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Inside this issue

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Editor's note

In this issue we have two articles. In the first, Rintaro Ono and David J. Addison examine the fishing lore of Tokelau, focusing on fishing practices, technologies and materials, and their relationship to fish ecology. They examine Tokelauan classification of the marine ecosystem and the ethnoecology of fish and molluscs, particularly the taxonomy and ecological knowledge related to the behaviour of fish and other marine life.

In the second, Sarah Brikke briefly examines the perception of sea turtles by French Polynesians, and in particular, the perceptions of children. This reminded me of a delightful afternoon session during a coral reef conference held in the Maldives, in March 1996. Local school pupils made a series of sophisticated presentations about what was happening to "our reefs". Those youngsters were so refreshing that I thought such a session should be included in all technical conferences. For sure, much more research needs doing on the perceptions of young people regarding environmental and resources issues. After all, "One day all this will be yours" (and the best of luck in trying to fix all your predecessors' messes). So it would be good to have follow-up articles from our readers on the children's art Ms Brikke examines.

Such diversity seems essential in helping us both understand and overcome the complex issues facing us now. Everybody should be encouraged to speak up. Although much of that participation is happening via the new information technology systems, there is still room for print media. But people are often quite shy about contributing "hardcopy"; "Oh, I can't write an article, I've never written one, What should I do? Please help." So, in that spirit I have abstracted below what I regard as the main points from a useful short article that appeared in 2008 in the *American Anthropologist*. It could help you overcome your reticence and encourage you to submit something to me when you reconfirm that many "real academics" can also be "real goof balls".

Astounded by the number of authors submitting poor quality manuscripts, Tom Boellstorff, Editor-in-Chief of the *American Anthropologist*, wrote "How to get an article accepted at *American Anthropologist* (or anywhere)" (*American Anthropologist* 110(3):281–283, September 2008). Boellstorff gave five simple tips that he assured readers would greatly increase their chance of a favourable decision at any journal. They are as follows.

1. **Be professional!:** Never forget to "accept all changes in document" after using the "track changes" function of Microsoft Word. A surprising number of authors do; "As a result, deleted text, comments from preliminary readers, and so forth are all interspersed with the main text in a bewildering range of colors. In addition, many manuscripts are submitted ... with a shocking number of typographical and grammatical errors" (Boellstorff 2008:281). That's guaranteed to annoy even the mildest mannered editor!
2. **Make sure data and assertions/claims are related:** One of the most common problems in manuscripts submitted is the relationship between the argument and supporting data; "Often a manuscript will be concerned with Topic A, but the data presented speak to Topic B" (Boellstorff 2008:281–282). That is just silly. No reader will understand how an author reached her or his conclusions if the wrong data are provided!
3. **Don't over-generalize:** Commonly, a manuscript either begins with or is built around sweeping claims unsupported by evidence that:

   > could not be provided, because, say, we cannot prove that "humans throughout history have sought to create forms of community based on their spiritual beliefs". Such sweeping generalizations invite nitpickers and quibblers and do not really serve the argument at hand. Of course, it is fine to speculate about broader implications, but this must be done in a way that builds from the data at hand and properly hedges its claims as it moves outward from that data." (Boellstorff 2008:282)

4. **Use references and citations effectively:** One of the commonest faults is that many authors seem to be unaware of other people's work. This can be inferred because they fail to cite the work of others. However, some authors clearly avoid citing others' work in an attempt to appear creative. And yet others will inflate the number of works cited — but not actually referred to — in an attempt to demonstrate their own "scholarship". Don't be tempted; these ruses are transparent to experienced editors and readers!
5. **Use an effective manuscript structure:** If your manuscript is structurally unsound, your argument will be unclear. Boellstorff (2008:282) noted three main structural faults. The first is that manuscripts often lack a "Conclusion" or have a disproportionately brief one that is insufficient for tying a text together and summarizing the main argument. The second is that manuscripts often contain unbalanced sections, one of which might account for more than half the total length of the manuscript. Balanced subsections are generally best for making an effective argument. The third is that the assertions or claims set out in an "Introduction" often are not those discussed in the body of a text! Consistency is needed throughout an entire manuscript. Text, Introduction and Conclusion need to be carefully cross-checked to verify this before sending a manuscript to an editor.

