

The octopus fishery on Lofanga, Kingdom of Tonga

Mecki Kronen¹ and Siola'a Malimali²

Introduction

Lofanga is a small coastal community of 39 households and a current (2008) resident population of 187 people that constitutes the sole population of the island of Lofanga, Ha'apai Group, Kingdom of Tonga (Fig. 1). Boat transport is needed to connect between the island and Pangai, the center of the Ha'apai mainland of Lifuka, some 20 km away. Lofanga island has an area of about 1.4 km² that is mostly used for crop cultivation. The island of Lofanga belongs to the noble Tupouto'a, who also owns a small piece of land at Hihifo, a settlement attached to Pangai on Lifuka, that he has allocated to the people of Lofanga as a squatter settlement. Thus, the families of Lofanga have an alternative base on Lifuka to make it easier for them to access to education, markets and medical care.

While the lifestyle in Lofanga does not differ much from that in other isolated and rural coastal communities in Tonga, the community is the only one in the Ha'apai group that has yet to benefit from the national rural electrification program. Thus, day-to-day life on the island itself is limited due to the absence of electrical power. The consequences, in particular for the island's fisheries activities, were

confirmed by observations made during the 2008 socioeconomic survey undertaken by the Pacific Regional Oceanic and Coastal Fisheries Development (PROCFish) programme, in close cooperation with the Tonga Ministry of Agriculture, Food, Forestry and Fisheries. With no readily available electricity supply, it is difficult to adequately ensure the cold chain during fishing trips, storage and transport of the catch to mainland markets. Ice must be purchased from the Fisheries Department in Pangai, Lifuka, which accounts for additional labour and transport costs. Without cooling facilities, fish has to be sold and consumed within 24 hours after it is caught. Because of the lack of infrastructure such as electricity, elevated labour and transport cost and limited access to markets, conditions today continue to be unfavourable for commercial fishing in Lofanga (Bender et al. 2002). This observation applies to both the finfish and invertebrate fisheries. However, fishers have adopted various strategies to cope with some of these unfavourable conditions, in particular the increasing costs for ice provision and transport. In this article, we focus on Lofanga's octopus fishery (evidence of which one cannot miss when visiting Lofanga island, see Fig. 2), women's and men's engagement in the fishery, and its role for income generation. Results presented here come

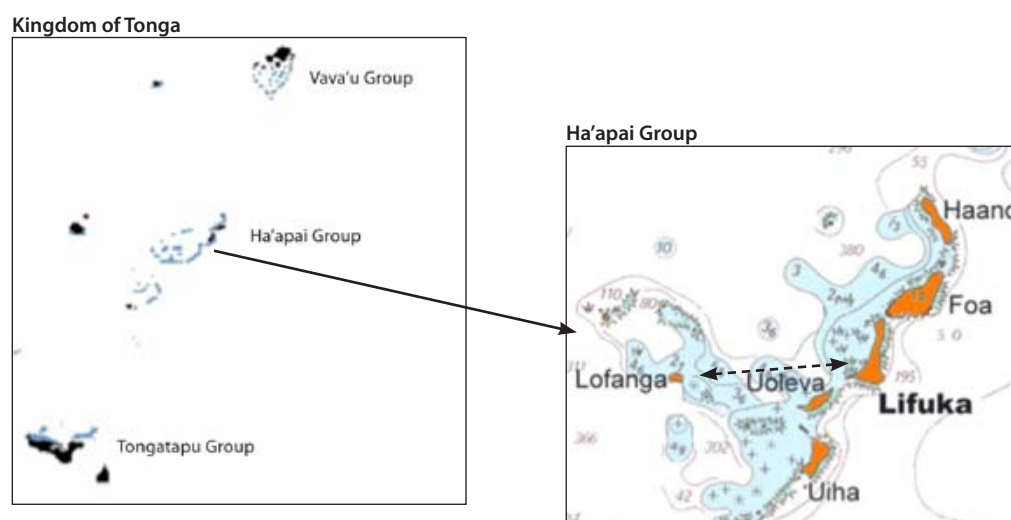


Figure 1. Location of Lofanga island, Ha'apai Group, Kingdom of Tonga

¹ SPC Community Fisheries Scientist, Reef Fisheries Observatory, Noumea, New Caledonia

² Senior Fisheries Officer, Fisheries Division, Ministry of Agriculture, Food, Forestry and Fisheries, Tonga

from the 2008 PROCFish socio-economic survey undertaken in the community of Lofanga.



