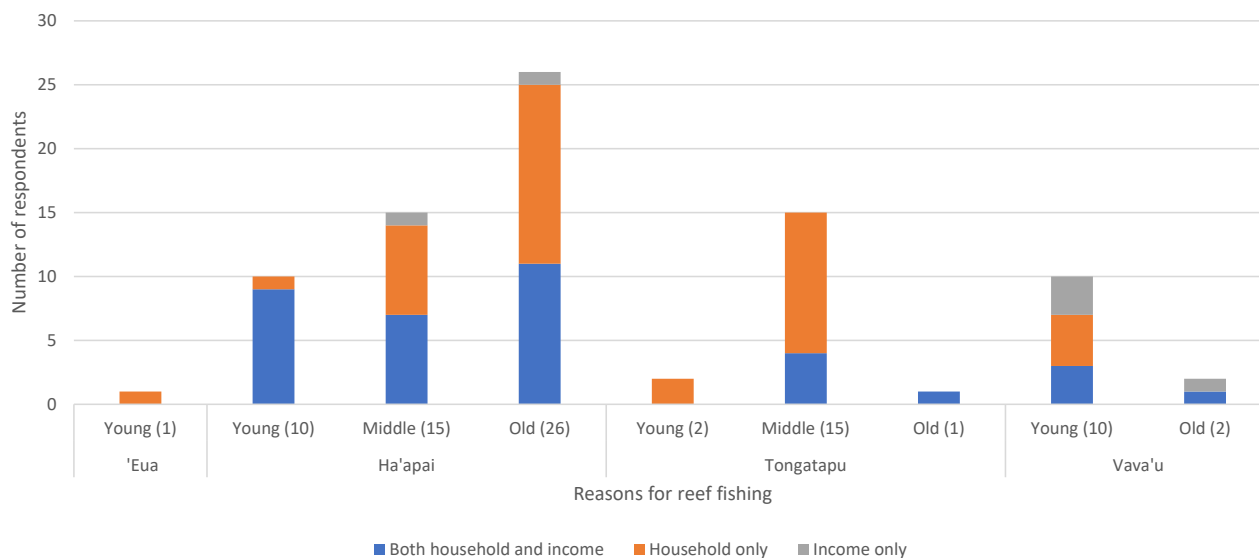


Figure 11. Purpose of reef fishing activities. Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 86.

Gleaning is primarily done for household consumption, with SMA households in Ha'apai also selling invertebrates for cash (young SMAs 6, middle-aged and older SMAs 7 each) and a few households on Tongatapu (young SMA 1, middle-aged SMAs 2) and Vava'u (young SMA 1). Only one household from older SMAs in Vava'u responded that they gleaned for income only (Fig. 12).

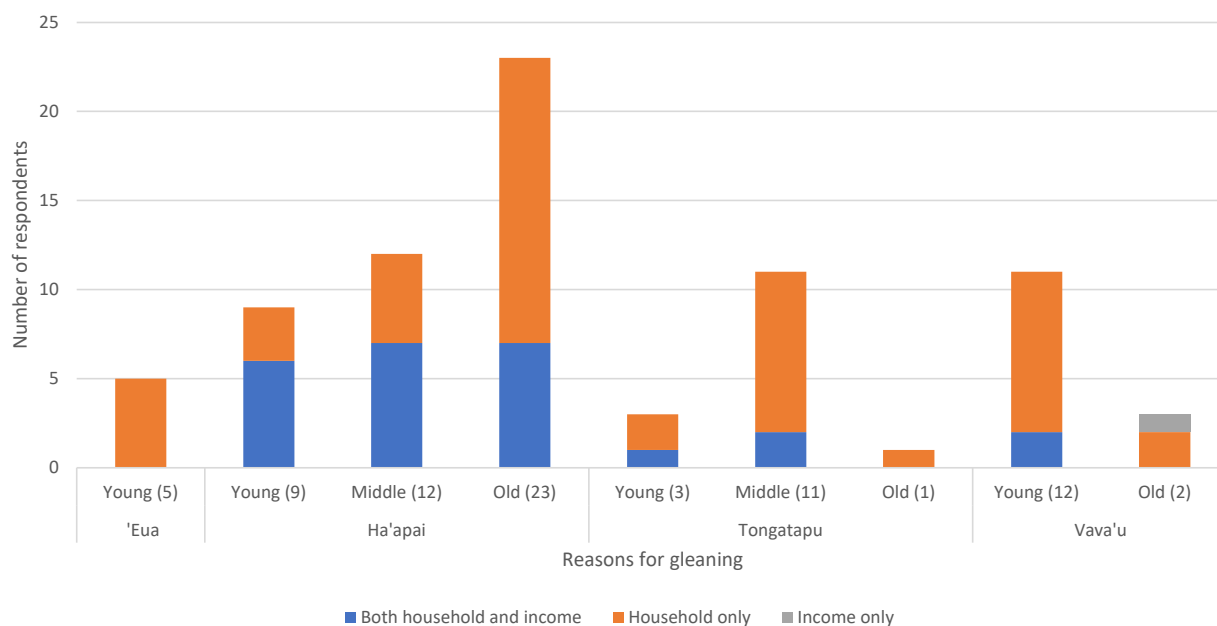


Figure 12. Purpose of gleaning activities. Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 82.

Based on 25 responses, engagement in pelagic and bottom fishing activities was the primary means of gaining seafood for both household consumption and income. Fewer households conducted pelagic and bottom fishing for household consumption only (Ha'apai and Tongatapu, 2 households each, and Vava'u, 1 household). Of note is that none of the households on 'Eua engaged in pelagic fishing in the last five years, despite the deeper waters that are much closer to coastal communities in this island group (Fig. 13)

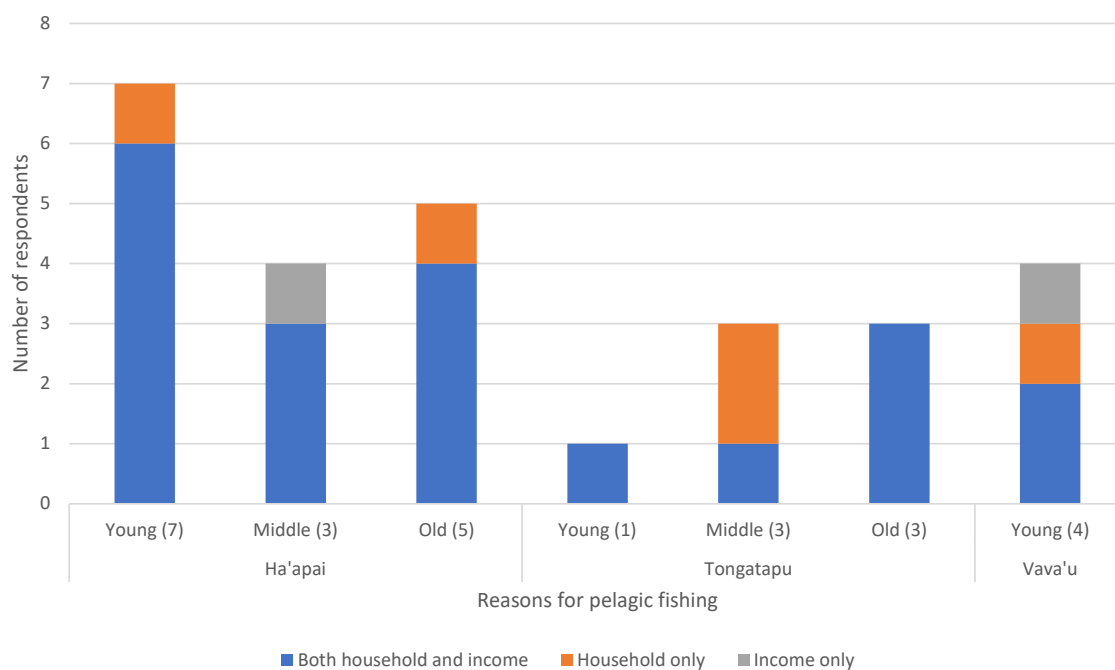


Figure 13. Purpose of pelagic fishing activities. Numbers in brackets correspond to sample size (SMA age by island group); total number of respondents is 31 (4 missing answers).

Reef fish, pelagic fish and invertebrates are all important seafood types for household consumption, with reef fish being the primary seafood consumed by all households surveyed and pelagic fish being the least important. Invertebrates are seen as slightly less important on Tongatapu (moderate 18, and of little importance 27) and in Ha'apai (18 and 26, respectively) (Fig. 14).

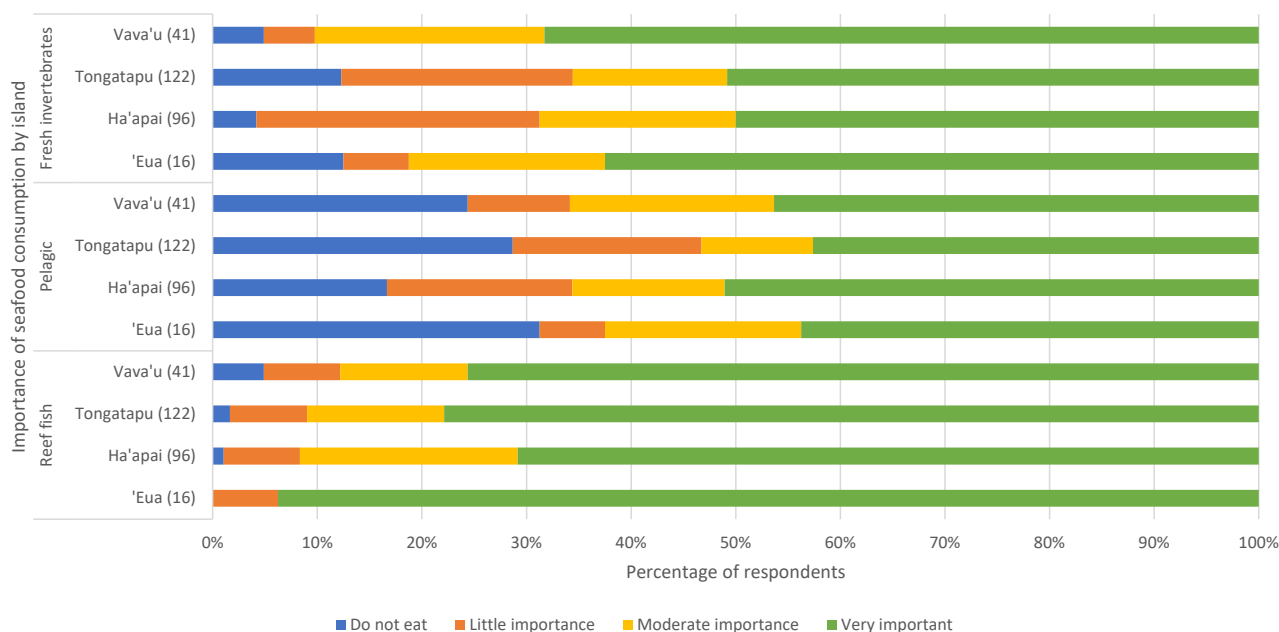


Figure 14. The importance of fresh seafood and fish for household consumption. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.

Both men (77.9%, 109 men) and women (74.1%, 100 women) feel that reef fish is very important for household consumption. Only 5 respondents, 1 man and 4 women, do not consume reef fish. Pelagic fish are not consumed by 32 men and 34 women, but was considered to be very important to 60 men and 67 women. More women felt that invertebrates and shells collected when gleaning were more important for consumption (81 women, 67 men) (Table 11).

Table 11. The importance of fish and seafood for household consumption by gender of respondents. Data shown as a percentage of the number of respondents (shown in brackets).

Seafood type	Respondents	Do not eat	Less important	Moderately important	Very important
Reef fish (%)	Men (140)	0.7	5.0	16.4	77.9
	Women (135)	3.0	9.6	13.3	74.1
Pelagic fish (%)	Men (140)	22.9	19.3	15.0	42.9
	Women (135)	25.2	12.6	12.6	49.6
Invertebrates (%)	Men (140)	8.6	20.7	22.9	47.9
	Women (135)	8.1	20.0	11.9	60.0





The average number of days a week that fish and seafood were consumed by households is shown in Figure 15. Across communities in all SMAs, reef fish was consumed three to four days a week, with crops such as taro, yams and cassava consumed almost daily (Fig. 15).

