

Report of a household fisheries and dietary survey October - November 2000

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Introduction

Samoa consists of two larger main islands, Upolu (1108 sq. km.) and Savaii (1695 sq. km.) as well as seven small islands, all located in a relatively small area of the Pacific Ocean, between 13° 25'S -14° 05'S and 171° 23'W-142° 48'W. Owing to the proximity of near neighbors, it has the smallest Exclusive Economic Zone in the Pacific, at only 130,000 sq. km. The present population is around 175,000 (Upolu, 132,000. Savaii 43,000), with an urban population in the Apia area of 39,000.

Fisheries play an extremely important role in the economy of the islands. They are a major earner of foreign revenue for the country, with reported fish exports in the year 2000 of around 4500 metric tons (mt) worth SAT40 million)¹. This is equivalent to between 60% and 70% of the total value of all Samoan exports.

Apart from their commercial importance, the fisheries of Samoa are also of major subsistence importance, contributing significantly to the health and nutrition of the people. This paper documents the important marine resources, fishing methods, and fisheries habitats, and shows to what level these are significant to the people. It places fresh seafood consumption into perspective with regard to consumption of other sources of animal protein such as meat and canned foods, and allows a value to be estimated for the subsistence resources.

Information for the report was obtained by conducting a survey of 5% of the population from a cross section of villages over a three-week period in late 2000. Some comparative historical information was available from several earlier surveys conducted within the past 25 years^{2,3,4,5,6,7,8}.

A stratified sampling strategy was adopted in order to allow more effort to be expended in surveying households more likely to engage in fishing. One major factor affecting fishing and fish consumption was likely to be the distance of the village from the coast. It was also possible that seafood catches may vary by coastal habitat, e.g. mangroves, lagoons, and cliffs. The survey was designed to take these possible variations into account.

Samoa village demography

The population of Samoa is spread throughout 21,424 households in 326 villages on four islands. About two thirds of these villages are on the island of Upolu, and one third on Savaii, with only a small number of villages on the other two inhabited islands, Manono and Apolima. The Statistics Department classifies about 18% of these villages, containing around 22% of the total number of households as urban.

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The number of households per village varied from a low of four to a high of 575, with an average of 65. The average number of people per household in 2000 was 8.2⁹. This equates to a total population of approximately 175,000. Table 1 gives a breakdown of Samoan villages by strata.

Location	Upolu		Savaii		Total	
	Villages	Households	Villages	Households	Villages	Households
Cliff	0	0	19	971	19	971
Inland	80	5371	18	749	98	6120
Lagoon	87	5502	49	2609	136	8111
Mangrove	57	5374	16	848	73	6222
TOTAL	224	16247	102	5177	326	21424

Table 1. Numbers of Samoan villages and households by strata

Household survey methodology

Survey design

The sampling methodology was designed over a period of several months by project and counterpart staff in early to mid 2000, with additional advice sought from the SPC Statistical Unit in Noumea. The questionnaire was designed by Fisheries Division and Project staff, in collaboration with the Samoa Statistics Department. Careful consideration was given to designing the questions in a way that would facilitate the collection of useable data from the households.

Village and household selection

Using information from the Agricultural Census 1989¹⁰, a fishing index was calculated for each village based on the number of fishing trips per week in the village. This index was used to stratify villages for sampling, so that less effort was afforded strata where fishing was rare, and greater effort was placed in villages where fishing was common. Villages were randomly selected within each stratum. The final number of villages selected was 66, consisting of 40 for Upolu, and 26 for Savaii, which represented 20% of all Samoan villages.

In order to further reduce the number of households to be surveyed to a more manageable sample, the number of households to sample in each village was determined as follows.

- Less than 50 households, sample 50% of all households.
- Between 50 and 99 households, sample 20% of all households.
- More than 100 households, sample 10% of all households.

This resulted in 1092 households in total, or 5% of total Samoan households. Figure 1 shows the distribution of the 66 villages around Samoa.

Enumerators were left to select individual households such that the required number of households in each village was sampled. For example, if 20% of households in a village were to be sampled, enumerators would select approximately every fifth household.

Population

The total number of households surveyed was 1092, consisting of 689 in Upolu and Manono, and 403 in Savaii. The total number of people included in the households was 9090, made up of 5818 from Upolu, including Manono, and 3272 for Savaii.

Appropriate weights were applied to raise all figures obtained for the sampled population to figures representing the total Samoan population. Table 2 shows the figures obtained for the sampled population, as well as the raised figures.