Figure 2. Tree-drying of octopus, visible evidence of the octopus fishery on Lofanga island

The role of fishing

Fishing plays a central role in the lifestyle of Lofanga's community. About 85 per cent of all households have one or several members who are actively involved in some kind of fishing. Seafood consumption is high — much higher than elsewhere in Tonga (Coyne et al. 1984; Finau et al. 1994). On average, Lofanga's people eat some kind of seafood every day and it constitutes their main protein source and contributes considerably to their total energy intake. Survey results suggest that on average fresh fish is consumed three times a week and invertebrates and canned fish are eaten twice a week each. On average, the annual per capita consumption is approximately 65 kg for finfish, 17 kg for invertebrates (edible parts only) and 21 kg for canned fish. Fishing also represents the most important income source for 70 per cent of all households (Fig. 3), while agriculture and handicrafts only provide 10–12 per cent of all households with a primary source of income, and another 30–60 per cent with a secondary source of income. Lofanga's fishing is characterised by little entrepreneurial skill, small informal groups, small fishing vessels, low capital investment, and corre-

spondingly low productivity (Sabri 1977; Veitayaki 1993; Tu'avao et al. 1994; Passfield 2001).

In addition, the Lofanga community is highly dependent on remittances. About 75 per cent of all households receive them, mostly from family members living overseas. These remittances, which average USD 770 per year, cover about 34 per cent of the average annual reported household expenditures for those families that receive them. This situation qualifies Lofanga as being part of the MIRAB (migration, remittances, aid, and bureaucracy) economy (Bertram and Walters 1985) that is considered to yield flexible economic and stable conditions in Tonga's outer island communities (Evans 2001).

Traditionally, Tongan women are not engaged in finfisheries, but are the major players in invertebrate collection (Bataille-Benguigui 1988; Bender 2001; Matthews 1991; Tonga et al. 2000). Previous studies have shown that Tongan and also Lofanga women may also catch finfish at times, although only very small amounts (i.e. about 2 per cent of the total annual finfish catch in Lofanga, as found in a previous survey) (Kronen 2002, 2004a; Kronen & Vunisea 2005; Kronen and Bender 2007). It is therefore not surprising that Figure 4 illustrates the traditional separation of men exclusively targeting finfish while women exclusively target invertebrates. However, about 38 per cent of men in Lofanga are engaged in both finfishing and invertebrate collection. The proportion (approximately 38 per cent) of women who target only invertebrates corresponds to a participation of over half of the total adult female population in Lofanga (52 per cent).

Invertebrate and octopus fishery

Fisherwomen only perform reeftop gleaning, while fishermen prefer free diving, in particular for giant

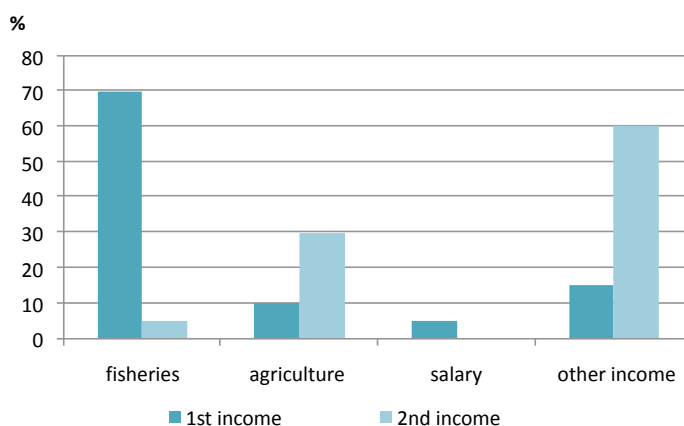


Figure 3. Importance of fisheries, agriculture, salaries and handicrafts (other) for income generation on Lofanga island

clams. Figure 5 demonstrates that the average annual catches (wet weight) reported by fisherwomen for reeftop gleaning are substantial, amounting to approximately 600 kg fisher⁻¹ year⁻¹. Average annual reported harvests of fishermen who dive for giant clams are about 150 kg higher.