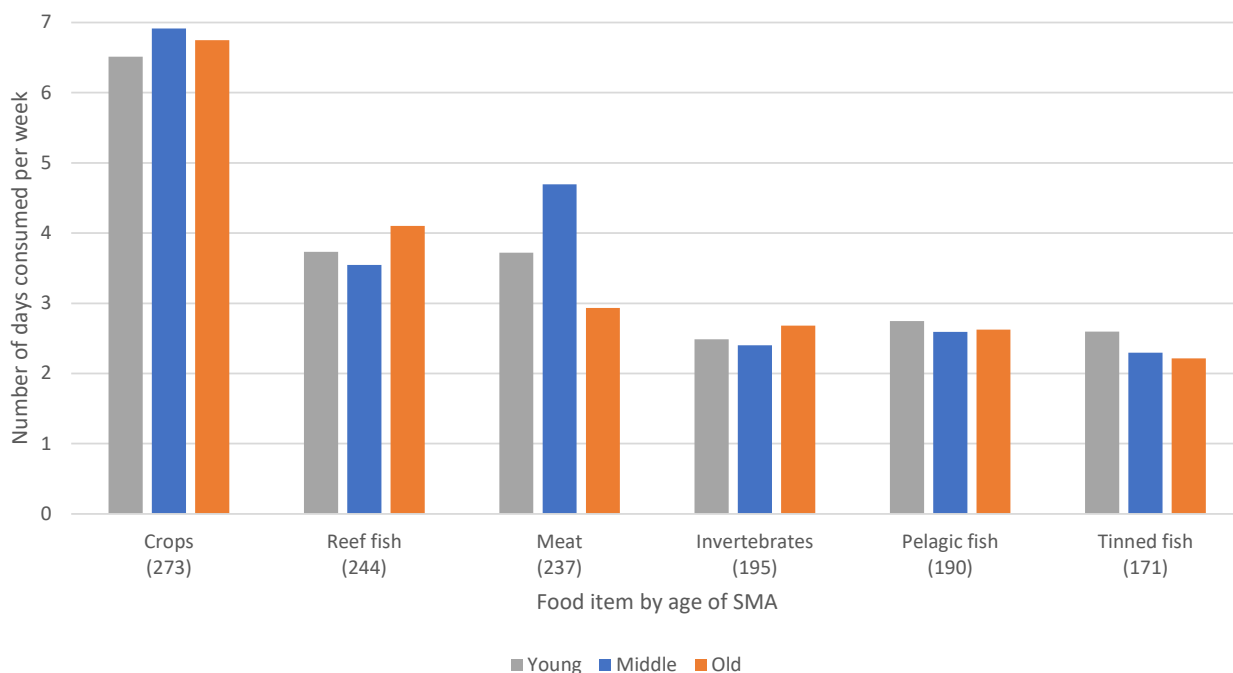


Figure 15. Average number of days per week each food item is consumed. Numbers in brackets correspond to number of respondents per food item; total number of respondents is 275.

Most respondents reported no change to the consumption of fish and seafood due to the establishment of the SMA programme, particularly tinned fish (59%, 70 men, 91 women). Almost half of the respondents also reported no change to the consumption of invertebrates (43%, 51 men, 67 women) and pelagic fish (40%, 52 men, 57 women). A similar number of respondents thought that the consumption of reef fish in their household had increased (39%, 67 men, 39 women) or had not changed (37%, 45 men, 58 women). In general, women felt more strongly that the SMA programme had not changed household seafood consumption, while more men felt that it had increased (Fig. 16).

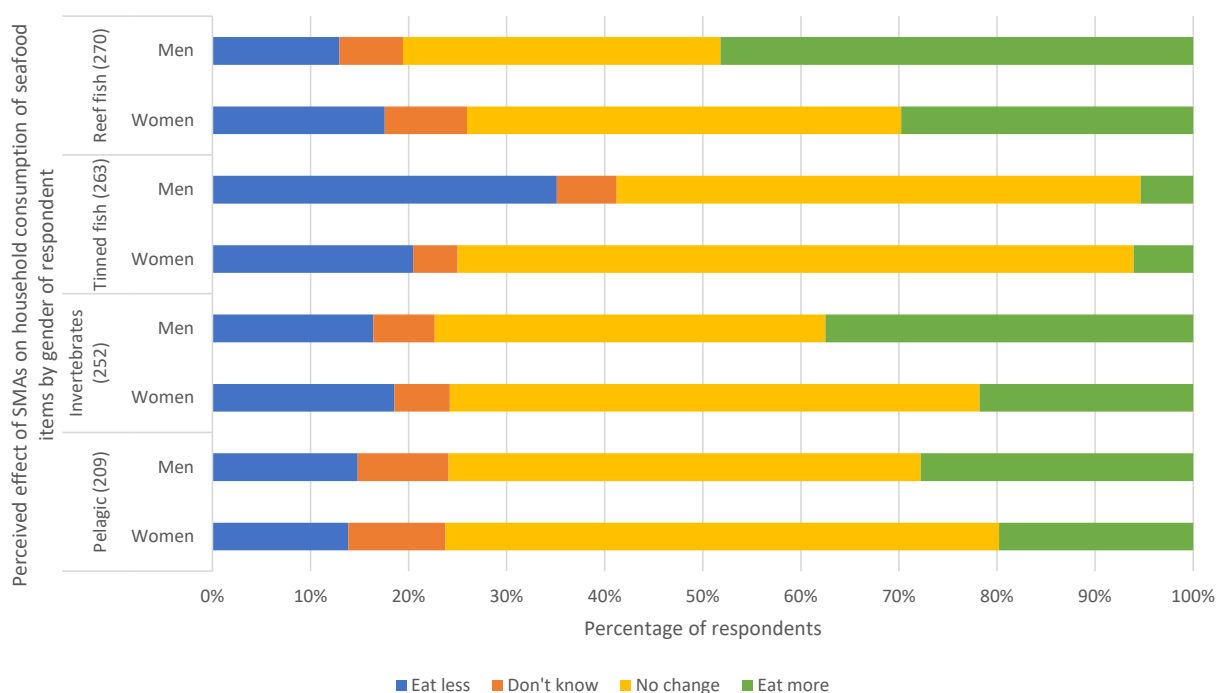


Figure 16. Household responses, by gender, to the perceived effect of SMAs on household consumption of fish and seafood. Numbers in brackets correspond to number of respondents per food item; total number of respondents is 275.

Most non-fishery activities, such as farming and livestock raising, are important for household use, with some contribution to income generation, particularly farming for middle-aged SMAs (Fig. 17). Coastal tourism is not considered to be an important income activity for households, with only three people engaged in tourism across all four island groups. Because the survey was conducted after the Covid-19 border closure, it is difficult to know if this low number is a result of Covid-19 impacts, or if it was already low before Covid-19.

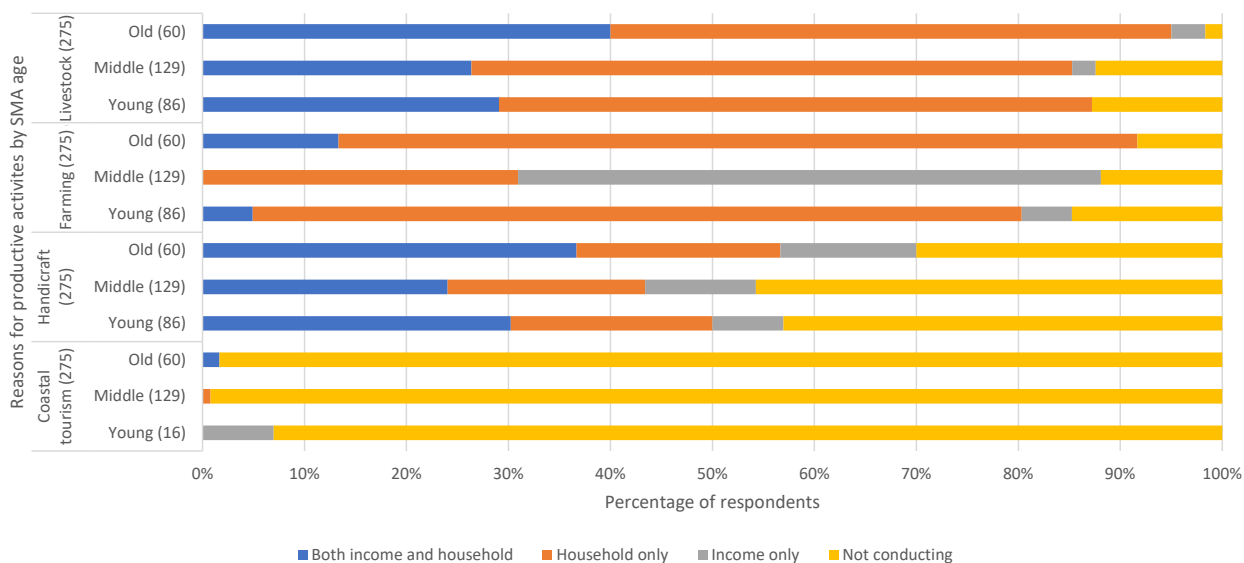


Figure 17. Purpose of non-fishing activities. Numbers in brackets correspond to sample size by SMA age, and to number of respondents for each activity; total number of respondents is 275.



### 3.4 Wellbeing

Households across all island groups agreed that they have the tools and means to sustain their livelihoods during difficult times, and that the household has support from relatives, family and community groups (Fig. 18).

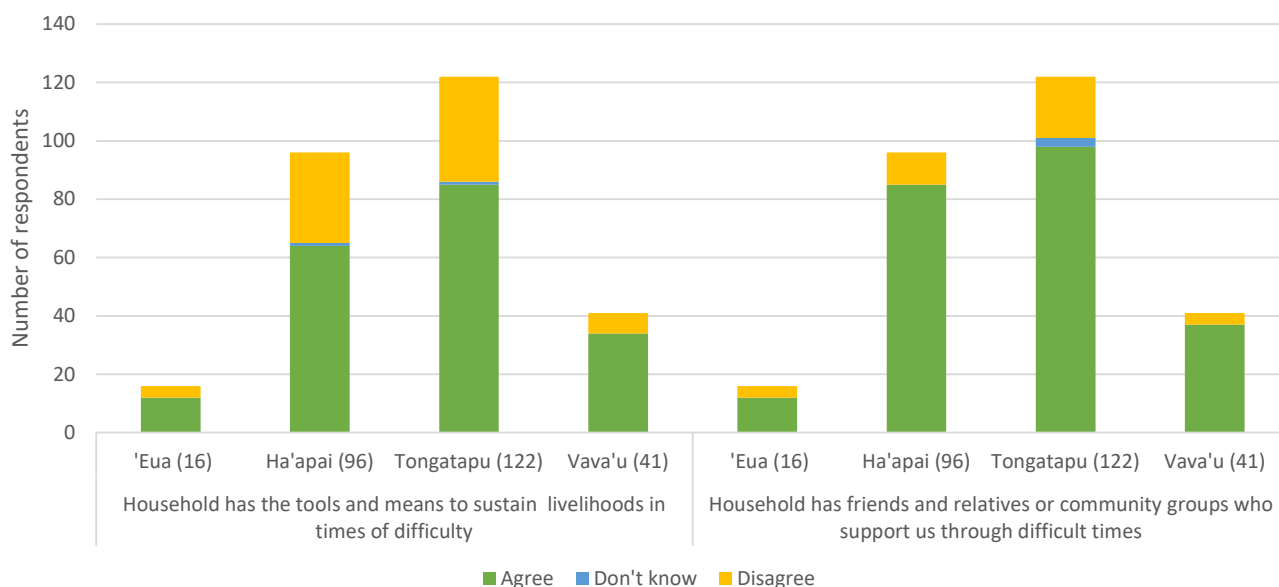


Figure 18. Perceived ability of household to cope during difficult times. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.

Overwhelming support was shown across island groups for the potential of the SMA programme to provide fish and seafood for future generations, with only 1 household in Ha'apai, 6 in Tongatapu and 2 in Vava'u believing there would be no change, and no one believing it would be worse (Fig. 19).

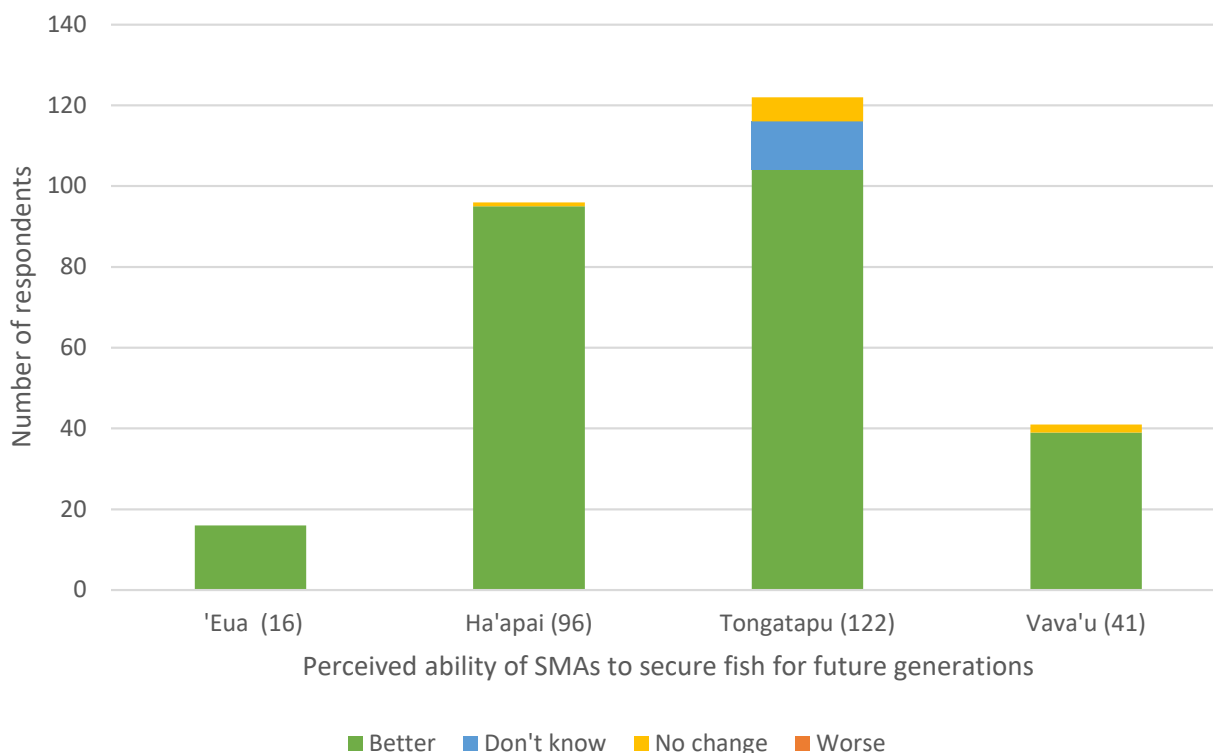


Figure 19. Belief that the SMA programme has the ability to help secure fish and seafood for future generations. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.