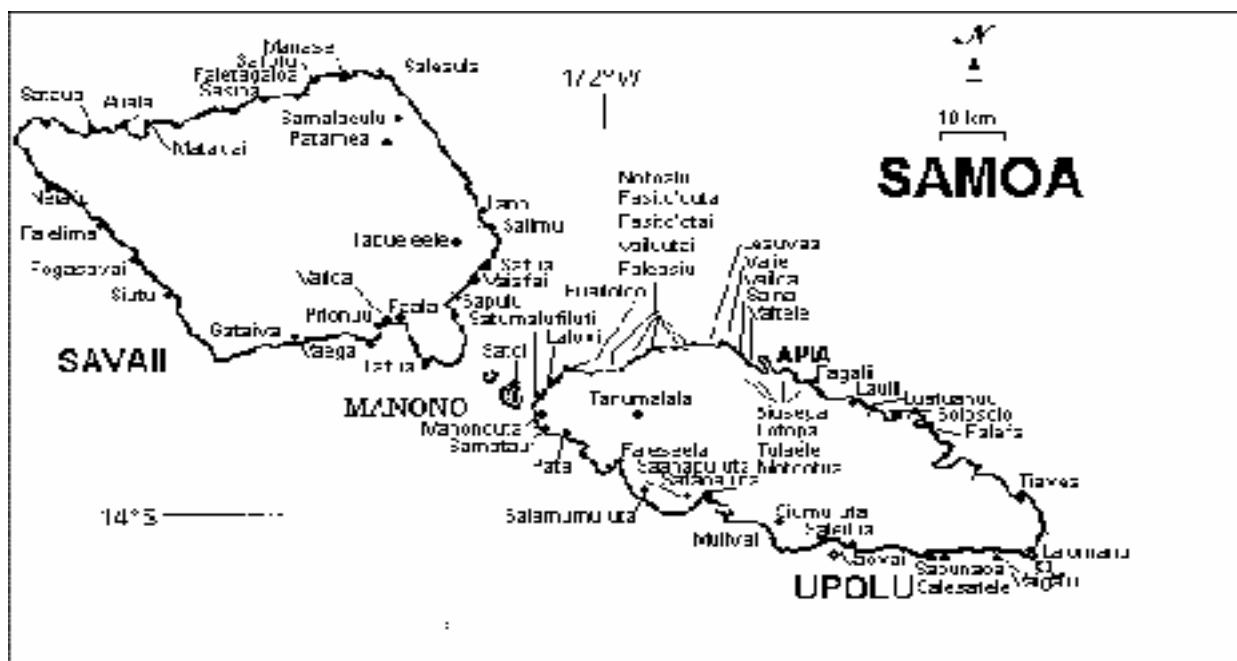


Figure 1. Map of Samoa showing locations of surveyed villages.

Island	Sampled no. of hh	Raised no. of hh	Sampled population	Raised population	Av. Household population
Upolu	689	16,223	5,818	131,866	8.13
Savaii	403	5,240	3,272	42,734	8.16
Samoa	1,092	21,463 ¹	9,090	174,600	8.14

Table 2. Population estimates based on the survey results. Note that there is a slight variation from the number of households reported in Table 1. This is probably due to rounding errors when using P. of S. weights for each village.

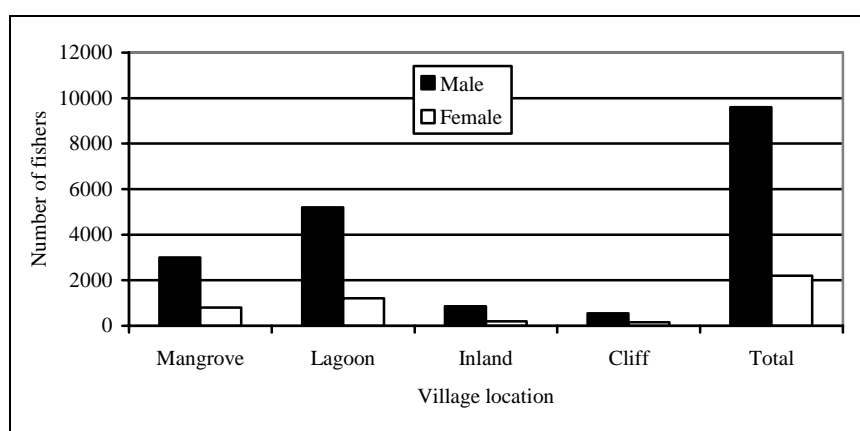


Figure 2. Number of male and female fishers in each stratum

Fishing activities

The survey indicated that there are 8,377 fishing households in Samoa. Within these households, there are 11,700 fishers, made up of 9,600 males and 2,100 females. Figure 2 shows the number of fishers for each stratum for this survey.

Fishing methods

Figure 3 shows the percentage use of the various fishing methods, both by time spent fishing, and the total number of trips. The most common fishing method both by time spent and number of trips is diving and spearing.