Finally, please do not forget to download the "SPC Special Interest Group newsletters and bulletins instructions to authors" (http://www.spc.int/coastfish/News/SIG-instructions.pdf) and send us your manuscripts formatted accordingly. Please pay particular attention to the style of the references. More than anything else, failure in the last item is what drives your otherwise benign Editor and Fisheries Information Officer up the wall, round the bend, and into the nearest bar and grill. (Needless to say, we quite enjoy these antics when the reason is good.)

Kenneth Ruddle

PIMRIS is a joint project of five international organisations concerned with fisheries and marine resource development in the Pacific Islands region. The project is executed by the Secretariat of the Pacific Community (SPC), the Pacific Islands Forum Fisheries Agency (FFA), the University of the South Pacific (USP), the Pacific Islands Applied Geoscience Commission (SOPAC), and the Pacific Regional Environment Programme (SPREP). This bulletin is produced by SPC as part of its commitment to PIMRIS. The aim of PIMRIS is to improve the availability of information on marine resources to users in the region, so as to support their rational development and management. PIMRIS activities include: the active collection, cataloguing and archiving of technical documents, especially ephemera ("grey literature"); evaluation, repackaging and dissemination of information; provision of literature searches, question-and-answer services and bibliographic support; and assistance with the development of in-country reference collections and databases on marine resources.

PIMRIS

Pacific Islands Marine Resources Information System

Ethnoecology and Tokelauan fishing lore from Atafu Atoll, Tokelau

Rintaro Ono[1] and David J. Addison[2]

Abstract

Marine exploitation has various cultural implications. In this paper we discuss Tokelauan fishing lore, focusing on fishing practices, technologies and materials, and relate these to fish ecology. We examine the Tokelauan classification of the marine ecosystem and the ethnoecology of fish and molluscs, particularly focusing on Tokelauan folk taxonomy and ecological knowledge related to the behaviour of fish and other marine life.

Introduction

Marine exploitation, especially fishing, is the most important subsistence activity in Tokelau, and has multifarious cultural implications (Huntsman and Hooper 1996; Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008; Matagi Tokelau 1991). This has probably been the case ever since people first settled the island. A previous archaeological study (Best 1988) suggested the possibility of up to 1,000 years of human occupation in Tokelau. Zoo-archaeological analyses of Best's excavated fish bones have shown that Tokelauans exploited various fish habitats — from the inshore area to the open ocean (McAlister 2002). Despite the prehistoric and contemporary importance of fishing in Tokelau, folk knowledge of fish behaviour, habitats and fishing technologies have rarely been published in English (e.g. Hooper 1985; Macgregor 1937), apart from some studies that contain information on tuna and outer-reef fishing (Gillett 1985; Hooper 1985, 2008; Hooper and Huntsman 1991).

The Mafutaga-a-Toeaina-o-Atafu-iMatauala-Porirua (2008) has produced an excellent book documenting (in Tokelauan) Atafu's rich traditions of fishing lore. The foresight and wisdom shown in this initiative is laudable, and could serve as an example for many island communities where fishing is quickly changing under the pressures of modern life. However, only those with strong Tokelauan language skills can access the rich information in this book. This excludes both non-Tokelauans and those Tokelauans who have been raised in diaspora and lack strong Tokelauan language skills.

Our purpose in this article is to discuss Tokelau marine resource use (with special reference to Atafu) from an ethnoecological perspective and for an English-speaking audience. Ethnoecological studies seek to investigate questions about how people conceptualise and exploit their ecosystems (Akimichi 1978; Conklin 1954; Frake 1961). The first goal is to discuss Tokelauan fishing lore, focusing on fishing practices and technologies, as well as materials, and relating these materials to fish ecology. The second goal is to examine the Tokelauan classification scheme of the marine ecosystem and the ethnoecology of fish and molluscs, particularly focusing on folk taxonomy and ecological knowledge related to the behaviour of fish and other marine life.