% of total fisher

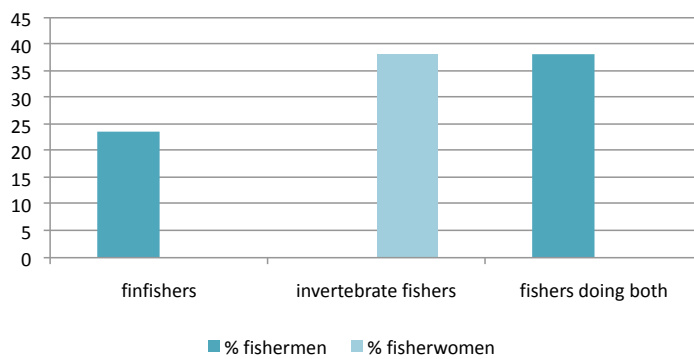


Figure 4. Participation of fishermen and fisherwomen in the different fisheries on Lofanga

kg fisher⁻¹ year⁻¹

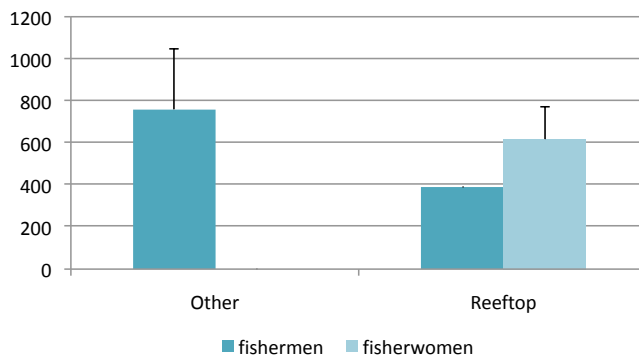


Figure 5. Average annual catch (wet weight) (+SE) of fishermen and fisherwomen targeting reefs for free diving and gleaning

Reported catch by species groups indicates the role that each of the target species plays (Fig. 6). Overall, giant clams are the most important target species (approximately 48 per cent of the total annual catch), followed by octopus catches with about 31 per cent of the total annual invertebrate harvest.

Taking into account that we have assumed an average wet weight of 500 g for a giant clam and 550 g for an octopus, these figures indicate that more giant clam than octopus specimens are collected on Lofanga's reefs. However, if we consider only the edible and useful part of these catches, the proportion between the two species changes substantially. We have assumed that the edible meat of a giant clam represents 19 per cent, on average, of its wet weight, while 90 per cent of an octopus is edible. In other words, the exploitable annual weight from octopus catches is about three times higher than for giant clam catches in terms of edible meat.

Other invertebrates that do not play a major role in terms of the proportion of total annual catch by wet weight, including sea urchins (*tukumesi*), gastropods (*elili*, *hulihuli*) and sea cucumbers (*loli*), are exclusively collected for home consumption, but never sold. It should be noted that subsistence needs also include a considerable share of non-commercial distribution of catches (*fetokoni'ai*) (Halapua 1982; Veitayaki 1993) — including commercialised and non-commercialised species — amongst community members and extended families, which is an