Table 12 indicates that most youth also believe that SMAs will benefit future generations.

Table 12. Responses from youth aged 15–34 as to whether the SMA programme can help secure fish and seafood for future generations.

Survey question	Response	Youth (men)	Youth (women)
Securing fish and seafood for future generations	Better	19	20
	Don't know	0	2
	No change	1	1
	Worse	0	0
<b>Total</b>		<b>20</b>	<b>23</b>

The connectivity of households to the ocean and reef due to SMAs was seen as being better by most respondents (80%, 12 respondents in 'Eua, 94 in Ha'apai, 80 in Tongatapu and 35 in Vava'u). Few households felt that the connection was less (7 respondents in Tongatapu, 4 in Vava'u and 2 in 'Eua) (Fig. 20).

Most respondents felt that the SMA had increased their ability to go fishing (65%). Differences by island group are presented in figure 20.

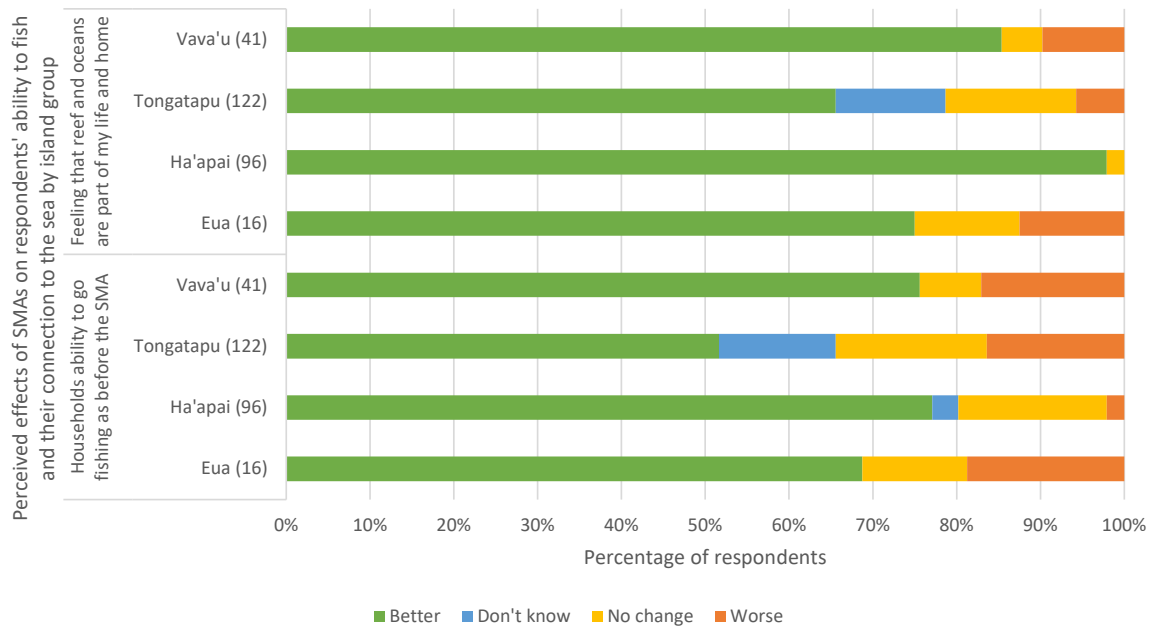


Figure 20. SMA changes to the ability to fish in places as before the SMA programme, and respondents' sense of connection to the ocean and reef. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.



Support for cultural and customary practices, including traditional fishing, was viewed by respondents across island groups as being better by 56% of respondents ('Eua 9, Ha'apai 71, Tongatapu 48 and Vava'u 26). However, 25% of households ('Eua 4, Ha'apai 17, Tongatapu 36 and Vava'u 9) felt there has been no change, and 4% believe that cultural and customary support was now worse ('Eua 1, Ha'apai 4, Tongatapu 5 and Vava'u 1) (Fig. 21).

Relationships within the household – especially between younger and older household members – due to SMAs were thought to be better, as reported by 56% of respondents ('Eua 6, Ha'apai 65, Tongatapu 55 and Vava'u 27). Over 30% of respondents ('Eua 8, Ha'apai 23, Tongatapu 40 and Vava'u 14) felt the SMA had no impact on relationships, and 1% felt the SMAs had made things worse (Ha'apai 2 and Tongatapu 2) (Fig. 21).

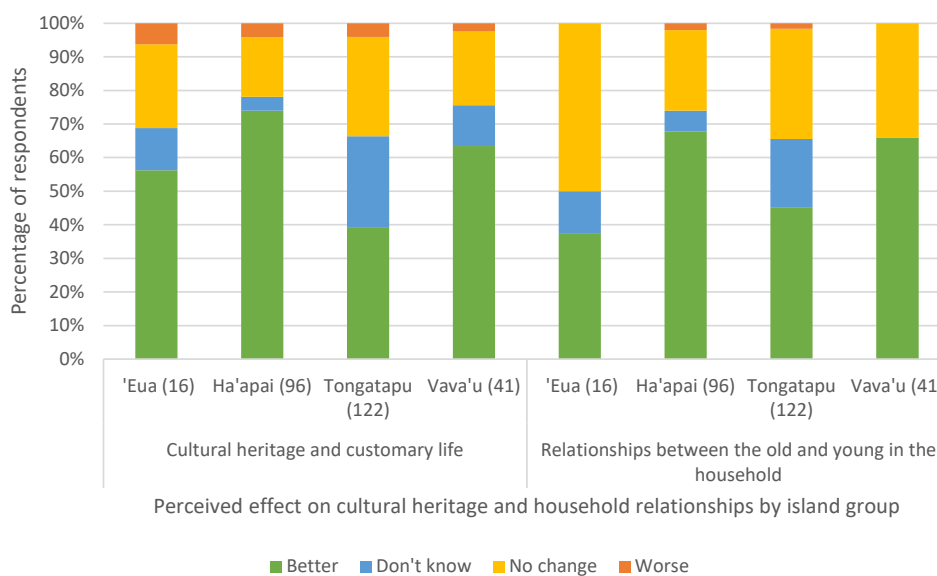


Figure 21. Changes to cultural and customary heritage, and changes in relationships between old and young household members due to SMAs. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.

An overwhelming support (95%) was reported for households' willingness to learn new livelihood activities, including non-fishery ones (e.g. farming, livestock rearing and tourism) (Table 13).

Table 13. Willingness to engage in and learn new and different livelihood activities that are both fishery and non-fishery related. Data by island group; total number of respondents is 275.

Household is willing to learn and engage in different livelihood activities	Island group	Agree	Don't know	Disagree
	'Eua (16)	15		1
Ha'apai (96)	92	3	1	
Tongatapu (122)	117	2	3	
Vava'u (41)	38		3	
<b>Total</b>	<b>262</b>	<b>5</b>	<b>8</b>	

### 3.5 Ecosystems and marine species

Over 70% of households reported that the number of marine species has increased (85 respondents), and 77% (93 responses) reported that the size of reef fish has increased (Fig. 22 a and b) as a result of the establishment of a SMA.

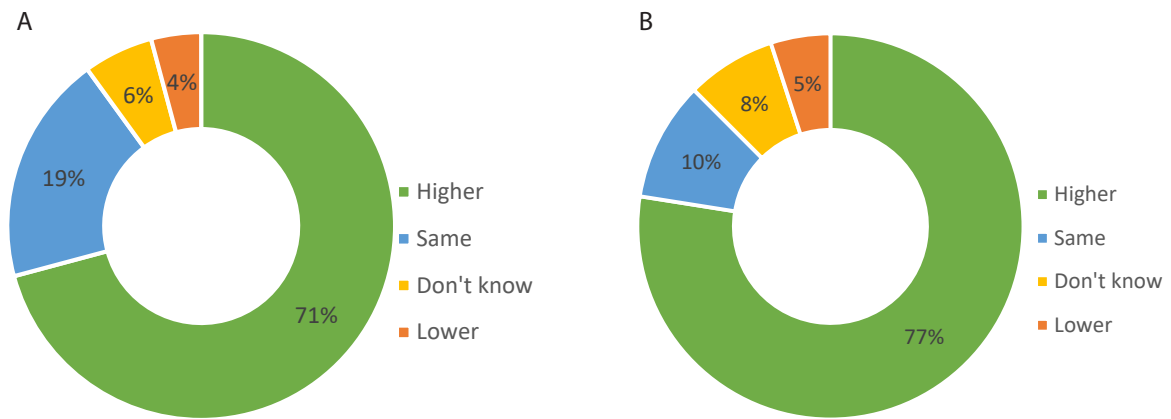


Figure 22. Perceived changes in the number (A) and size (B) of reef fish since the establishment of the SMA programme. Total number of respondents is 120.

Pelagic species are also believed to be increasing in size (64 responses) and number (60 responses) (Fig. 23 a and b). Pelagic fishing is conducted by much fewer people (31), although quite a lot of pelagic and deep-water species of fish are purchased, especially in Tongatapu.

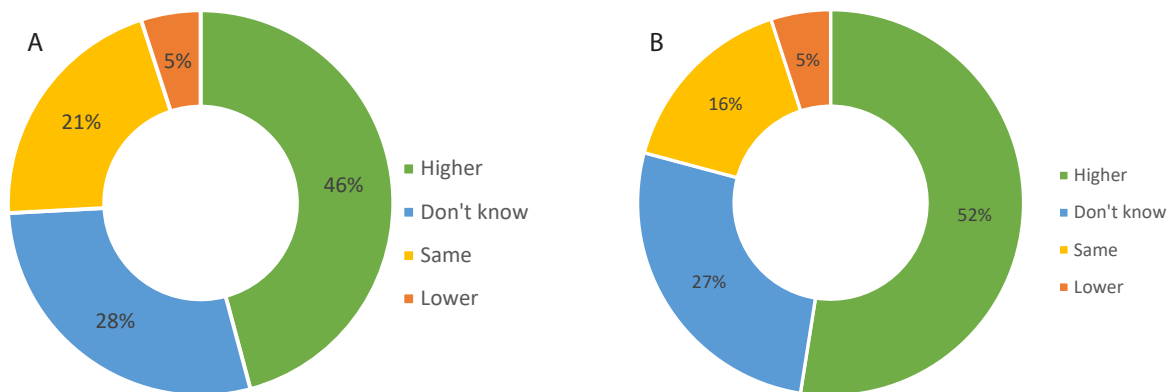


Figure 23. Perceived changes in the number (A) and size (B) of pelagic and bottom fish since the establishment of the SMA programme. Total number of respondents is 120.

The number of invertebrates is perceived to have increased by 84 households; 88 households believe the size of invertebrates have increased, with a much lower number of households observing that there are fewer invertebrates and that their size has decreased (Fig. 24 a and b).

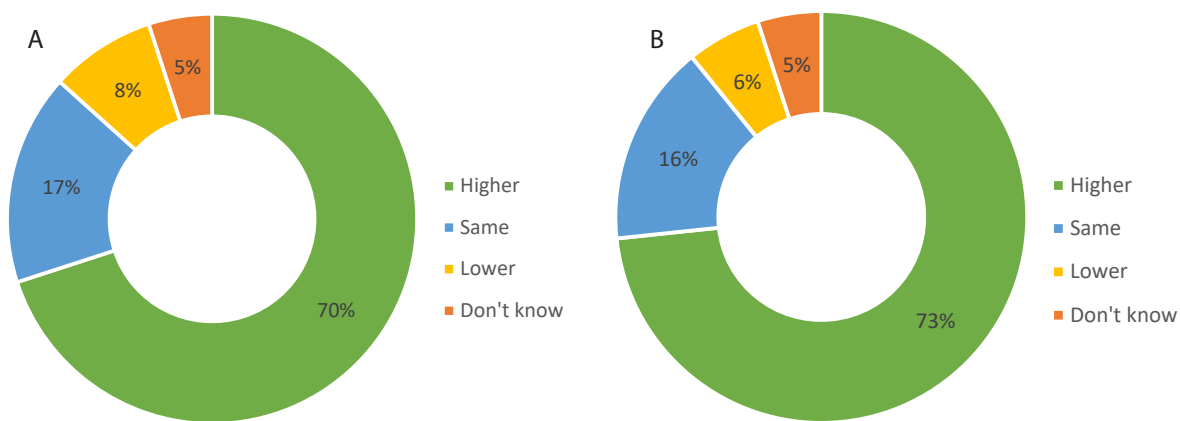


Figure 24. Perceived changes in the number (A) and size (B) of invertebrates harvested since the establishment of the SMA programme. Total number of respondents is 120.