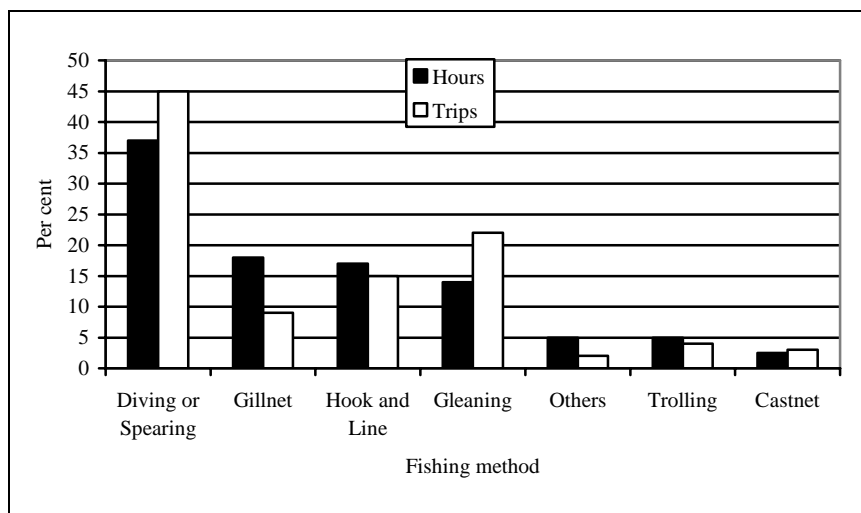


Figure 3. Percentage of each fishing method by number of trips and by total hours

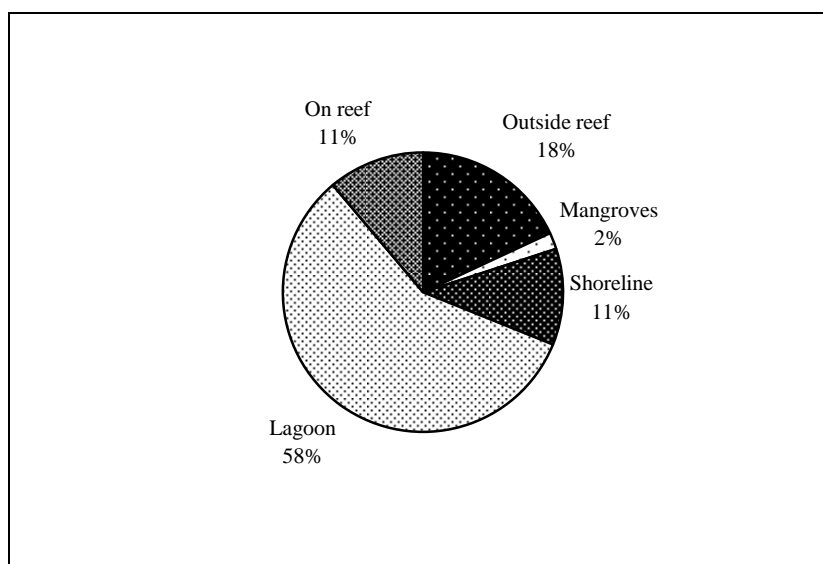


Figure 4. Reported percentage of fishing trips in each type of fishing area

Fishing location

The proportion of total fishing trips undertaken in each of the fishing zones is shown in Figure 4. Inshore fishing trips comprise 82% of the total. Only 18% of trips are undertaken outside the reef. Most of these are likely to be diving and spearing on the reef edge, or

fishing close to the reef from canoes, as very few fishers have access to boats that can safely fish far offshore. Note that Figure 4 represents the frequency of fishing trips, and not the time spent in each location. Time spent in each location is shown in Table 3.

Catch and effort

The total seafood catch reported from the survey was 7169 tons. The average CPUE for all fishing was 2.05kg/person/hr fished. Table 4 gives the breakdown for the seafood catch and the CPUE for the different strata. This shows that 29% of the seafood caught is classed as offshore. This includes bottom fish caught over the reef, as well as tuna and other pelagic species. Villages in the Fisheries Project catch a higher proportion of offshore species, reflecting the fact that they spend more time fishing outside the reef than do Non-Project villages (Table 3). This could be attributable to the efforts of the Village Fishery Management Advisory Committees (VFMACs), to shift effort from the depleted lagoon resources to the offshore resources¹¹.

