# *"Ungakoa"* – fishing for a rare delicacy in the South Pacific

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"*Ungakoa*" or "*ugako*" — here referred to as *ungakoa* — is a local seafood specialty in the Cook Islands and Niue. *Ungakoa* represents a group of sessile gastropods, more commonly known as vermetids or worm-shells. Their vernacular name comes from their worm-like tube shells, which may be regularly or irregularly coiled. The shells are usually cemented to hard substrates (Fig. 1).

During the Pacific Regional Oceanic and Coastal Fisheries Programme (PROCFish-C), a number of rural coastal fisheries communities and their fishing grounds were surveyed in 17 Pacific Island countries to assess the current status and usage of reef and lagoon resources. Structured questionnaires were used to collect fisheries data from female and male fishers of invertebrates and finfish. Socioeconomic baseline data and seafood consumption information were also collected for households. (Socioeconomic surveys show the types of fisheries that exist and the extent to which these have developed in response to natural habitat endowment, subsistence needs, consumer preferences and income opportunities.)

For the fishing communities surveyed in Cook Islands (Aitutaki, Mangaia, Rarotonga) and Niue, *ungakoa* emerged as one of the most sought-after local seafood specialties. According to our knowledge, *ungakoa* can be regarded as a rather rare fishery. It is also interesting to note that in all the places where there is an *ungakoa* fishery, people also have access to other, often highly exploited invertebrate species, such as giant clams, sea cucumbers, sea urchins, crustaceans, etc.

**Figure 1.** Ungakoa worm-like tube shell (Niue) *[Mecki Kronen]*

*Ungakoa* seem to prefer hard limestone and basalt substrates. Niue, also known as "the rock of the Pacific", has a land area of 259 km$^2$ and is the largest raised coral limestone island in the world. The island is built on a volcanic foundation and has a maximum elevation of 68 m. Its coastline consists of cliffs with "staircase" terraces (intertidal fringing reef flats, "*tofola*") and narrow subtidal fringing reefs that quickly descend to over 1000 m within 5 km of the shore. *Ungakoa* is found on the intertidal reef flats.

*Ungakoa* also prospers on the hard limestone and basalt intertidal reef flats (<100 to a maximum of 300 m depth) around Mangaia, a small island southeast of Rarotonga. Here, the animals are found either fully exposed or submerged in pools of water during low tide. On the flat, *ungakoa* densities are observed to be highest just behind the algal crest (in Mangaia, the algal crest is the slightly raised zone of the reef-flat immediately behind the surf zone) where the appropriate substrate is also abundant. The high density observed in this zone may be due to the clean water with high levels of oxygen that is available there. Beyond the reef flat, higher densities of predominantly larger specimens are found in the subtidal zone (3–6 m) behind the surf. Women cannot access this high energy zone for gleaning, which may explain the high abundance and significantly larger specimens of *ungakoa* observed there. *Ungakoa* was also reported by fishers living on Aitutaki, and in the communities of Titikaveka and Ngatangiia on the southeastern and eastern sides of Rarotonga. Aitutaki lies about 225 km to the northwest of Rarotonga. Aitutaki is termed an almost-atoll as it has a lagoon enclosed by a peripheral reef and reef flat

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(typically 0.5 to 1.0 km wide), but it also has a relatively large volcanic island (Araura). Two of the 15 small islands or *motu* around the rim of the peripheral reef are volcanic in origin. Rarotonga is the emergent summit of a Pliocene-Pleistocene volcanic complex that consists mainly of basalt rock types (Thompson et al. 1998). The island is surrounded by a shallow, narrow lagoon system that is defined by an equally narrow barrier reef system. In both fishing grounds, *ungakoa* is found on intertidal reef flats composed of basalt and hard limestone.

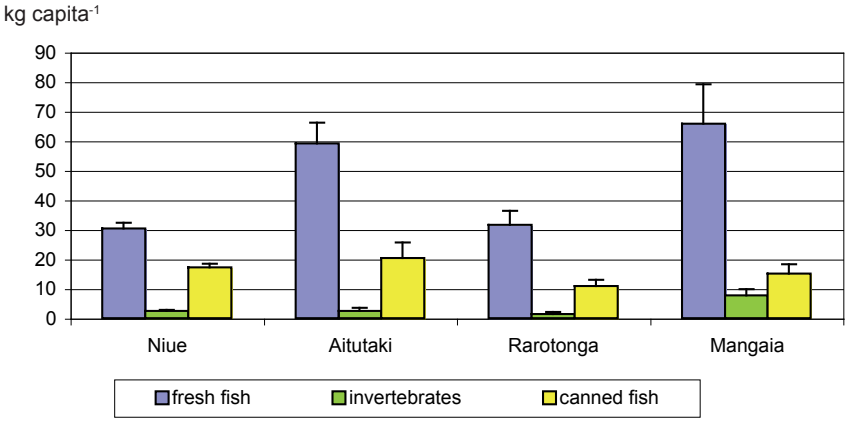


**Figure 2.** Per capita consumption of fresh fish, invertebrates (edible weight) and canned fish for each of the communities surveyed