Responses from households that are engaged in fishing, harvesting or processing show that most felt that reef areas and lagoon areas within SMAs were in better condition. Responses regarding mangroves, estuaries and deep reefs indicate that several households did not know whether there have been habitat changes since the establishment of the SMA (Table 14).

Table 14. Changes to marine habitats within SMAs. Data are filtered by households engaged in fishing, processing, or selling marine species. Number of respondents is shown in brackets.

Marine habitat	SMA age	Better	Don't know	No effect	Worse
Reef	Young (40)	33	1	6	
	Middle (42)	32	3	7	
	Old (38)	34		4	
Lagoon	Young (24)	32	3	5	
	Middle (33)	28	5	9	
	Old (29)	33		5	
Mangroves and estuaries	Young (24)	15	14	11	
	Middle (33)	21	9	10	2
	Old (29)	9	23	6	
Deep reef	Young (24)	20	16	4	
	Middle (33)	25	10	7	
	Old (29)	26	8	4	
Seagrass	Young (24)	25	4	6	5
	Middle (33)	30	3	8	1
	Old (29)	33	1	4	

A small number of respondents thought that seagrass areas within younger SMAs and middle-aged SMAs were in worse shape since the establishment of the SMA (5 and 1 respondents, respectively). Likewise, only two fishers thought that mangroves and estuaries within middle-aged SMAs (2 households) were in worse condition since the establishment of the SMA (Table 14).

Strong support in all four island groups was expressed for household members to be more engaged in sustainable fisheries management ('Eua 88%, Ha'apai 99%, Tongatapu 85% and Vava'u 78%), with a few households disagreeing to do more to sustain fisheries (9 households across all island groups) (Table 15).

Table 15. Household willingness to be more engaged in sustaining fisheries by island group. Number of respondents is in brackets; total number of respondents is 275.

Island group	Agree	Don't know	Disagree
'Eua (16)	14		2
Ha'apai (96)	95		1
Tongatapu (122)	104	14	4
Vava'u (41)	32	7	2

## 3.2 Climate change and resilience

Table 16 shows household responses to feeling little or no ability to cope with climate hazards and natural disasters, with most households feeling they cannot cope.

Cyclones have been experienced by 187 households, and 63% of these feel they do not have the ability to cope. About 82% of households (56) feel that coral bleaching will impact them, and they will not have the ability to cope (Table 16).

Table 16. Households that have experienced natural and climate-related hazards and the coping ability of the household. Data show responses to feeling little or no ability to cope.

Climate-related hazard	No. of households that have experienced impacts in last five years	No. of # households with little or no ability to cope	Percentage of households that have experienced hazards
Cyclones	187	118	63
Drought	149	86	58
Changes in rainy/dry season	133	81	61
Coastal erosion	101	74	73
Saltwater intrusion	82	67	82
Sea level rise	84	64	76
Flooding	78	57	73
Coral bleaching	56	46	82
Increased sea surface temperature	44	29	66



Communities are willing to adapt to and mitigate climate change impacts, including learning new livelihood activities. Figure 25 shows that households overwhelmingly support the need for new activities, and examples are shown in Table 17. Communities on low-lying lands near coastal areas may have to move away from the shoreline due to rising sea level and storm surges. However, households in 'Eua (11) and Tongatapu (62) were not supportive of relocating, whereas households in Ha'apai (94) and Vava'u (38) were more agreeable to the idea (Fig. 25).

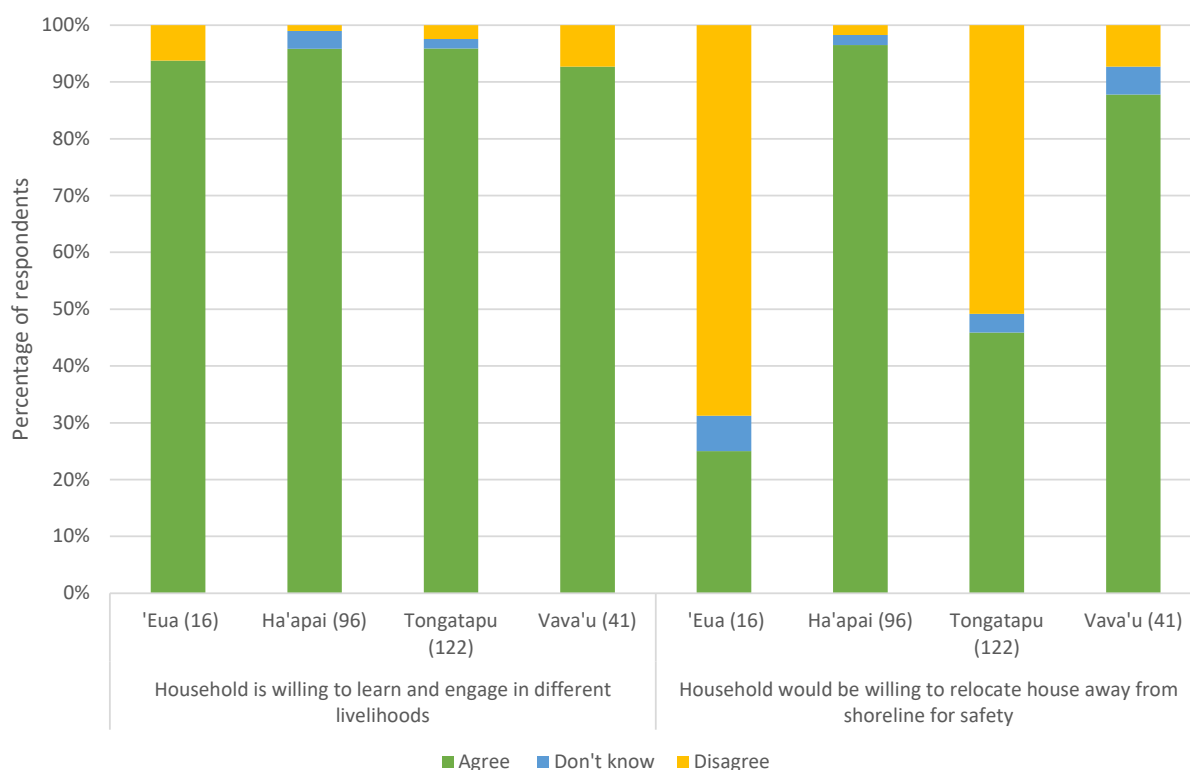


Figure 25. Willingness to adapt and mitigate climate change impacts by island group. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.

The need for strengthening and supporting SMA management and communities to better cope and adapt to the impacts of climate change (Table 17) indicates that developing non-fishery alternative livelihoods is the primary need for women (90 responses) and across all SMAs (185 responses). For men, the highest need was information sharing and knowledge-based training on climate change (100 responses). The development of aquaculture was the lowest identified need across all SMAs (118 responses).

Table 17. Adaptive activities and management support for fishery and non-fishery activities to be developed for community adaptation and resilience to natural disasters, climate change and social shocks. Data provided by gender of respondent and SMA.

	Men (112)	Women (106)	Young SMA (76)	Middle-aged SMA (86)	Old SMA (56)	All
Alternative livelihoods (non-fishery)	95	90	60	73	52	185
Safety-at-sea training	95	85	68	61	51	180
Improved knowledge and awareness of climate change	100	79	55	72	52	179
Improved enforcement in SMAs	92	80	62	61	49	172
Additional and/or revised fisheries rules	86	83	59	62	48	169
Improved handling and processing for fisheries	91	77	59	59	50	168
Insurance for loss or damage	89	78	61	56	50	167
Fish aggregating device (FAD) deployment and training	95	62	55	54	48	157
Loans or microfinance	87	65	48	59	45	152
Small-scale aquaculture	67	51	41	39	38	118

### 3.7 SMA management challenges and opportunities

Overall, most households expressed a high level of support of the SMA programme (89%) and the fish habitat reserve (FHR) (85%). The enforcement of community-based rules within SMAs is believed to have improved by most households (young SMAs 70, middle-aged SMAs 87 and old SMAs 52), with fewer households feeling it was worse (middle-aged SMAs 9, young 3 and old 1. (Fig. 26). The use of local knowledge to inform management decisions was largely viewed as having improved with the establishment of the SMA programme as reported by communities living in young SMAs (55), middle-aged SMAs (67) and old SMAs (42). Some households, however, were unsure of how local knowledge was used within the SMA, as reported by households in young SMAs (11), middle-aged SMAs (35) and old SMAs (5).

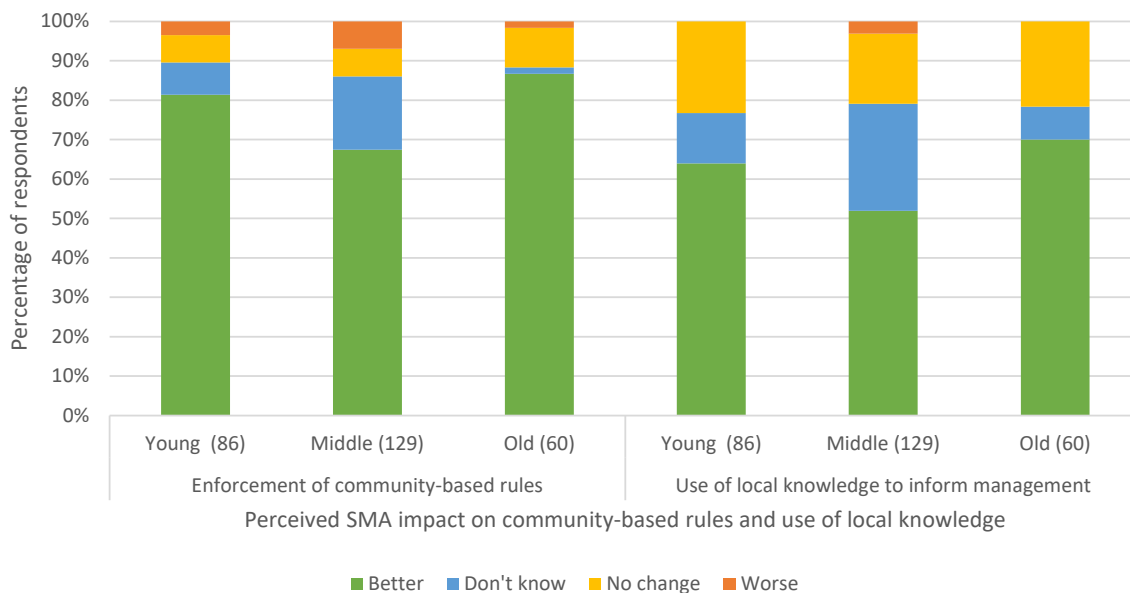


Figure 26. Effects of the SMA programme on enforcing community-based rules, and whether local knowledge is informing management practices. Numbers in brackets correspond to sample size by SMA age; total number of respondents is 275.

The household survey found that more men (102) than women (87) found the inclusion and recognition of women’s roles as being supported by SMA management, decision-making and leadership (Fig. 27). Women believe that less change in this area has occurred (23) as compared to men (18). Few male or female respondents felt the situation was worse (3 men, 3 women).

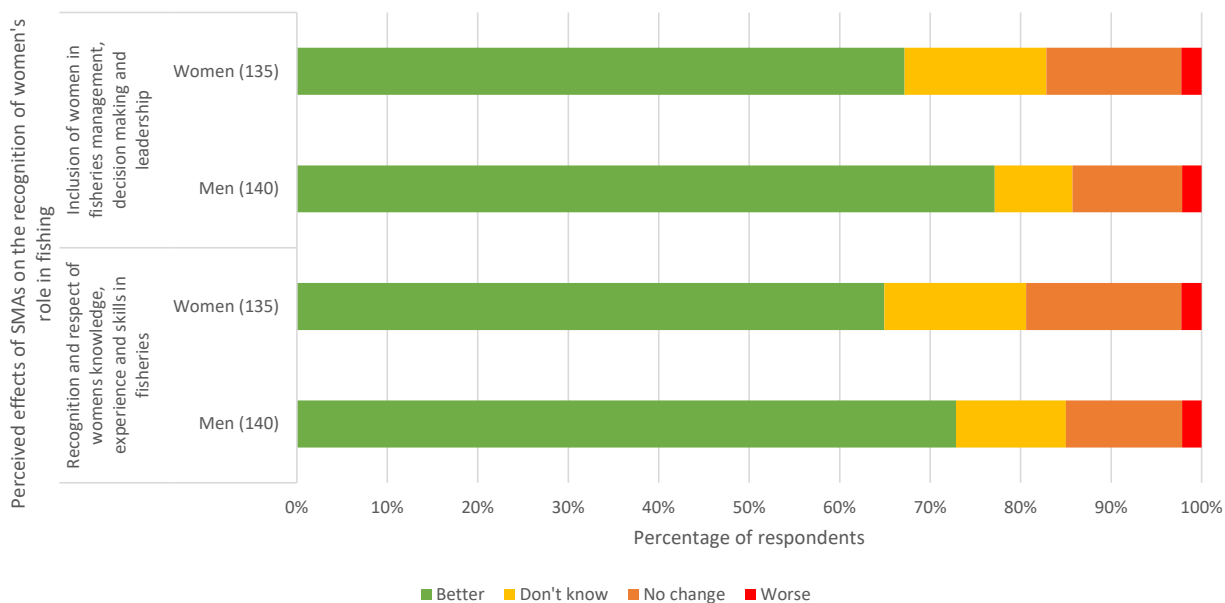


Figure 27. Effects of the SMA programme on the inclusion, recognition and support for women's knowledge and engagement in fisheries management. Numbers in brackets correspond to sample size by gender; total number of respondents is 275.