Village Strata	Mangrove	Shoreline	Lagoon	On reef	Outside reef
Inland	0.8	2.7	59	12	25.6
Cliff	0.0	16.0	57.1	3.0	23.9
Mangrove	2.7	9.5	51.3	10.3	26.2
Lagoons	0.6	11.5	44.8	12.5	30.8
Upolu	1.5	9.9	51.1	12	25.6
Savaii	0.7	11.5	41.4	9.8	36.7
Project	0.7	10.3	38.2	15.6	35.1
Non project	1.5	11.2	51.3	9.5	26.4
Samoa total	1.3	10.3	48.3	11.4	28.7

Table 3. Percentage of total time spent at each fishing location

Village Strata	Inshore fish	Offshore fish	Crustacean	Mollusks	Other Inverts	Seaweed	CPUE kg/hr
Inland	59.8	12.2	4.7	16.9	6.4	0.0	2.25
Cliff	60.2	11.1	0.7	25.9	2.1	0.0	1.63
Mangrove	46.0	34.2	2.3	11.7	5.5	0.4	2.12
Lagoons	41.0	29.4	3.0	17.9	8.2	0.5	2.00
Upolu	46.4	28.7	3.2	13.2	7.9	0.6	1.99
Savaii	40.8	29.6	2.2	22.4	4.9	0.1	2.19
Project	32.9	42.6	1.5	14.2	8.0	0.8	2.80
Non project	50.6	22.3	3.6	17.0	6.4	0.2	1.77
Samoa total	44.8	29.0	2.9	15.9	7.0	0.4	2.05

Table 4. Seafood catch (% of total) by broad category of seafood, and total CPUE

Villages with management plans developed under the Project initiated community based fisheries management programme reported a catch rate of 2.8kg/hr, 40% higher than the average, and 55% higher than that for villages without management plans, as can be seen in Figure 5. This may be attributable to the fact that these villages are effectively managing their own fisheries, but may also be due to other factors, such as villages with the most productive marine areas seeing good reason in joining the village fishery management project in order to maintain what they had.

Women's fishing

The survey found that 18% of all fishers are females, responsible for about 10% of the total fishing effort. The average trip length for women was three hours, compared with four hours for men. Observations in the villages suggest that women mainly glean for invertebrates along the shoreline. Exceptions are women diving, sometimes from canoes, for invertebrates such as sea cumpers, jellyfish, sea urchins, and for seaweed.

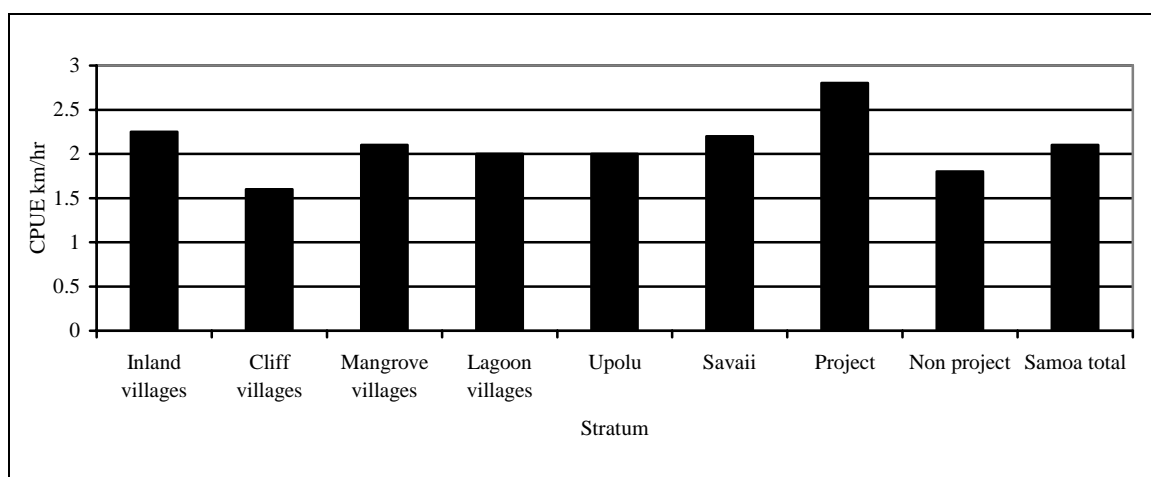


Figure 5: Catch per unit effort (kg/person/hr) for each stratum.

Despite the lower effort expended by women, it is likely that they harvest around 23% of the total weight of seafood, assuming they are responsible for collecting most of the shell fish and other invertebrates harvested in the villages. Women are also the major contributors to post harvest processing of both men and women's catch.

Subsistence consumption

Seafood

Annual subsistence consumption of seafood was estimated to be 9,971 tons for 2001. This was determined by multiplying the total number of meals of seafood consumed by a portion size of 366g per adult, and 188g per child under 15yrs. This portion size was ascertained by a separate questionnaire survey of Fisheries Division staff, and refers to the whole weight of the fish (not flesh only). It is assumed that most of the fish consumed that was in excess of the village catch was purchased through commercial outlets, and came from bycatch from the commercial longline fishery. The survey indicated that 7169 tons of this seafood was caught in the villages. The different seafood varieties consumed are shown in Table 5.