% of annual catch

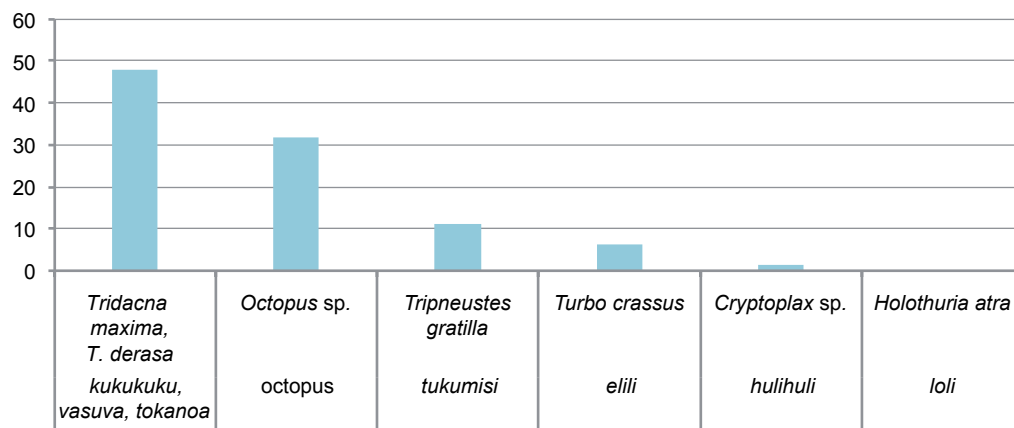


Figure 6. Importance of target species calculated from reported annual catches (wet weight) on Lofanga island

integral component of Lofanga's lifestyle (Bender 2001, 2004; Kronen 2002).

Considering that three quarters of the total annual invertebrate catch in Lofanga is accounted for by fisherwomen (Table 1), and that octopus constitute 40 per cent of the total reeftop gleaning catch (Fig. 7), fisherwomen account for a considerable share of both octopus and giant clam catches. The 20 per cent of total annual invertebrate catches harvested by fishermen performing free diving is mainly accounted for by giant clam catches, as shown in Figure 8. The importance of fisherwomen's participation in octopus fishing, and to an important extent also in giant clam fishing is highlighted by Table 2. Of all invertebrate catches, octopus and giant clams are the only species that are also sold. In fact, almost 80 per cent of all octopus harvested are intended for sale, while only 31 per cent of all giant clams are exclusively harvested for commercial interest, and another 14 per cent may or may not be commercially used. If we assume that half of all catches classified as being used for both purposes may be allocated for subsistence and the other half for income generation, about 60–62 per cent of all octopus and giant clam catches are for income generation. This comparison must also take into account that the edible or useful part of both species varies considerably (i.e. 90 per cent versus 19 per cent of exploitable or edible weight for octopus and giant clams, respectively).

Table 1. Proportion (%) of recorded annual invertebrate catches by fishery and gender

Fishery	Fishermen	Fisherwomen
Reeftop gleaning	3.5	76.4
Reef free diving	20.1	0
Total	23.6	76.4

In addition, the expense of boat transport to reach Lofanga's closest urban market of Pangai on mainland Lifuka forces fishers to reduce their travel frequency to a minimum or makes it unaffordable. Usually, people visit the main island about twice a month. This frequency does not allow a continuous commercial giant clam fishery due to its short shelf life without cooling or freezing, which are unavailable on the island. Octopus, however, is dried on the island (Fig. 9) and therefore has an extended shelf life and can be sold upon arrival of the next transport or at the next marketing occasion. While fishermen are mainly in charge of selling the finfish catch, processing and marketing of invertebrate catches is mainly the responsibility of fisherwomen or the wives of the fishermen who harvest them.

Local prices for octopus are also more attractive as compared to fresh giant clam meat. A dried octopus fetches around TOP 4.00 (average prices quoted

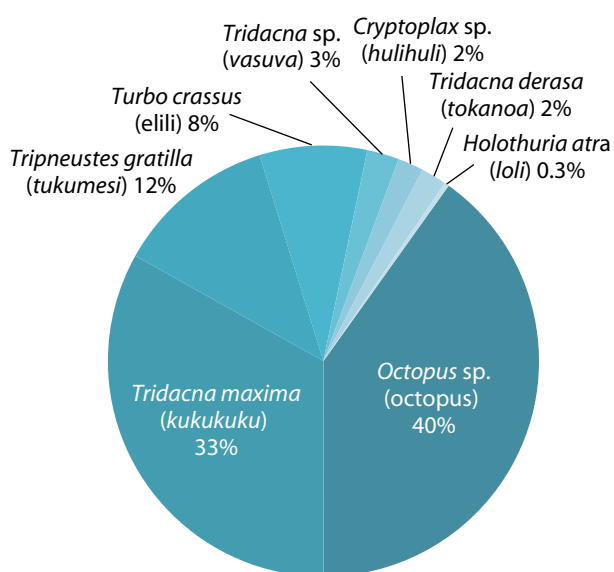


Figure 7. Proportion (%) of target species that constitute the reported total annual catch by reeftop gleaning in Lofanga (contribution of reeftop gleaning to Lofanga's total annual reported invertebrate catch by wet weight is approximately 80 per cent)