Most household responses showed that the effects of illegal (60%) and harmful or destructive fishing practices (73%) had decreased since the establishment of the SMA programme. With regards to harvesting for the aquarium trade (57%), many respondents did not know if there was any change (Table 18). Poaching and illegal trespassing was seen as having increased according to 15% of households in middle-aged SMAs and 12% in young SMAs.

Table 18. Effects of the SMA programme on destructive fishing activities. Data show percentage of respondents by age of SMA. Total number of responses per question is 275.

Fishing practice	Age of SMA	Better	Don't know	No change	Worse
Poaching or illegal trespassing	Young (86)	53	13	10	10
	Middle (129)	70	29	11	19
	Old (60)	43	3	7	7
	<b>Total</b>	<b>166</b>	<b>45</b>	<b>28</b>	<b>36</b>
Use of destructive fishing methods	Young (86)	65	13	6	2
	Middle (129)	84	29	10	6
	Old (60)	51	4	5	
	<b>Total</b>	<b>200</b>	<b>46</b>	<b>21</b>	<b>8</b>
Harvesting for aquarium trade	Young (86)	29	43	13	1
	Middle (129)	42	72	10	5
	Old (60)	18	41	1	
	<b>Total</b>	<b>53</b>	<b>13</b>	<b>10</b>	<b>10</b>

SMA management is based on the capability and resources of the CCMC and the support of MoF and its partners. Weak enforcement of rules and regulations was the biggest challenge identified by households (139 responses), followed by a lack of funding or access to financial resources to assist the CCMC (109 responses). Relationships between communities was not seen as a big challenge, with 24 responses for conflicts, and 7 responses for strained relationships (Fig. 28).

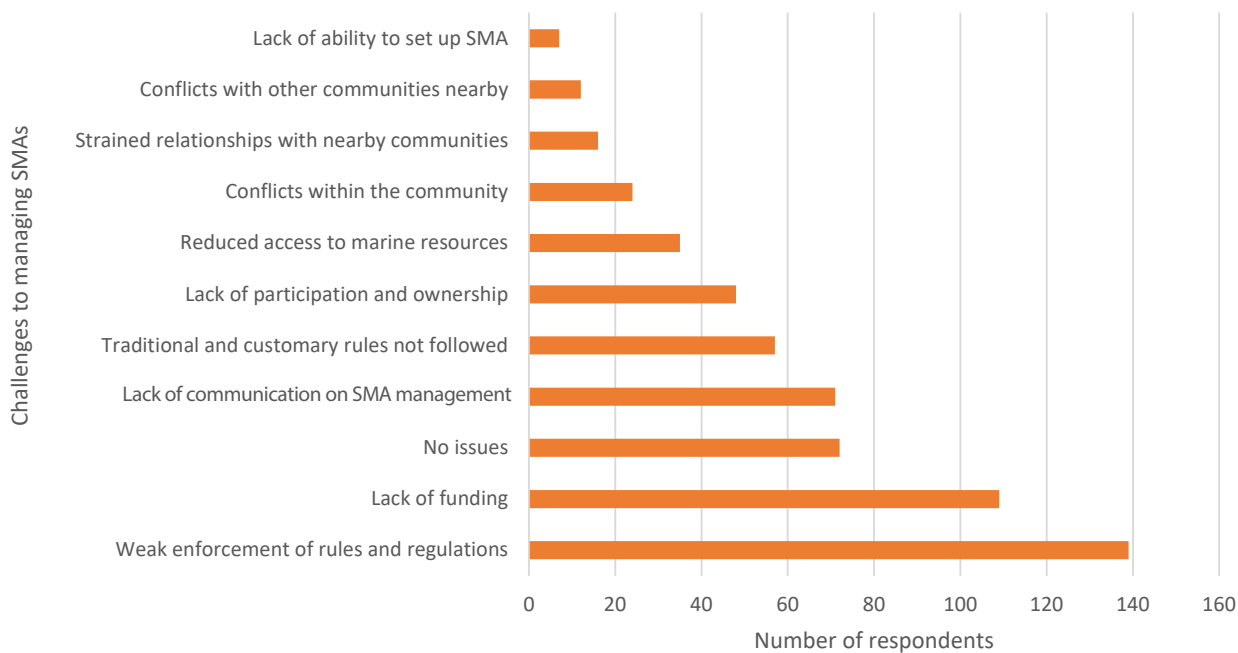


Figure 28. Ranking of the top three challenges to managing SMAs. Total number of respondents is 275.

Natural disasters were identified as being the biggest threat to SMAs, followed by overfishing, pollution and runoff, and trash and marine debris. Threats from management activities, inadequate enforcement and lack of awareness of rules and regulations were also identified as threats (Fig. 29).

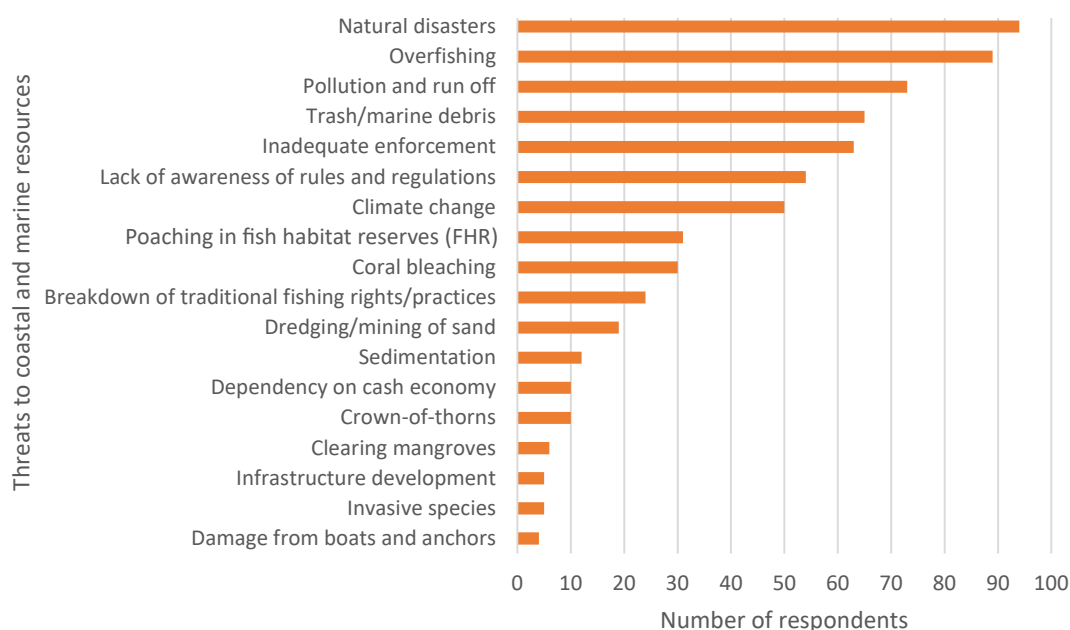


Figure 29. Ranking of the top three perceived threats to coastal and marine resources. Total number of respondents is 273.

Information needs for strengthening knowledge on the SMA programme were identified by households, with information on SMA regulations being a primary need (221 responses), especially by women (113). Locations of SMAs (130) through maps and information boards was the second greatest need, followed by how to apply to fish in an SMA (91), and how to be involved in an SMA (89) (Table 19)

Table 19. Information needs of households in order to strengthen the SMA programme. Respondents were asked to identify all that apply.

	Men (n=140)	Women (n=135)	Young (n=86)	Middle (n=129)	Old (n=60)	Total responses (n=275)
<b>Understand SMA regulations</b>	108	113	67	109	45	221
<b>Location of SMAs</b>	77	73	23	78	29	130
<b>How to apply to fish in an SMA</b>	44	47	26	42	23	91
<b>How to be involved in an SMA</b>	46	43	24	42	23	89

Training for SMA households has been conducted by MoF and regional organisations to further fisheries management and adaptive fishing practices. Table 20 shows the types of training for community representatives, and the representation by gender of attendees. In total, 178 of the surveyed individuals attended these training workshops (116 men, 62 women). Responses indicate that the training level of these workshops was high (99 respondents, 56%) with 17% (31 respondents) feeling that the trainings were not beneficial. Women accounted for 35% of trainees (Table 20).

Table 20. Representation of men and women in training workshops provided on fisheries management and alternative fishing activities, with the percentage of representation of women at each training. Evaluation of the training as a benefit to communities is rated.

Training topic	Men (140)	Women (135)	Women % total attendees	Training evaluation		
				High	Medium	Low
FADs (23)	16	7	30	11	9	3
Small-scale fishing (35)	23	12	34	19	12	4
Fisheries management (56)	39	17	30	28	9	19
Post-harvest processes (29)	17	12	41	18	8	3
Sea safety (35)	21	14	40	23	10	2
<b>Total</b>	<b>116</b>	<b>62</b>	<b>35</b>	<b>99</b>	<b>48</b>	<b>31</b>

### 3.8 Expanding the SMA programme

The potential for shared management of SMAs was strongly opposed by 67% of all households surveyed, and supported by 29%. In contrast, 66% of respondents felt that landlocked communities should be involved in the SMA programme (Table 21).

Table 21. Responses to the potential for shared management between communities, and for landlocked communities being included in the SMA programme.

	No	Don't know	Yes
Shared management between communities (275)	183	13	79
Landlocked communities to be included (275)	80	13	182

Twelve respondents from 'Eua and 83 from Ha'apai were strongly opposed to shared SMA management between communities, with Tongatapu (46 respondents) and Vava'u (18 respondents) showing slightly more support (Fig. 30).

Respondents from 'Eua felt slightly more opposed to landlocked communities being included (9 respondents), with Ha'apai (62 respondents), Tongatapu (90 respondents) and Vava'u (23 respondents) mostly supporting the inclusion of landlocked communities (Fig. 30).

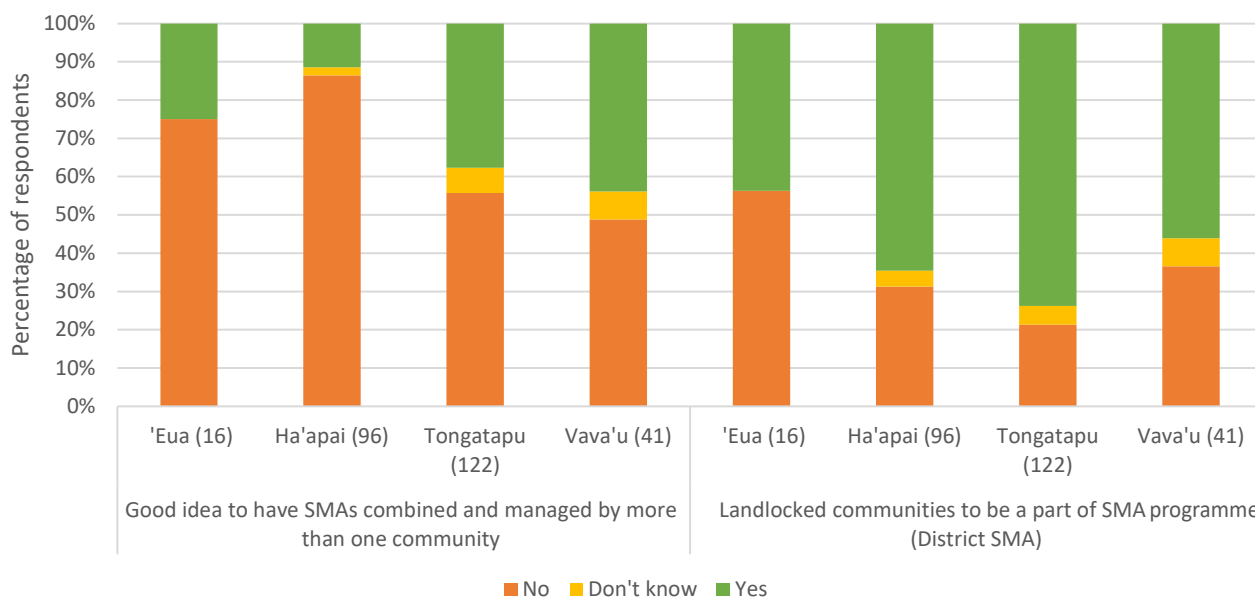


Figure 30. Willingness to share management of SMAs by island group, including with landlocked communities. Numbers in brackets correspond to sample size by island group; total number of respondents is 275.

### 3.9 Household demographics

The following section provides the overview of household demographics. Table 22 shows the age distribution of respondents according to island group, the youngest being 19 and the oldest 92.

Table 22. Age ranges for respondents of the SMA household survey across 'Eua, Tongatapu, Ha'apai and Vava'u.

Age of respondents	'Eua	Ha'apai	Tongatapu	Vava'u
18–20		1	1	
21–30	1	4	8	7
31–40	9	19	27	7
41–50		28	23	7
51–60		19	31	8
61–70	4	14	24	8
71–80	2	10	8	2
81–90		1		1
>90				1
<b>Total per island group</b>	<b>16</b>	<b>96</b>	<b>122</b>	<b>41</b>

Youth respondents accounted for 16% (46 respondents) of all respondents, with 25 females and 21 males (Table 23).