Strata	Crustacean	Mollusk	Other Inverts	Seaweed	Lagoon fish	Red fish	Pelagic fish
Cliff	4.6	7.9	4.9	0.1	28.4	46.2	7.9
Inland	7.3	6.0	6.4	3.1	24.0	35.3	17.9
Lagoon	5.1	8.3	8.0	1.8	30.9	38.8	7.1
Mangrove	5.3	7.6	8.4	3.1	32.1	36.3	7.1
Savaii	5.1	7.7	5.8	0.4	29.3	44.6	7.1
Upolu	5.9	7.4	8.1	2.9	29.4	35.6	10.6
Samoa	5.7	7.5	7.6	2.4	29.4	37.5	9.9

Table 5. Percentage of total meals consumed containing various seafood groups

Figure 6 shows the percentage of total meals made up by each of the various seafood groups for all strata combined. Finfish comprise approximately 77% of all seafood consumed, with invertebrates and seaweed making up the other 23%. The only notable variation across strata is shown in the inland villages, where pelagic fish comprised 18% of the total.

Of the inland villages surveyed 44% were in or near the Apia urban area. It is therefore likely that pelagic fish are more commonly eaten in inland villages because inland villagers are more likely to purchase their fish from the Apia Municipal fish market, where pelagic species are generally cheaper to buy than reef or lagoon fish.

Seafood consumption can be further broken down within these larger groups. Figure 7 shows the nature of consumption in more specific categories. The most commonly eaten seafood species are surgeonfishes, locally known as *pone* *Ctenochaetus striatus* and *alogo* *Acanthurus lineatus*.

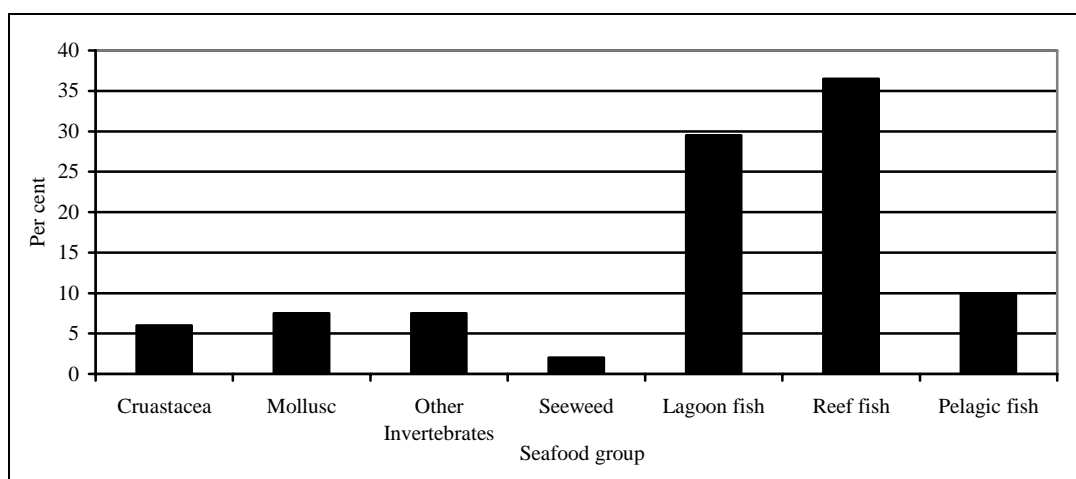


Figure 6: Percentage of total meals containing various seafood groups, Samoa

In the inland stratum, tuna is the single most common type of fish eaten, the only stratum where surgeon fish do not dominate. Other pelagic fish are also more commonly eaten in the inland villages, adding further support to the theory that these villages obtain most of their seafood from the fish market where bycatch from the longline fishery is sold.

Jellyfish (*alualu*), which would be considered by many nationalities as a somewhat unusual food, was reported to be eaten at a surprisingly high number of occasions, and in fact more often than giant clams (*faisua*).

Note that snapshot surveys of this nature are unlikely to pick up any seasonal variation in catches. This survey was undertaken in October/November, and seafood types that were reported to be consumed rarely may be consumed more often at other times. For example, scad consumption was fairly low for this survey, whereas if the survey had been conducted in March/April, when *atule* are abundant, it may have produced higher figures. Another seasonal species is *palolo*, reported to be eaten by 60% of all households, but only once or twice per year, in October and November.