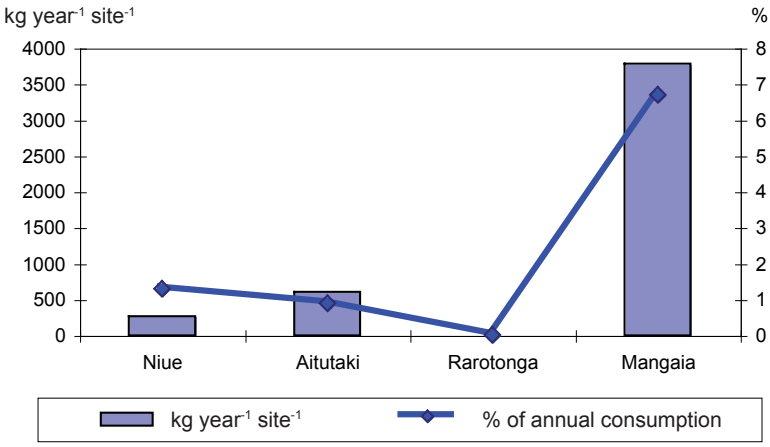


**Figure 3.** Total annual consumption and proportion (%) of *ungakoa* in total annual invertebrate (edible weight) consumption for each community surveyed

From a socioeconomic point of view, the development and persistence of the rather rare and particular *ungakoa* fishery are interesting given that both Niue and Cook Islands enjoy a well-developed lifestyle that combines traditional Polynesian and Western values. Both are closely affiliated with New Zealand, sharing its currency and educational system, and receive significant external economic assistance. Although seafood is still a traditional and important component of the people's diet, and they continue to fish and collect invertebrates, salary-based employment and urban living have brought changes in diet and the wide adoption of a cash-based and relatively costly lifestyle. The present resident populations are estimated at ~ 1,700 people on Niue, and ~19,000 people in Cook Islands. Niue has one of the highest education levels in the region. Alternative income opportunities in the government sector, private business, and tourism in the case of Cook Islands, along with external economic assistance, explain why fishing (reef and open water) is more often undertaken for leisure rather than to supply food and income.

In this context, the data collected were assessed to determine the role of *ungakoa*. Figure 1 shows that in each of the four communities surveyed, seafood consumption is still important. The annual per capita consumption of fresh fish ranges from 30 to 65 kg, and that of invertebrates, expressed in edible meat weight only, from 2 to almost 10 kg. Interestingly, a comparison of the consumption of fresh seafood and canned fish shows that a considerable share of people's protein is supplied by mostly imported canned fish products, i.e. from 10 to 20 kg per person per year.

If only invertebrate consumption is taken into account, extrapolation of data collected from respondents in each of the four communities shows that total annual *ungakoa* consumption (edible meat weight) is as little as a few kilograms for Aitutaki but reaches as much as 3800 kg for Mangaia (i.e. given a total population of 660 people, this figure corresponds to an average per capita consumption of 5–6 kg per year). As also shown in Figure 3, the proportion of *ungakoa* in total annual invertebrate consumption varies considerably, and reaches as high as 7% for Mangaia.

Interviews with invertebrate fishers revealed significant variations in the total annual invertebrate catch in terms of quantity and gender participation (Table 1). For instance, in Mangaia and Rarotonga, women collect most of the invertebrate catch, while in Niue and Aitutaki, gender participation

**Table 1.** Recorded and extrapolated total annual invertebrate catch (wet weight) and the percentage contribution of male and female fishers by community surveyed.

| Community | Recorded total annual catch (t year$^{-1}$) (wet weight) | Extrapolated total annual catch (t year$^{-1}$) (wet weight) | Male invertebrate fishers (%) | Female invertebrate fishers (%) |
|---|---|---|---|---|
| Niue | 11.6 | 35.3 | 47.4 | 52.6 |
| Mangaia | 14.1 | 129.9 | 29.0 | 71.0 |
| Aitutaki | 4.2 | 109.7 | 57.8 | 42.2 |
| Rarotonga | 3.8 | 36.3 | 8.3 | 91.7 |