We collected fish and mollusc names from fishermen[3] of different ages on Atafu Atoll. Identification was aided by the use of color drawings and photographs as references. We selected three men who were locally recognised as knowledgeable about fish and fishing. These men were interviewed formally in order to collect the names and information for fish, other land and sea animals, lunar cycles and fishing grounds. For fish we used reference books (Allen 1999; Okamura and Amaoka 1997) and discussed with informants the fish depicted. For shell names, one man and one woman were selected for interviewing. We used reference shells that we collected on Atafu and confirmed the names with reference books (Abbott 1991; Habe and Kosuge 1996). Beside these formal interviews, we also informally interviewed 10 local men in order to obtain information on specific fishing events and landings during our stay on Atafu. Tokelauan names were cross-checked with the Tokelauan Dictionary (Tokelau Dictionary 1986); these and some additional names shown in the dictionary are listed in Appendix 1.

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3. Fishing is a male activity in Tokelau.

Tokelau's atolls

New Zealand-administered Tokelau is a group of three atolls located about 500–600 km north of Samoa at 8–10°S and 171–173°W (Fig. 1). Atafu Atoll is located at the northwest end of the archipelago, with Nukunonu Atoll in the middle, Fakaofo Atoll to the southeast, and Olohega Atoll at the south end of the archipelago. Tokelau's total land area is tiny; the combined dry land area of all three atolls (excluding Olohega) is only 12.2 km² (Huntsman and Hooper 1996). Tokelau's exclusive economic zone is considerably larger, covering 290,000 km² (Passfield 1998). The average mean annual temperature in Tokelau is 28°C, and annual rainfall is 2,900 mm (Toloa et al.1994). Geo-culturally, Tokelau is located at a crossroads between eastern and western Polynesia (Burrows 1939, 1940), about 400 km east of Tuvalu and 400 km west of the northern Cook Islands.

Like most low and exposed atolls, Tokelau is particularly susceptible to wave surge during tropical storms. Between November and March the weather is often unsettled, and the atolls are exposed to high winds and rough seas. During these months, sea travel is frequently restricted to the sheltered waters inside the reef (Matagi Tokelau 1991). Occasionally, the atolls are struck by cyclones during this season.

Atafu, Nukunonu and Fakaofo are typical atolls with a large central lagoon surrounded by an intermittent chain of sandy islets known as *motus*; Olohega has a landlocked brackish water lake in the centre instead of a central lagoon. The largest of the atolls is Nukunonu, with a land area of about 5.5 km², the second largest is Fakaofo with 3 km², Atafu is the smallest with 2.5 km², and the land area of Olohega is about 1.5 km². Lagoon size is even more variable: Atafu's lagoon is considerably smaller than the other two, covering only 19 km², compared with 109 km² for Nukunonu, and 59 km² for Fakaofo (Huntsman and Hooper 1996).

In terms of population, Atafu is the most populous with about 600 people, followed by Fakaofo with some 500, and Nukunonu with about 400. Olohega currently has fewer than 20 people. Tokelau has been an incorporated territory of New Zealand since 1948. Over 7,000 Tokelauans now live in New Zealand, and several thousand more live in Australia. Although Olohega is currently part of American Samoa, many Tokelauans consider it historically and culturally part of Tokelau (Matagi Tokelau 1991).