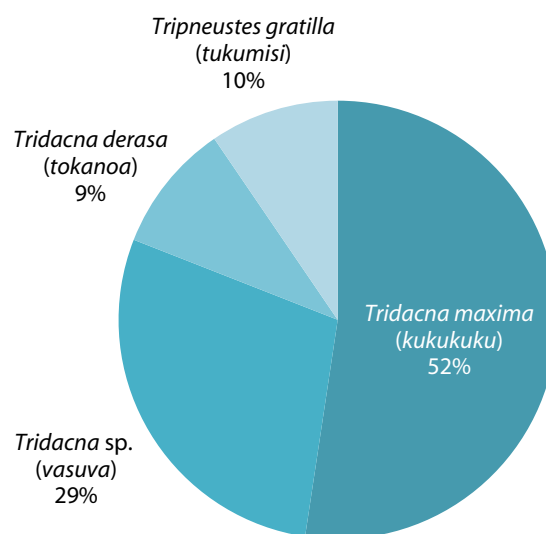


Figure 8. Proportion (%) of species that constitute the reported total annual catch by reef free diving in Lofanga (contribution of reef free diving to Lofanga's total annual reported invertebrate catch by wet weight is approximately 20 per cent)

Table 2. Percentage of invertebrate catches by species groups that are caught for home consumption or for commercial purposes

Vernacular names	Scientific names	% exclusive consumption	% exclusive sale	% consumption and sale
Kukukuku, vasuva, tokanoa	<i>Tridacna maxima</i> , <i>T. derasa</i> , <i>T. spp.</i>	55	31	14
Octopus	<i>Octopus sp.</i>	21	0	79
Tukumisi	<i>Tripneustes gratilla</i>	100	0	0
Elili	<i>Turbo crassus</i>	100	0	0
Hulihuli	<i>Cryptoplax sp.</i>	100	0	0
Loli	<i>Holothuria atra</i>	100	0	0

range between TOP 60 and TOP 100 for 20 octopuses). At the Pangai market, consumers pay between TOP 10 and TOP 15 per kilo of fresh giant clam meat, corresponding to an average of TOP 1.50 per reasonably sized giant clam (shell included). These selling prices are favourable if compared to the local reef fish price, which is currently about TOP 4.00–5.00 kg⁻¹. In addition, sellers of reef fish must purchase ice to ensure an adequate cold chain for maintaining fish quality.



Figure 9. Octopus is sun dried on Lofanga to extend its shelf life for commercialisation

Conclusions

Fisherwomen from Lofanga contribute substantially to the population's high per capita invertebrate consumption and generate complementary income for family expenditures by fishing, cleaning, drying and marketing octopus, as well as by collecting, de-shelling and occasionally selling giant

clams. Fisherwomen and fishermen on Lofanga continue to apply fishing and processing strategies in response to the island's natural resource endowment, particularly its marine resources, and unfavourable economic conditions (Kronen 2004). Fishing and sun-drying of octopus is an example of such a strategy adapted to the natural resources and economic situation on the island. The activities of the fishers provide subsistence as well as a means to meet social obligations and the need to generate income to maintain the community's traditional livelihood and social institutional networking (Iwariki and Ram 1984).

Lofanga's relatively high per capita invertebrate consumption of approximately 17 kg/year is mainly accounted for by octopus and giant clams, complemented by small catch rates of sea urchins, gastropods and sea cucumber gonads. Only octopus and giant clams are also targeted commercially. Due to the lack of continuous cooling and freezing capacities on the island, giant clams can only be collected and de-shelled for selling the fresh meat if transport to Pangai's market is guaranteed.

By comparison, sun-drying octopus has extended its shelf-life and rendered the product less vulnerable to fluctuations in the frequency and cost of transport to the market on Lifuka, providing Lofanga's women with a continuous fishery that supplies food for the family and generates complementary household income.