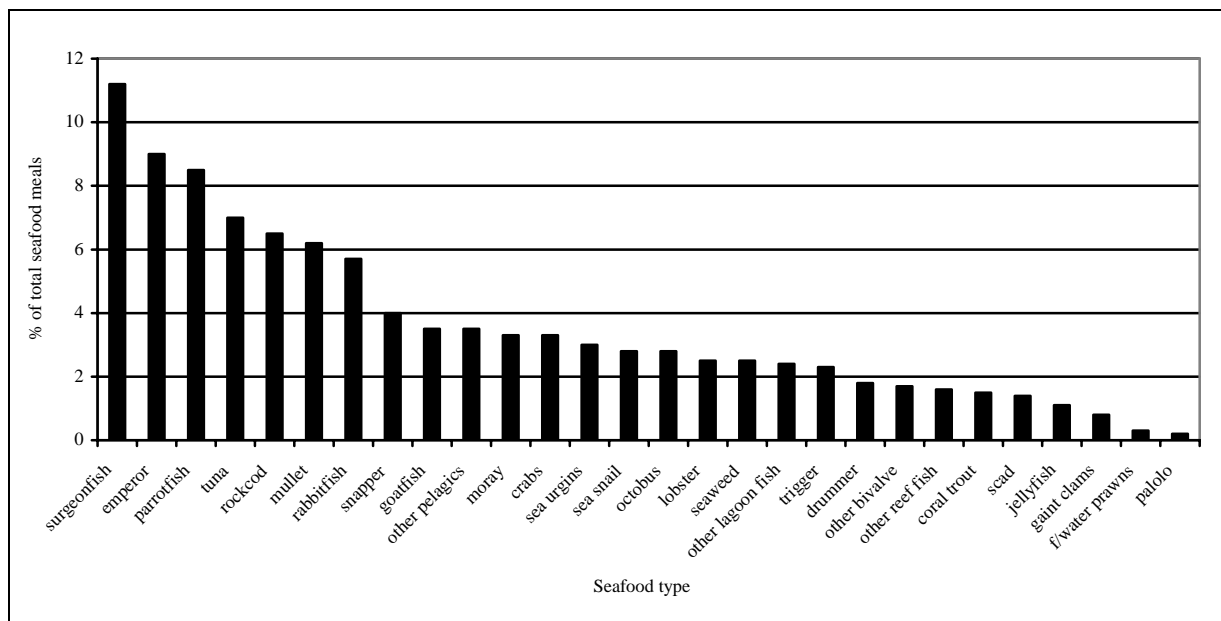


Figure 7. Percentage of meals containing specific seafood types, Samoa.

Seafood consumption per capita

Figure 8 shows the per capita consumption of seafood for the various strata, with 57kg being the overall average for Samoa¹. This is made up of approximately 44kg of fish, and 13kg of invertebrates and seaweed. This is much higher than the world average per capita consumption of fish of around 12kg².

In 1991 it was estimated that fish consumption per capita in Upolu was approximately 21.5 kg per capita, i.e. a subsistence catch of 2,260 mt for the year⁵. The subsistence catch for Savaii has likewise been estimated at around 1400 mt, or 35 kg per capita, for the same period^{6,7}. The total subsistence catch was estimated at 4,600 tons in 1989, or around 30 kg per capita, by collecting data from school students issued with a one week fishing diary⁴.

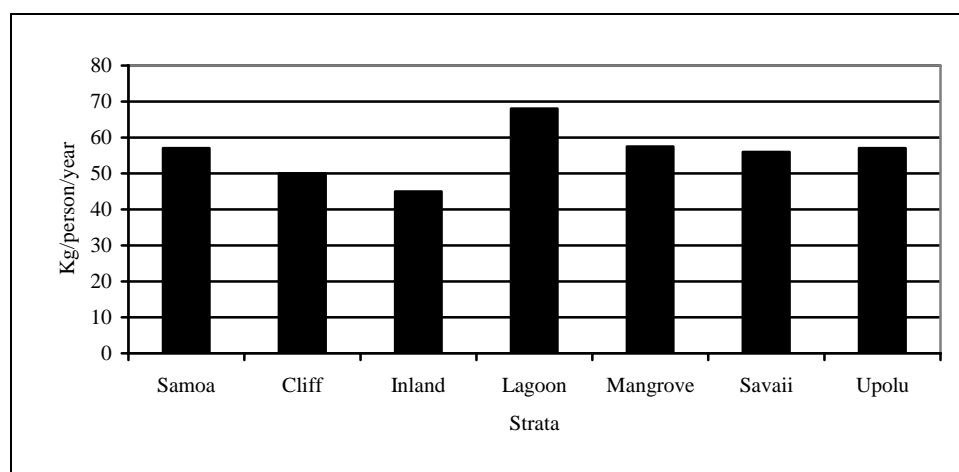


Figure 8: Seafood consumption per capita for each stratum

The higher per capita fish consumption reported from this survey (57 kg) compared to earlier surveys may be partly attributed to the large increase in the commercial longline fishery, and the associated influx of bycatch to the local market. Although high, this consumption rate is not inconsistent with other per capita fish consumption reported for the Pacific³. As would be expected, inland villages consume significantly less seafood than coastal villages.