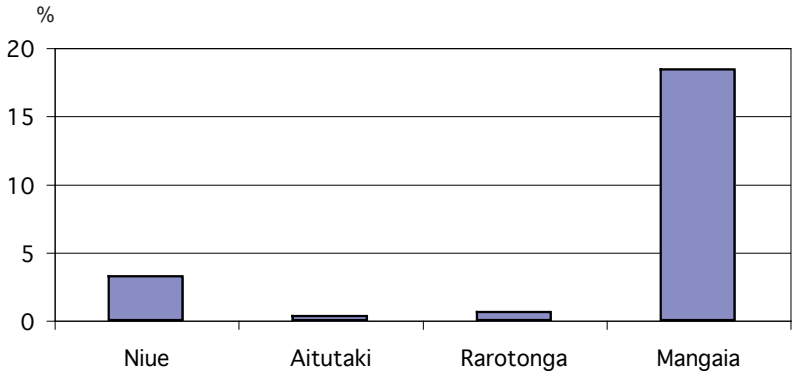


**Figure 4.** Proportion (%) of *ungakoa* in total annual reported invertebrate catch (wet weight) by community surveyed

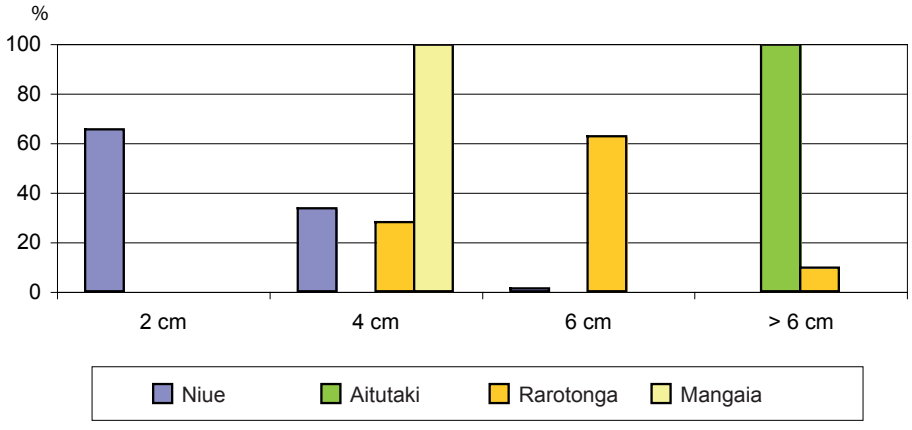


**Figure 5.** Average size frequency distribution of reported catches from Niue and Cook Islands

is balanced. A comparison of the total annual harvest in biomass (wet weight) by species shows that *ungakoa* usually makes up only a small, if not insignificant amount of the biomass harvested, except for Mangaia where *ungakoa* makes up about 18% of the total annual invertebrate harvest (wet weight) (Fig. 4).

*Ungakoa* is mainly collected by women but also to some extent by men, except in Niue where *ungakoa* gleaning seems to be in the women's domain. Men took only a minor part in any invertebrate collection on Rarotonga and *ungakoa* was not mentioned as a target species by male respondents.

The figures for total consumption and the overall representation of *ungakoa* in the diet and fisheries of the various communities may be considered low. However, *ungakoa* is tedious and labour intensive to collect and individual specimens weigh only a few

**Figure 6.** Niue fisher equipped with axe and basket on her way to collect *ungakoa* [*Mecki Kronen*]

**Figure 7.** On Niue, the tube-shell is destroyed to retrieve the vermetid [*Mecki Kronen*]

**Figure 8.** Mrs Oiana Pukeiti, Mangaia, shows the hooks used to extract small or larger *ungakoa* specimens without damaging the tube-shell [*Mecki Kronen*]

grams. On average, collecting a handful (50–100 g) of *ungakoa* on Niue's intertidal flats takes between 2 and 3 hours. Women equipped with a hammer and basket (Fig. 6) venture out if favourable tidal conditions coincide with an appropriative time of day. Niuean women use axes and hammers to chip away at the reef and dislodge the tubeworms (Tuara 2000). These methods have the potential to destroy live corals growing on the hard rocky substrate. However, the reef flats concerned do not host a rich array of marine life and if the process is done properly, only the tubes are destroyed and little damage is done to the reef surface.