Table 23. Number of youth respondents according to island and gender. In Tonga, youth are defined as being between 18 and 34 years old.

	Men	Women	Total
'Eua	1	4	5
Ha'apai	7	5	12
Tongatapu	8	11	19
Vava'u	5	5	10
<b>Total</b>	<b>21</b>	<b>25</b>	<b>46</b>

In total, 1809 people were recorded living in the 275 households surveyed, with an average of 6.2 people per household, ranging between 1 and 20 household members (Table 24).

Table 24. Number of people living within the 275 households surveyed by island group, including children under age 18, and men and women over age 18. Number of households surveyed is in brackets.

Island group	Children (<18)	Adult males aged >18	Adult females aged >18	Total
'Eua (16)	48	27	26	<b>101</b>
Ha'apai (96)	195	173	268	<b>636</b>
Tongatapu (122)	341	223	268	<b>832</b>
Vava'u (41)	101	66	73	<b>240</b>
<b>Total</b>	<b>685</b>	<b>489</b>	<b>635</b>	<b>1809</b>

Most household respondents across the four island groups had completed high school (83.6%, 111 women, 119 men) with less than 2% of respondents (2 women, 1 man) completing some level of university (Table 25).

Table 25. Level of education received by respondents. Total number of respondents is 275.

Education level	Women	Men
No formal education	0	4
Elementary school	11	9
High school	111	119
Community college	11	7
Some university, no degree	2	1
<b>Total</b>	<b>135</b>	<b>140</b>

Table 26 shows that across all four island groups, “other” (informal work) is recorded as the dominant type of occupation, and includes overseas seasonal work (regional seasonal employee programme), housecleaning, handicraft-making, and looking after the house and household members. Farming and fishing are conducted across the four islands.

Table 26. Occupation of respondents by island group and SMA age. Number of respondents is shown in brackets; total number of respondents is 275.

Occupation	'Eua	Ha'apai			Tongatapu			Vava'u	
	Young (16)	Young (26)	Middle (25)	Old (45)	Young (9)	Middle (104)	Old (9)	Young (35)	Old (6)
Businessmen/women (%)	12.5		8.0	8.9	11.1	5.8	11.1	8.6	16.7
Farmer (%)	12.5	30.8	12.0	15.6	11.1	24.0		20.0	33.3
Fisher (%)	12.5	23.1	32.0	24.4	33.3	8.7	44.4	8.6	
Government employee (%)	12.5					1.0	11.1		
Other (%)	50.0	46.2	44.0	44.4	33.3	50.0	33.3	51.4	50.0
Private company/sector employee (%)				2.2		7.7		5.7	
Retiree (%)			4.0	4.4	11.1	2.9		5.7	



## 4. Discussion

The household survey data show that in many areas the SMA programme is highly beneficial and supported by individuals from the surveyed SMA communities. There is a range of demographic differences between island groups due to population density, economic development and resource availability. Some of these demographic differences are easily seen in the household responses and presented in the discussion below.

Within the 275 households surveyed, questions were posed to the head of the household or to a family member that had knowledge of the SMA programme. Respondents included men, women and youth (<35 years). The survey proved to be gender inclusive, with 135 women and 140 men responding to questions. It is important to note that while some questions captured individual perceptions, many were formulated at the household level. This means that even though there was an equal representation of gender in the sample, some questions do not allow an analysis of the differences between men and women.

As an example, in the income question (Section 3.1, Table 5), two women and one man answered that livestock was an income activity. This does not, however, mean that women are more engaged in livestock rearing than men, but that women answered that household-level question. In contrast, this same table shows that more men identified reef fishing as an important income source, and more women identified handicraft-making. This reflects the actual predominance of each gender in these activities, suggesting that some respondents answered some household-level questions from an individual perspective. It is, therefore, not straightforward to interpret questions, even if they are formulated specifically at the household level or at the individual level.

Considering the above-mentioned difficulty in interpreting the data, the results in Table 8 suggest a prevalence of men (114) conducting gleaning activities compared to women (41). It is usually more common for women to practice gleaning activities (Friedman et al. 2009), but this unexpected result, rather than being an artifact of the research tool, seems to be supported by the answers to other questions in this survey. This considerable difference in the number of men and women gleaners should be further explored to understand if fishing practices are changing, and if so, since when and why?

Food security and seafood availability is extremely important to communities, and relies in part on the success of SMA management to protect and conserve fish species. The survey results show that most respondents feel that the SMA programme has helped increase the number (abundance) and size of reef fish, invertebrates and pelagic species caught. This is supported by a paper that evaluated SMAs from an ecological perspective (Smallhorn-West et al. 2020), and which showed that there are benefits of SMA management to fish species (primarily food consumption species such as parrotfish) within SMAs compared to non-SMA sites.

Tongatapu has the highest population (70%) among the four island groups, and provides more job and market opportunities within Tonga, thereby allowing for an increase in the number of people and households that have more reliable income and ability to purchase fish. This could explain a higher reliance on purchased food (Table 10). Subsistence and livelihood activities are more common in the outer islands ('Eua, Ha'apai and Vava'u), which have lower economic development and fewer employment opportunities.

Natural disasters and climate change hazards pose one of the largest threats to SMA communities, and all communities have experienced increasing impacts from these in the last 10 years. Climate change impacts will increasingly affect fisheries through coral bleaching, rising sea levels and temperatures, and ocean acidification. These impacts flow down to social and community issues and adaptation methods and activities need to be developed so that they are inclusive and holistic in their approach.

Concern should be shared with other line ministries and non-governmental organisation partners regarding the ability of households to cope with natural disasters and climate change. Preparation and response measures need to be inclusive of, and led by, community members. Ensuring adaptive capacity for all stakeholders through sharing knowledge and participation in awareness programmes needs to become a priority for the safety and adaptation of all households, livelihood and economic activities to climate change.

Management support for communities is essential to the success of social and conservation objectives of the SMA. Current SMAs have a mixture of financial and human resource support, which is dependent of financing and partner organisations. Secondary activities are conducted by line ministries (e.g. environment, climate change, internal affairs), although for the benefit of the communities, shared programmes and effectiveness is important. This can be done by designing effective communication and implementation mechanisms that can be used across programmes, especially for financial management, and identifying social and environmental priorities for needs and assessment. If there are too many mechanisms to be coordinated by the community, time and effort will be limited to each activity.

Regarding data collected from the household survey, it was considered too extensive for the objectives of monitoring and evaluation of the SMA programme, and the information selected in this report is based on providing MoF with an overall evaluation across island groups and SMA age.

Not all households responded to each question needed and not all data was recorded in the tablets. This means that some questions had a very small number of responses, and the outcome is not conclusive enough to be included in this report. It is not clear from discussions why questions were missed, or why data were not included.

This survey was not intended to provide a full gender analysis of the SMA programme, and only questions that were deemed relevant were analysed by gender. Someone wishing to conduct a gender data analysis can apply directly to the MoF's chief executive officer for the data.

## 5. Recommendations

This report provides an overview of the challenges, benefits and threats faced by SMA communities, and recommendations regarding needs, further activities and assessment by MoF and regional partners (i.g. SPC and FAO). The following are recommendations for next steps.

### 5.1 Awareness

Awareness programmes that are inclusive and provide knowledge-sharing platforms are being conducted through national SMA workshops so far held in 2015, 2019 and 2021. These workshops bring together SMA community members and partners for discussions on the benefits of, and challenges to, the SMA programme. These workshops are important for SMA managers, although they may not provide a platform for the broader sharing of knowledge.

MoF currently conducts high school awareness programmes on Tongatapu, and these programmes are very important for sharing knowledge to students and youth. Expanding this programme to the outer islands (i.e. 'Eua, Ha'apai and Vava'u) would also be beneficial.

Continue discussions with the Ministry of Education on the potential for including fisheries management and conservation in primary school curricula (age 5–10 years), as this would be very beneficial to future generations.

Materials for sharing the locations of SMAs, and the rules and regulations governing them, need to be designed to ensure that community members outside of the CCMC benefit from the knowledge. Traditional communication forms (*talatalanoa* or discussion programmes) should be balanced with media (newspapers and radio) and social media channels. Some outer island areas, especially Ha'apai and Vava'u, do not yet have consistent internet, and awareness materials need to take this into account and provide other means of communicating, such as with posters and printed materials. Participants of the 2021 national SMA workshop recommended specific communication means for more remote communities, such as installing radio reception equipment and developing interactive radio programmes. This is particularly important for non-SMA communities and external fishers, so that they are aware of SMA boundaries, and they can avoid those areas or request permits from relevant managers.

Effective communications and coordination mechanisms were highlighted during the 2021 national SMA workshop to ensure that technical information reached all community members, but also to promote the sharing of information between SMA and non-SMA communities, and other relevant stakeholders, such as town officers, MoF, other government agencies, non-government stakeholders and donors. It was proposed to strengthen local communication skills, and to take advantage of ongoing gatherings such as kava and weaving groups, or church events.

### 5.2 Alternative livelihood activities

Respondents heavily supported the need for developing alternative activities for climate change adaptation, including non-fishery-based activities such as farming, handicraft-making, and livestock rearing, and can also include other niche programmes that are unique to different communities. The development of concepts for alternative activities should engage youth, women and the relevant sector, and needs further consultation and feasibility surveys. This can also create a second outcome for providing financial support for SMA communities.

Small-scale aquaculture development was not heavily supported in the household survey, although further discussion and sharing of potential species, markets and plans is needed. MoF is expanding activities on fisheries marketing and development in order to further ensure that food security and sustainable financing options are included in SMA management. Aquaculture was also widely discussed during the last national SMA workshop, underlining the importance of specific feasibility studies, social acceptance and environmental impact assessments.

## 5.3 Training

Management training for SMA communities needs to be evaluated to ensure that all SMAs have the same resource opportunities, legislation and policy. The training should be reflective of the basic needs and outputs of SMA management (e.g. catch data, compliance, monitoring and evaluation) in order to secure better support for communities.

Training of youth ambassadors, especially in compliance and monitoring, is essential to the future of SMAs and the transfer of knowledge – both traditional knowledge from elders but also using technology (e.g. GPS units, recording devices for compliance). These youth ambassadors would be very effective in ensuring that knowledge is shared.

## 5.4 Management

Monitoring and evaluation of SMAs needs to be done consistently by community and fisheries officers across all SMAs, with clear indicators for monitoring, including meeting attendance (gender and youth), conservation and management outcomes (catch data, environmental awareness, food security), and effective compliance strategies. A strategy is required for each site to involve all members of the community in different aspects of management (e.g. regulations, communications and monitoring), particularly youth and women. These clearer targets will provide greater evaluation from both a community management and a governance framework standpoint.

Expanding the SMA programme will need to include further consultation with communities and partner organisations on the best way forward from a policy and legislative standpoint, especially with regards to sharing management responsibilities, and the inclusion of landlocked communities. This will ensure that uncertainties from communities can be dealt with and best reflected in policies and frameworks.

Establishing and acting on these recommendations relies on the financial and human resources of MoF, and could create beneficial relationships with overseas and national partners. This would provide and engage wider audiences, especially through awareness and training development. Fisheries mandates, management activities and authorities for SMAs, however, will remain with MoF.

The national SMA workshop further recommended that non-fishery threats—such as climate change, mishandling of rubbish, coastal development, and others—be assessed and regulated. Fisheries management needs to be properly supported by national policies and legislation, particularly if alternative SMA models, such as the district-level SMAs, are implemented.

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Let's now talk about activities for income or for your household use. I am going to read a list of activities. Please tell me whether your household is engaged in any of them and whether they are done by men or women. I will also ask how the SMA has changed the income from these activities.

Livelihood activities <i>[ask row by row]</i>	6. Is your household engaged on a regular basis in the following activities for income, for subsistence (household use/consumption, not for sale), or both?	<i>[only ask if the household is engaged in either income or subsistence in the previous question]</i> 7. Are the activities done by men or women, or youth?	<i>[only ask if the household is engaged in income]</i> 8. How has SMA changed the income?	
<b>a</b> Fishing for reef fish	1 <input type="checkbox"/> income 2 <input type="checkbox"/> household use 3 <input type="checkbox"/> both	1 <input type="checkbox"/> men 2 <input type="checkbox"/> women 3 <input type="checkbox"/> male youth 4 <input type="checkbox"/> female youth	0 <input type="checkbox"/> no change 1 <input type="checkbox"/> decreased 2 <input type="checkbox"/> increased 99 <input type="checkbox"/> don't know	
<b>b</b> Fishing for other (pelagic and bottom) fish	1 <input type="checkbox"/> income 2 <input type="checkbox"/> household use 3 <input type="checkbox"/> both	1 <input type="checkbox"/> men 2 <input type="checkbox"/> women 3 <input type="checkbox"/> male youth 4 <input type="checkbox"/> female youth	0 <input type="checkbox"/> no change 1 <input type="checkbox"/> decreased 2 <input type="checkbox"/> increased 99 <input type="checkbox"/> don't know	
<b>c</b> Gleaning shells and invertebrates	1 <input type="checkbox"/> income 2 <input type="checkbox"/> household use 3 <input type="checkbox"/> both	1 <input type="checkbox"/> men 2 <input type="checkbox"/> women 3 <input type="checkbox"/> male youth 4 <input type="checkbox"/> female youth	0 <input type="checkbox"/> no change 1 <input type="checkbox"/> decreased 2 <input type="checkbox"/> increased 99 <input type="checkbox"/> don't know	
<b>d</b> Aquaculture	1 <input type="checkbox"/> income 2 <input type="checkbox"/> household use 3 <input type="checkbox"/> both	1 <input type="checkbox"/> men 2 <input type="checkbox"/> women 3 <input type="checkbox"/> male youth 4 <input type="checkbox"/> female youth	0 <input type="checkbox"/> no change 1 <input type="checkbox"/> decreased 2 <input type="checkbox"/> increased 99 <input type="checkbox"/> don't know	
<b>e</b> Coastal tourism-related activities	1 <input type="checkbox"/> income	1 <input type="checkbox"/> men 2 <input type="checkbox"/> women 3 <input type="checkbox"/> male youth 4 <input type="checkbox"/> female youth	0 <input type="checkbox"/> no change 1 <input type="checkbox"/> decreased 2 <input type="checkbox"/> increased 99 <input type="checkbox"/> don't know	

9a .What is the activity that produces the highest income for your household over the last year?