Other sources of animal protein

In order to determine the relative importance of seafood in the Samoan diet, the survey also gathered information on consumption of other major sources of animal protein. Overall canned fish consumption for Samoa was 14kg per capita, tinned meat consumption was 5.7kg per capita and consumption of other fresh or frozen meat, including mutton flaps, chicken, sausages, salted beef etc was 94kg per capita.

The inland stratum shows the highest consumption of other meats. Rural inland villages are likely to replace fishing activities with farming activities and rely more on local produce such as chicken, pork and occasionally beef than on seafood.

Figure 9 shows the total combined protein consumption (excluding such items as eggs and milk not covered in the survey) for each stratum. This shows an overall figure of 171kg per capita for Samoa. Approximately one third of this comes from seafood. The figures are fairly uniform across all strata though the cliff villages do appear to be a little lower than the others. This may be due to small sample size (2villages, 22 households).

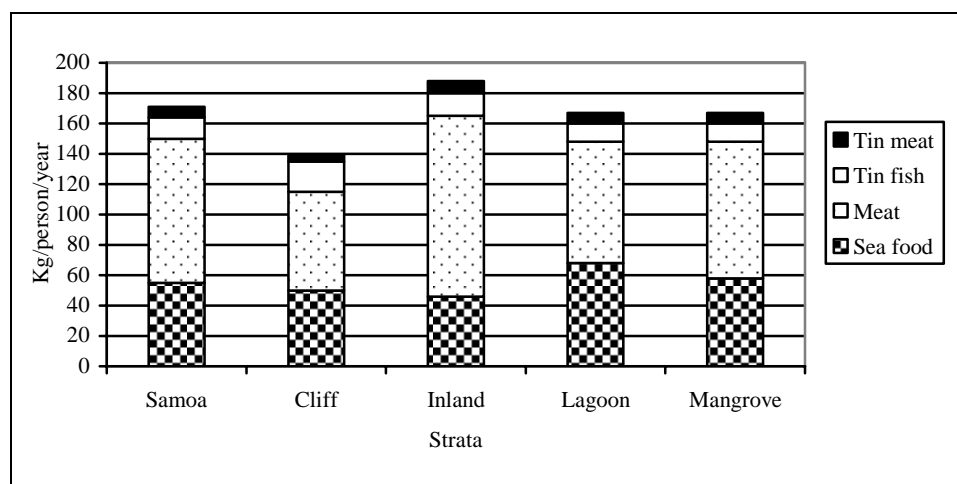


Figure 9: Total annual protein consumption per capita by strata

Values of marine resources

Allocating a dollar value to the consumed seafood allows for an approximation of the value of marine resources to the village economy to be made. A comparison can also be made with the value of other sources of animal protein in the household economy. The following figures are used to calculate these values:

Seafood – An average value of ST16.29 per kg of consumed seafood was calculated, based on the proportions of different seafood types reported to be consumed and a weighted average price for seafood in the Apia markets.

Canned fish – This was valued at establishes an approximate value of the ST4.40 per kg, based on ST2 for a 3453g tin

Canned meat – This was valued at ST15.40 per kg based on an average price of ST7.00 per 450g for the cheaper brands.

Other meat – An average value for meat of ST4.69 per kg based on 362 instances where value and weight of meat consumed were given in the survey, were given, with the 10 highest and 10 lowest excluded as outliers.

Figure 10 shows the relative values of these commodities as well as the total weights consumed. Note that preliminary figures available from the Statistic Department for canned fish imports for the year 2000 are about 30% below those obtained from the survey.

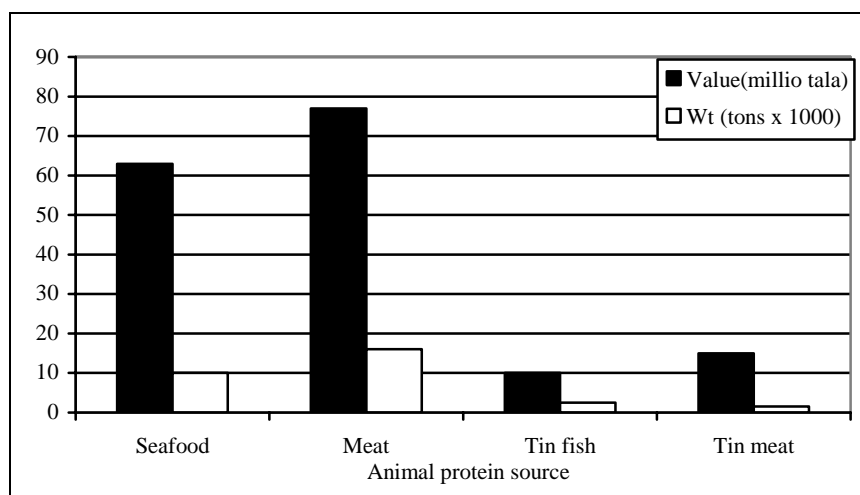


Figure 10: Value in millions of tala and weight in thousands of tons for the major sources of animal protein

Discussion and conclusion

The household survey has documented the importance of seafood in the diet of the Samoan people. It establishes an approximate value of the consumed seafood of over ST60 million per year. When added to the value of fishery exports the gross value of Samoa's marine resources is around ST100 million per year.