References

- Bataille-Benguigui M.-C. 1988. The fish of Tonga: Prey or social partners? *Journal of the Polynesian Society* 97(2):185–198.
- Bender A. 2001. *Fischer im Netz: Strategien der Ressourcennutzung und Konfliktbewältigung in Ha'apai, Tonga*. Herbolzheim, Germany: Centaurus. 330 p.

- Bender A., Kägi W. and Mohr E. 2002. Informal insurance and sustainable management of common pool marine resources in Ha'apai, Tonga. *Economic Development and Cultural Change* 50(2):427–439.
- Bender A. 2008. Meshing a tight net: A cultural response to the threat of open access fishing grounds. p. 197–218. In: Casimir M.J. (ed). *Culture and the changing environment: Uncertainty, cognition, and risk management in cross-cultural perspective*. Oxford, UK: Berghahn. 394 p.
- Bertram I.G. and Watters R.F. 1985. The MIRAB economy in South Pacific microstates. *Pacific Viewpoint* 26(3): 497–519.
- Coyne T., Badcock J. and Taylor R. 1984. The effect of urbanisation and western diet on the health of Pacific island populations. SPC Technical Paper No. 186. Noumea, New Caledonia: South Pacific Commission. 175 p.
- Evans M. 2001. *Persistence of the gift: Tongan tradition in transnational context*. Waterloo, Canada: Wilfrid Laurier University Press. 208 p.
- Finau T.L., Udagawa K. and Nakajo N. 1994. Fish and meat consumption of Tongan people. *Fisheries Bulletin of Tonga* 1:29–36.
- Halapua S. 1982. *Fishermen of Tonga: Their means of survival*. Suva, Fiji Islands: Institute of Pacific Studies, USP. 100 p.
- Iwariki S. and Ram V. 1984. An introductory study of the socio-economic aspects of household fisheries in the small island economies of the South Pacific. *Memorial Kagoshima University Research Center South Pacific* 5(1):53–65.
- Kronen M. 2002. Women's fishing in Tonga: Case studies from Ha'apai and Vava'u islands. *SPC Women in Fisheries Information Bulletin* 11: 17–22.
- Kronen M. 2004(a). *DemEcoFish Tonga country report socioeconomic component*. Noumea, New Caledonia: Secretariat of the Pacific Community. 108 p.
- Kronen M. 2004(b). Fishing for fortunes? A socio-economic assessment of Tonga's artisanal fisheries. *Fisheries Research*. 70:121–134.
- Kronen M. and Vunisea A. 2005. Gender in fisheries and aquaculture. Social capital and knowledge for the transition towards sustainable use of aquatic ecosystems. Noumea, New Caledonia: Secretariat of the Pacific Community. 19 p.
- Kronen M. and Bender A. 2007. Assessing marine resource exploitation in Lofanga, Tonga: One case study - two approaches. *Human Ecology* 35(2):195–207.
- Matthews E. 1991. Women and fishing in traditional Pacific Island cultures. *Fisheries Information Paper* 14. Noumea, New Caledonia: South Pacific Commission. 7 p.
- Passfield K. 2001. Profile of village fisheries in Samoa. Samoa Fisheries Project. Technical Report. Government of Samoa, Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia, Samoa.
- Sabri J. 1977. Small-scale fisheries and development in Peninsula Malaysia-problems, prospects. P. 63–74. In: Lockwood B. and Ruddle K. (eds). *Proceedings of the Planning Meeting on Small-scale Fishery Development: Social Science Contribution*. East-West Food Institute, Honolulu, Hawaii, 6–11 September. Honolulu: East-West Center. 215 p.
- Tonga N., Naqasima-Sobey M. and Quinn N. 2000. Local marine biological knowledge and management practices in Hihifo village, Ha'apai, Kingdom of Tonga. *SPC Women in Fisheries Information Bulletin* 7:9–13.
- Tu'avao T., Kava V. and Udagawa K. 1994. The present situation of fisheries in the Tongatapu Island group. *Fisheries Research Bulletin of Tonga* 2:27–42.
- Veitayaki J. 1993. Village-level fishing in the Pacific. p. 73–97. In: South G.R. (ed). *Marine resources and development*. Suva, Fiji Islands, The Ray Parkinson Memorial Lectures, PIMRIS, University of the South Pacific. 154 p.