- 1  Fishing for reef fish
- 2  Fishing for other (pelagic and bottom) fish
- 3  Gleaning shells and invertebrates
- 4  Aquaculture
- 5  Coastal tourism-related activities
- 6  Farming/growing crops
- 7  Livestock
- 8  Handicraft
- 9  Salaried/waged employment
- 10  Own/Family business
- 11  Money from relatives (remittances)
- 12  998 Other, please specify \_\_\_\_\_

9b. What is the activity that produces **the second highest income** for your household over the last year?

- 1  Fishing for reef fish
- 2  Fishing for other (pelagic and bottom) fish
- 3  Gleaning shells and invertebrates
- 4  Aquaculture
- 5  Coastal tourism-related activities
- 6  Farming/growing crops
- 7  Livestock
- 8  Handicraft
- 9  Salaried/waged employment
- 10  Own/Family business
- 11  Money from relatives (remittances)
- 12  998 Other, please specify \_\_\_\_\_

## Section 2: well-being and resilience

Now I would like to ask how SMA has affected the different aspects of your household and community. I will first read you some statements, please let me know whether the SMA has made them worse or better, or there has been no change?

*[check respective column for answer]*

10. How has SMA affected the following?	0 No change	1 Worse	2 Better	99 don't know
1 Maintaining fish supply throughout the year				
2 Maintaining other seafood supply throughout the year				
3 Maintaining fish and seafood supply during natural disasters and/or climate change impacts				
4 Securing fish and seafood for the future generations				
5 Benefits of the catch from the SMAs to neighbouring villages.				
6 Equitable and fair access to the reefs and sea for all community members, including women, youth, minorities, poor, disabled people				
7 My household's ability to go fishing where we want just like before SMA.				
8 My household's safety as a result of healthier ecosystems that can better mitigate impacts of hazards (such as coral reef or mangrove protecting shorelines from coastal erosion or storm surge )				
9 My household's cultural heritage and traditional or customary way of life (such as traditional ways of fishing)				
10 My household's ability to work with others in the community to protect our marine and fisheries resources				
11 Relationship between our community with neighbouring landlocked communities				
12 Relationships among the younger and the older members in my household				
13 Feeling that the reefs and the ocean are a part of my life and my home.				



Now I would like to ask you about different types of hazards your household has experienced please rate the degree of impact and your household's capacity to cope with them.

Hazards <i>[ask row by row]</i>	11. Has your household experienced the following hazards within the past 5 years?  <i>if no or don't know, skip q12, q13, and q14</i>	12. How would you rate the degree of negative impact on fisheries for your household?  0 = No impact 1 = low 2 = medium 3 = high 99 = don't know  <i>[focus on negative impacts only]</i>	13. How would you rate your household's ability to cope with or adapt to it?	14. In your opinion, does SMA help mitigate impacts of any hazard?
<b>a</b> Coastal/beach erosion	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>b</b> Sea level rise	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>c</b> Increased sea surface temperature	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>d</b> Mass coral bleaching	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>e</b> Saltwater intrusion into gardens/fields/taro patches/wells/	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>f</b> Tropical storm/cyclone	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>g</b> Changes in rainy and dry seasons	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>h</b> Drought	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>i</b> Flood/land slide from heavy rain fall	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>j</b> COVID-19 <i>[check yes in q11 without asking]</i>	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know
<b>k</b> 998 Other, specify: _____	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know			0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes 99 <input type="checkbox"/> don't know

I am going to read several statements related to capacity of your household to cope with or adapt to hazards.

15. Do you agree or disagree with the following statements?	1 = Disagree	2 = Agree	99 = don't know
<b>a</b> My household is able to change fishing methods if necessary			
<b>b</b> My household is able to move to different fishing sites if necessary			
<b>c</b> My household is willing to learn and engage in different types of livelihoods in response to climate and other hazards			
<b>e</b> My household has the tools and means to sustain our livelihoods in times of difficulty			
<b>f</b> My household has friends, relatives, and other community groups who support us through difficult times.			
<b>g</b> My household responds and recovers well from extreme environmental shocks/disasters			
<b>h</b> My household fisheries are more able to recover from climate-related disasters impact today than they were 5 years ago.			
<b>i</b> My household would be willing to relocate our house away from the shoreline in order to be safer.			
<b>j</b> In my household, local and traditional knowledge for managing and sustaining fisheries are passed on from elders and parents to young people			
<b>k</b> Today, traditional knowledge and practices are adequate to help us now successfully cope with climate risks and impacts.			
<b>l</b> My household is able to get information when we need to better cope with climate impacts on fisheries			
<b>m</b> Our community members work well with each other in times of natural disasters or difficulties			
<b>n</b> Our community leaders can provide us with the resources we need to adapt to climate change			
<b>o</b> Our government can help us better cope with climate impacts			
<b>p</b> NGOs/CSOs can help us better cope with climate impacts			
<b>q</b> I would like to do more to help sustain our fisheries			

16. Please rate your household's level of need for the following in order to cope with climate impacts on fisheries.

	0 = No need	1 = Low need	2 = Medium need	3 = High need	99 = don't know
<b>a</b> Improved knowledge and awareness of climate change impacts					
<b>b</b> Alternatives for non-fisheries livelihoods (for ex. tourism, handicraft, farming)					
<b>c</b> (Small-scale) aquaculture					
<b>d</b> FADs deployment and associated training					
<b>e</b> Safety at sea training					
<b>f</b> Improved enforcement in our SMA					
<b>g</b> Additional/revised rules and regulations to better protect and sustain fisheries resources					
<b>h</b> Improved ways for fisheries handling, processing, and storing (e.g. cold storage, solar equipment)					
<b>i</b> Insurance for loss/damage					
<b>j</b> Loans or micro-finance products to buy fisheries assets (for instance gears, boat etc.)					
<b>k</b> Other, please specify _____					

17. In times of difficulty, who or what among the following would your household mainly depend on? *[please check all that apply.]*

- 1  Skills and savings of our household members
- 2  Family and friends
- 3  Other community members
- 4  Village leader
- 5  Government
- 6  God/Church
- 7  NGOs, CSOs,
- 998  Other, please specify \_\_\_\_\_

## Section 3: management effectiveness

Now I would like to ask you questions related to SMA management.

24. Please rate the following for your household.

	Rating
<b>a</b> Level of support to SMAs	1 <input type="checkbox"/> Low    2 <input type="checkbox"/> Moderate    3 <input type="checkbox"/> High    99 <input type="checkbox"/> Don't know
<b>b</b> Level of support to FHRs	1 <input type="checkbox"/> Low    2 <input type="checkbox"/> Moderate    3 <input type="checkbox"/> High    99 <input type="checkbox"/> Don't know
<b>c</b> Level of satisfaction of SMAs	1 <input type="checkbox"/> Low    2 <input type="checkbox"/> Moderate    3 <input type="checkbox"/> High    99 <input type="checkbox"/> Don't know

25. How has SMA affected the following?	0 = No change	1 = Worse	2 = Better	99 = I don't know
<b>a</b> My household's participation in planning and decision making related to marine resource management.				
<b>b</b> Access and availability of information that allow my household to better manage coastal and marine resources.				
<b>c</b> Community's ability to manage fisheries resources				
<b>d</b> Customary and traditional ways of managing fisheries being strengthened				
<b>e</b> Use of local knowledge to inform management decision making				
<b>f</b> Poaching or illegal trespassing by non-registered fishers and fishing vessels authorized to fish in SMA				
<b>g</b> Effectiveness of enforcing community-based rules and regulations to protect fisheries resources				
<b>h</b> Use of destructive fishing methods, e.g. metal bars, iron rods				
<b>i</b> Harvest of marine life for aquarium industry, including hard coral, soft coral, small inverts, and aquarium fish				
<b>j</b> Protection or restoration of habitat				
<b>k</b> Protection or restoration of species				
<b>l</b> My household's rights and ownership of fisheries resources				
<b>m</b> Right to fisheries resources of surrounding communities, especially those who are landlocked				
<b>n</b> Recognition and respect of women's knowledge, experiences, and skills in fisheries				
<b>o</b> Inclusion of women in fisheries management decision making and leadership				
<b>p</b> Responsibility among the youth to look after the SMA.				

27. How has SMA impacted fishing conflicts?	
a Within village	0 <input type="checkbox"/> No impact    1 <input type="checkbox"/> decreased impact    2 <input type="checkbox"/> increased impact    99 <input type="checkbox"/> Don't know
b With other SMA villages	0 <input type="checkbox"/> No impact    1 <input type="checkbox"/> decreased impact    2 <input type="checkbox"/> increased impact    99 <input type="checkbox"/> Don't know
c With landlocked villages	0 <input type="checkbox"/> No impact    1 <input type="checkbox"/> decreased impact    2 <input type="checkbox"/> increased impact    99 <input type="checkbox"/> Don't know

28. What does your household consider to be the top 3 threats to coastal and marine resources in your community? *[Do not read choices. Check only three answers.]*

- 1  Overfishing
- 2  Poaching/fishing in FHR (no take area in the SMA)
- 3  Inadequate enforcement
- 4  Lack of awareness of rules and regulations of SMA
- 5  Breakdown of traditional fishing rights/practices
- 6  Crown of thorns
- 7  Invasive species
- 8  Trash/marine debris
- 9  Pollution and runoff
- 10  Infrastructure development
- 11  Dredging/mining of sand and corals
- 12  Clearing mangrove
- 13  Sedimentation
- 14  Damage from boats and anchors
- 15  More dependent on cash base economy
- 16  Coral bleaching
- 17  Natural disasters (e.g. cyclone)
- 18  Climate change (e.g. hotter air or sea temperatures)
- 19  COVID-19
- 998  Others, specify: \_\_\_\_\_

29. What do you see as the 3 biggest problems or challenges with the way SMAs are managed? *[Do not read choices. Check only three answers]*

- 1  No problem
- 2  Reduced access to marine resources
- 3  Lack of funding
- 4  Lack of communication on SMA rules, regulations, or management plans
- 5  Weak enforcement of rules and regulations
- 6  Lack of participation and ownership by community members
- 7  Traditional/customary rules and regulations to protect marine resources are not followed
- 8  Conflicts with other communities nearby
- 9  Conflicts within the community
- 10  Lack of ability to set up a SMA
- 11  Strained relationships with nearby communities
- 998  Others, specify: \_\_\_\_\_

30. Have you participated in the following trainings linked to SMA. If yes, what do you rate your knowledge gained from it?	Participated?	31. What is the level of your knowledge gain from the training?
<b>a</b> FADs	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes	1 <input type="checkbox"/> low 2 <input type="checkbox"/> medium 3 <input type="checkbox"/> high
<b>b</b> Small-scale fishing training	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes	1 <input type="checkbox"/> low 2 <input type="checkbox"/> medium 3 <input type="checkbox"/> high
<b>c</b> Fisheries management	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes	1 <input type="checkbox"/> low 2 <input type="checkbox"/> medium 3 <input type="checkbox"/> high
<b>d</b> Seafood post-harvest activities	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes	1 <input type="checkbox"/> low 2 <input type="checkbox"/> medium 3 <input type="checkbox"/> high
<b>e</b> Safety at sea and using fishing gear in a safe manner	0 <input type="checkbox"/> no 1 <input type="checkbox"/> yes	1 <input type="checkbox"/> low 2 <input type="checkbox"/> medium 3 <input type="checkbox"/> high

32. What type of information would help you be better informed of the SMA program?  
*[Check all that apply.]*

- 1  Location of SMAs
- 2  SMA regulations
- 3  How to be involved in SMA
- 4  How to apply for access to fish in an SMA

998  Others, specify: \_\_\_\_\_

Now let me ask you a couple of questions about District-level SMAs.

*[read the definitions of district and district-level SMA]*

**DISTRICT** means electoral constituency

**DISTRICT-LEVEL SMA** means where more than one community manages a SMA – it could be a combination of coastal communities or with landlocked communities.

33. If the law permitted, do you think it is a good idea to have SMAs combined and managed by more than one community? (district-level SMAs)

0  no      1  yes      99  don't know

34. Do you think landlocked communities should be given an opportunity to be part of an SMA under a district-level SMA?

0  no      1  yes      99  don't know

## Section 4: fisheries resources

*[this section will be answered only by those who are involved in fisheries at least one answer (income, household use or both) in q6 a, b, or c]*

35. Have you been involved with fisheries activities for an average of at least once a month for the past 5 years? The activities include fishing, catching, processing or selling finfish and other seafoods.