The village level fishers harvest seafood weighing 7169 tons, valued at approximately ST145 million. This fishery can be considered to be the most important component of Samoa's fisheries to the Samoan economy. The cost of harvesting the approximately ST145 million worth of seafood is low, with labour being the most significant input. In comparison the cost of harvesting the ST40 million of exported tuna is probably around ST22 million, half of it leaves the country to pay for imports for the industry such as fuel, bait, fishing gear as well as loan servicing.

The value of the seafood to the health of consumers is well documented. The high per capita consumption of fresh seafood in Samoa contributes towards keeping the villagers healthy, saving the country money on health associated costs. The most common fishing methods used are those that require a minimal financial outlay for fishing gear such as boats, nets, etc. These methods include diving and spearing and gleaning. The most popular areas for fishing, again, are those for which a boat is not required, i.e. lagoons.

Considerable time is spent fishing outside the reef. It would be hoped this will in the future, through prudent village-based management relieving pressure on inshore resources. The Fisheries Division can continue to assist by making village fishers more aware of the vulnerability of inshore resources and at the same time increasing their ability to harvest pelagic resources outside the reef through training.

Of the 55 coastal villages and 927 coastal households included in the survey 17 villages containing 303 households had fisheries management plans developed with Fisheries Project assistance. These villages had a catch rate 55% higher than villages without management plans. This suggests that the management plans have had a positive impact on fisheries in these villages, though it may be that those villages that have adopted management were already blessed with more abundant marine resources and thus were more receptive to improved management.

Household fisheries surveys such as this are expensive in terms of labour and associated costs. They can however give an indication of the value of subsistence fisheries as well as provide an indication of the proportion contributed by seafood to the overall subsistence protein consumption of the country. Because of the costs involved, particularly in terms of manpower, they are likely to be repeated only every 3 to 5 years, and it would be useful to obtain some information in these intervening years.

An alternative method to collect subsistence fisheries data, which has been trialed on several occasions, is the use of school students^{4,1,2}. Further consideration should be given to using this method in future, as it can provide a substantial amount of data at relatively low cost, on an annual or even quarterly basis. It has the added advantage that it can be used as a teaching tool to raise awareness about marine resources in school age children. Considerable planning, time, and effort would be required to initiate such a programme, and get it included into the schools regular curriculum. After this initial push, it should require less effort to maintain than a nationwide household survey.

Finally it should be noted that this was a survey based on respondents' recall of their fishing activities and seafood consumption patterns, rather than on direct measurements such as creel surveys or weighing food items to be consumed. Information contained in the report should be viewed with this in mind. However, people's knowledge of their own practices and habits should not be underestimated and may in fact prove more accurate in the long term than other methods of data collection such as 'snapshot' creel surveys and household diaries.

References

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- ² Statistics Department, undated. *Fishery Catch Assessment Survey, 1978*.
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- ⁴ King, M. 1989. *Fisheries research and stock assessment in Western Samoa*. FAO Terminal Report, TCP/SAM/8852: (draft). FAO, Rome
- ⁵ Zann, L. 1995. *The Inshore Resources of Upolu, Western Samoa. Coastal Inventory and Fisheries Database*. A report prepared for the AusAID supported Fisheries Extension and Training Project. IDSS/
- ⁶ Statistics Department, 2000. *Demographic and Vital Statistics Survey, 2000*. Govt. of Samoa.

- 7 Statistics Department, 2000. *1999 Census of Agriculture*. Govt. of Samoa.
- 8 Note that there is a slight variation from the number of households reported in Table 1. This is probably due to rounding errors when using the P. of S. weights for each village.
- 9 Passfield, K., A. Mulipola and S. Vaofusi. 1999. *The outer reef slope fishery profile*. Report prepared under the AusAID supported fisheries project. GRM International, Apia.
- 10 The seafood weight referred to here is equivalent live weight. The actual amount of flesh eaten would be approximately 70% of this, or 40kg per capita.
- 11 King, M. 1995. *Fisheries biology, assessment and management*. Fishing News Books, London
- 12 Coyne, T. 1994. The effect of urbanisation and western diet on the health of Pacific island populations.