In the case of Mangaia, Cook Islands, *ungakoa* can only be collected when tidal conditions, wind and time of day are all favourable, which happens only rarely in many places around the island. For Aitutaki, the considerable distance to reef flats that provide good breeding grounds for *ungakoa* means that it is harvested only occasionally. In Rarotonga, invertebrate and finfish fisheries in the reef and lagoon are very limited due to increasing awareness of the risk of fish poisoning. All these factors may explain the differences in the level of exploitation of *ungakoa* between the four communities surveyed, and overall, the relatively small annual quantities harvested.

*Ungakoa* represents a number of different genera and species, which is reflected in the average size reported by fishers (Fig. 5). In Niue, the length of specimens collected ranged from 2 to 4 cm, while in the Cook Islands it ranged from 4 to 8 cm.

From a biological and taxonomic point of view, *ungakoa* are all members of the Vermetidae family, which are derived from the super-family Vermetoidea (Phyllum: Mollusca, Class: Gastropoda). The family Vermetidae is represented by four genera: *Dendropoma, Petaloconchus, Serpulorbis* and *Vermetus* (Wilson 1993). The *ungakoa* specie(s) utilised for food on Mangaia is a member of the genus *Dendropoma*, but the species name cannot be ascertained. The two distinct size classes of the species exploited in Mangaia and other Cook Islands sites suggest that two different species of *Dendropoma* are being harvested. In Niue, there are suggestions that the *ungakoa* is a member of the genus *Serpulorbis*. For Mangaia, the species name cannot be ascertained. Proper taxonomic keys are needed to make identification to species level.

Destruction or preservation of the tube-shell is the major difference between the *ungakoa* harvesting techniques used in Niue and Cook Islands. In Niue, hammers are used to break the shell (Fig. 7), enabling retrieval of the *ungakoa*. In Cook Islands, special hooks have been developed (Fig. 8) to retrieve the *ungakoa* without destroying its tube shell. The hooks vary in size depending on the size of the

specimen targeted. Some believe that if the shell tubes are not destroyed, new animals can use the empty shells to grow and propagate faster. However, unlike hermit crabs, each *ungakoa* specimen has to produce its own shelled burrow. Therefore, the use of the hooks avoids the task of pounding burrows and possibly crushing live corals, but is unlikely to enhance regeneration of stock. There is also a belief that destroying the tube shells enhances reproduction. There is no biological evidence for either of these beliefs.

Vermetids are suspensory feeders. They catch and feed on micro-plankton or detrital fragments suspended in the water column. This feeding strategy is commonly used by bivalves but is uncommon in gastropods. The sessile nature of vermetids is related to this kind of feeding strategy as the animal cannot move around to browse for food. Vermetids use two means to capture suspended food particles. Particles may be washed into the mantle cavity with the incurrent water and trapped on the gill filament with the aid of mucous from the gill before being shuttled to the mouth via a special ciliary tract. The other method involves deploying mucous nets in the water and then drawing them in to be swallowed when the particles are trapped. Most vermetids use both methods to obtain their nutrition but some specialise in using one method or the other.

Unlike other sedentary animals, vermetids have separate sexes. However as they are sessile, they do not copulate. Sexual reproduction occurs when sexually mature males release packages of sperm into the water. Some of these are captured during feeding by females and eventually fertilise the female's eggs (Wilson 1993). Fertilised eggs are brooded in the mantle cavity of the female. Embryos are maintained there until they have passed through the larval stages and have metamorphosed into little juvenile snails, and crawling or free-swimming larvae are released. These larvae spend around an hour free-swimming before cementing themselves to the substrate.

*Ungakoa* was reported to be sold in some of the communities surveyed. On Niue, 20% of the catch was reported to change hands on a commercial basis, while 66% of all *ungakoa* catches on Mangaia were sold locally. Mostly women confirmed that they collected *ungakoa* to earn some additional income. Several women are known to be efficient and experienced *ungakoa* fishers and they are contacted on a personal basis when *ungakoa* is needed for a family meal. In fact, the demand for *ungakoa* is so high that most of the catch is sold on a one-to-one basis rather than at the weekend market. On Mangaia, a 2-litre ice-cream container filled with *ungakoa* meat is worth NZD 50.00 on average.[4] The containers, which are the most common local unit for selling *ungakoa* meat, hold about 1 to 1.5 kg of meat and may contain at least 100 *ungakoa* specimens. There are many ways of eating *ungakoa*. Fishers eat it raw on site. At home it may be eaten raw or seasoned with lemon juice. Some women prepare *ungakoa* meat as a cold or warm dish with coconut milk, or it may be used as an ingredient in a warm seafood dish.

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