0  No *[if no, skip to section 5 demographic]*      1  Yes

36. Do you yourself participate in the following activities?

- 1  Reef fishing
- 2  Gleaning nearshore for shells and invertebrates
- 3  Pelagic and bottom fishing
- 4  Aquaculture

37. How has SMA changed the health of the following marine habitats in the SMA area?

a Reef	0 <input type="checkbox"/> no effect	1 <input type="checkbox"/> made worse	2 <input type="checkbox"/> made better	99 <input type="checkbox"/> don't know
b Lagoon	0 <input type="checkbox"/> no effect	1 <input type="checkbox"/> made worse	2 <input type="checkbox"/> made better	99 <input type="checkbox"/> don't know
c Mangrove and Estuarine	0 <input type="checkbox"/> no effect	1 <input type="checkbox"/> made worse	2 <input type="checkbox"/> made better	99 <input type="checkbox"/> don't know
d Deep reef	0 <input type="checkbox"/> no effect	1 <input type="checkbox"/> made worse	2 <input type="checkbox"/> made better	99 <input type="checkbox"/> don't know
e Seagrass	0 <input type="checkbox"/> no effect	1 <input type="checkbox"/> made worse	2 <input type="checkbox"/> made better	99 <input type="checkbox"/> don't know

Now I would like to ask you about different aspects fisheries within your SMA? these are about your general impression and do not apply to a specific type/species.

38. Compared to before SMA, how has SMA changed the following?

a Number of household members who fish or harvest seafood	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
b Number of household members who sell/trade seafood	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
c Number of reef fish caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
d Size of reef fish caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
e Number of other (pelagic or bottom) fish caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
f Size of other fish (pelagic or bottom) fish caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
g Number of shells and invertebrates caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
h Size of shells and invertebrates caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
i Commercial value of species of fish caught	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
j Price of seafood when we sell	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
k Price of seafoods when we buy from the market	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
l Fishing/harvesting costs/expenses	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
m Fishing/harvesting frequency	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
n Access to fishing/harvesting site	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
o Distance to fishing/harvesting site	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
p Fishing/harvesting time	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
q Fishing/harvesting safety	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
r Freshness of locally sourced seafood	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know
s Abundance of sea life that is culturally important	0 <input type="checkbox"/> same	1 <input type="checkbox"/> lower	2 <input type="checkbox"/> higher	99 <input type="checkbox"/> don't know



## Section 5: demographic

*[If more than one person participates in the survey, record the demographic info of the person who answered the most. If participation is equal, have the respondents decide whose demographic data will be recorded].*

We are almost done. This last section is about demographic information. Please remember, you do not have to answer any question that you don't want to.

40. What is your age? \_\_\_\_\_ years old.

41. Sex of the respondent *[check without asking]*    1  male    2  female

42. What is your marital status?

1  Single    2  Married    3  Divorced    4  Widowed

43. How many people in your household are in the following age groups?

- 1  Children under 18 \_\_\_\_\_
- 2  Male adults (18 and older) \_\_\_\_\_
- 3  Female adults (18 and older) \_\_\_\_\_
- 4  Total household members = \_\_\_\_\_

44. What is your highest level of education?

- 1  No formal education
- 2  Elementary school
- 3  High school
- 4  Community college
- 5  Some university, no degree

45. What is your primary occupation?

- 1  Government employee
- 2  Private company/sector employee
- 3  Businessmen/women
- 4  Retiree
- 5  Farmer
- 6  Fisher
- 998  Other, specify: \_\_\_\_\_

46. Which of the following situation best describe your household economic condition?

- 1  Your household income is not enough to cover basic expenses of your household.
- 2  Your household income is just enough to cover basic expenses of your household.
- 3  You household income covers basic expenses of your household and you have saving.

47. How long have your household lived in the community where you now reside?  
\_\_\_\_\_ years.

That completes the survey.

Thank you for your time and participation. We greatly appreciate it.

# Annex 2: Statistical analysis

Statistical analysis to understand why a few respondents expressed less support for SMAs

Several indicators relating to rights and access to resources showed similar patterns (Chronbach's alpha 0.8), where women were slightly less positive than men about the improvement of conditions since the establishment of the SMA (Fig. A). This in turn was related to a somewhat diminished support for the SMAs in general, and the no-take areas (fish habitat reserves) within SMAs in particular (Fig. B and Table A). The proportion of unsatisfied people is low, but it is worth paying attention to unsatisfied sections of communities to understand their source of discontent and, if feasible, address any issues.

It is worth noting that most of the hesitancy or negativity about the benefits of the SMA programme came from middle-aged SMAs, which were overrepresented in Tongatapu. This was the reason for running some of the analyses using Tongatapu as a factor; it was found that it was, in fact, a key aspect behind some observed differences. In contrast, respondents from older SMAs seemed to be considerably more certain about the benefits of the SMA programme, and in the example in Figure B, 100% of participants from older SMAs (27 women and 33 men) supported fish habitat reserves.

The higher support could potentially be explained by the structure of the SMA programme, where Coastal Community Management Committees (CCMC) must include women and a female youth representative. While all SMAs, from young to old, have such committees, it is likely that in the case of older SMAs, women have had more time to become empowered, resulting in increased engagement and support. The Ministry of Fisheries reports that levels of women's participation are variable, so an effort will be required to understand what lies behind these differences, so that in the upscaling of the SMA programme, issues can be addressed, and strengths can be enhanced. It is also worth noting that there might be other factors beyond gender, such as socioeconomic status, religion, ethnicity, and others, and these might be behind some of the discontent. A specific effort should be made to take into consideration any factor that might disadvantage specific groups.

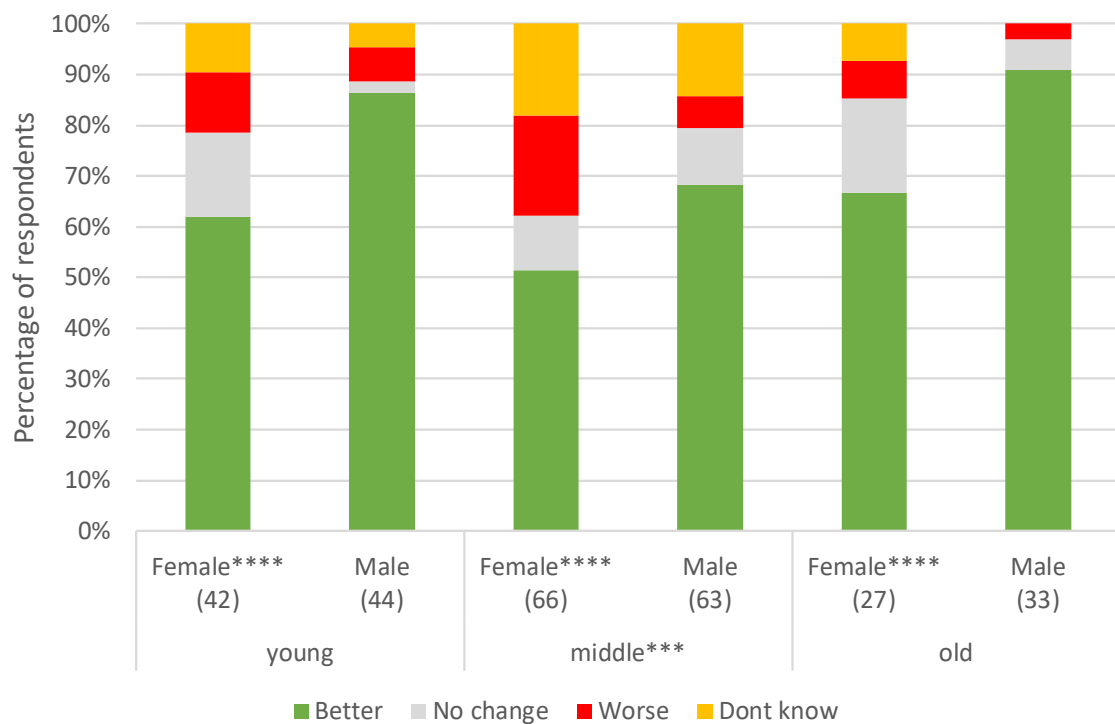


Figure A. Perceived effects of SMAs on rights and ownership of resources. Numbers in brackets correspond to sample size (SMA age by gender); total number of respondents is 275. \*\*\* indicates significant differences at the 99% confidence interval ( $p < 0.01$ ) and \*\*\*\* ( $p < 0.001$ ).

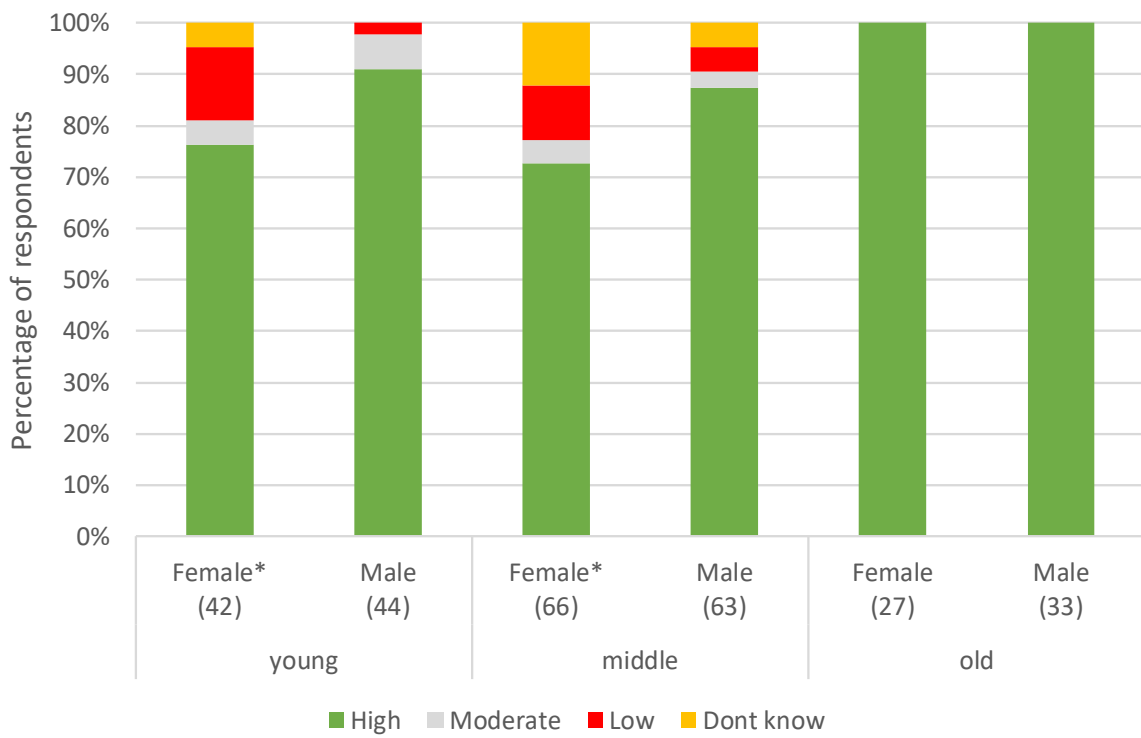


Figure B. Level of support for fish habitat reserves (FHR). Numbers in brackets correspond to sample size (SMA age by gender); total number of respondents is 275. \* indicates significant differences at the 90% confidence interval ( $p < 0.1$ ).

Table A. Summary of analyses performed. Total number of respondents is 275. It is important to note that when the analyses were run with only active fishers (N=120), most of these differences were not detected.

Variables related to the effect of SMAs on:	Factors			
	SMA age	Tongatapu	Gender	Socioeconomic status
<b>Ability to fish where we want</b>	*** Z=2.648 p<0.01 (middle-aged SMAs were less positive)	Not included	** Z=-2.145 p<0.05 (women were less positive)	No difference
<b>Fair and equitable access to reefs and sea</b>	** Z=2.172 p<0.05 (middle-aged SMAs were less positive)	Not included	** Z=-2.278 p<0.05 (women were less positive)	No difference
<b>Rights and ownership of resources</b>	*** Z=2.649 p<0.01 (middle-aged SMAs were less positive)	Not included	**** Z=-3.729 p<0.001 (women were less positive)	No difference
<b>Participation in planning and decision making</b>	No difference	*** Z=3.009 P<0.01 (Tongatapu was less positive)	*** Z=-2.764 p<0.001 (women were less positive)	Not included
<b>Recognition of women's knowledge, experiences and skills</b>	No difference	** Z=2.300 p<0.05 (Tongatapu was less positive)	No difference	Not included
<b>Inclusion of women in decision making</b>	No difference	*** Z=2.896 p<0.01 (Tongatapu was less positive)	* Z=-1.684 p<0.1 (women were less positive)	Not included
<b>Satisfaction with SMAs</b>	* Z=-1.677 p<0.1 (middle-aged SMAs were less positive)	Not included	* Z=1.783 p<0.1 (women were less positive)	Not included
<b>Support of SMAs</b>	No difference	No difference	* Z=1.744 p<0.1 (women were less positive)	Not included
<b>Support of FHRs</b>	No difference	Not included	* Z=1.842 p<0.1 (women were less positive)	No difference







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