People and language

Tokelauans are Polynesian, with strong affinities to the atoll peoples of Tuvalu to the west, and the northern Cook Islands to the east. Interaction with Samoa to the south has been important for at least the last century, and possibly much longer. However, oral tradition is silent on the earliest origins of the Tokelauan people (Huntsman and Hooper 1996; Huntsman pers. comm.; Tokelau Dictionary 1986). Archaeologically, the Lapita cultural complex is the first indication of people in western Polynesia

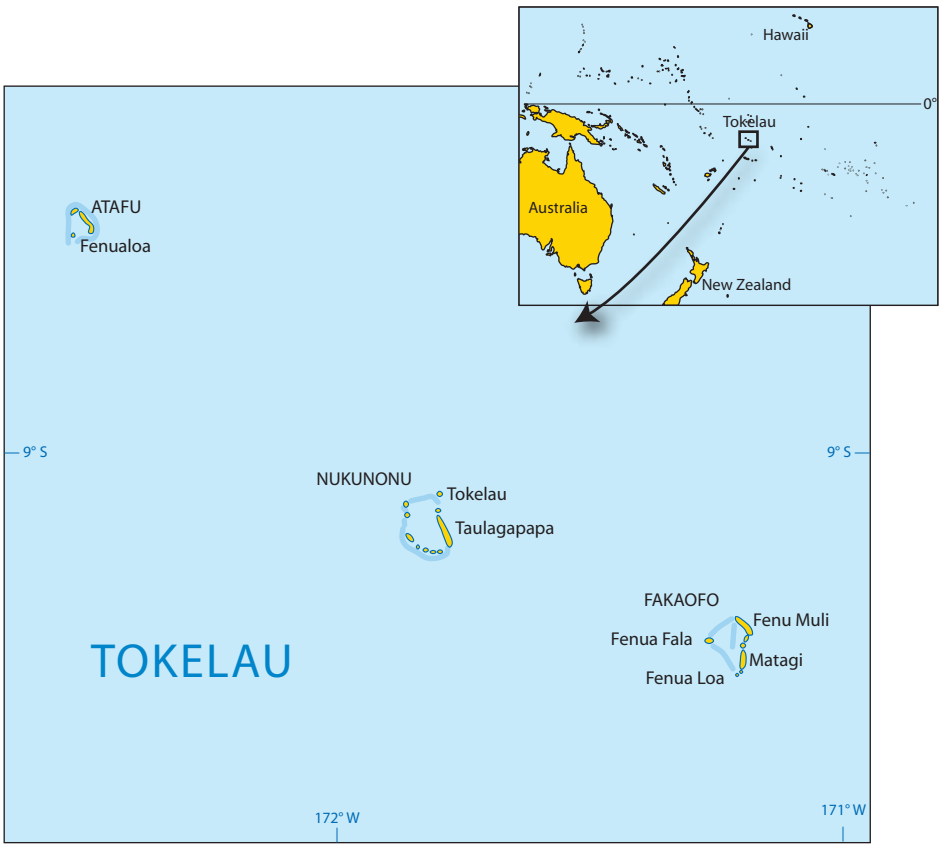

Figure 1. Atafu, Nukuonu and Fakaofo, the three main atolls of Tokelau

around 3000–2800 calibrated years BP[4] (e.g. research summarised in Kirch 1997). In the "Hawaiki" model (Kirch and Green 2001), an "Ancestral Polynesian Society" with unique cultural and linguistic traits developed in the area of Fiji, Tonga, Samoa, Uvea and Futuna over the following millennium of regular interarchipelagic contact. A dialect chain developed over this area and eventually split into a northern and southern branch. At around 1300–800 cal BP and subsequent to this split, eastern Polynesia and the Polynesian outliers were settled, mostly from islands speaking the northern branch of the dialect chain — Proto Nuclear Polynesian (Green 1966; Green 1988; Marck 2000; Pawley 1966,1967).

Tokelau was probably first settled during this period of expansion. The single prior archaeological excavation in Tokelau (Best 1988) dated unidentified charcoal from basal cultural deposits on Atafu to around 1150–690 cal BP.[5] On Fakaofo, turtle bone from the lowest cultural deposits dates to 790–530 cal BP (Best 1988). The apparent discrepancy between these two dates could be resolved by arguing that the area of overlap represents the actual initial settlement period for Tokelau. Coconut endocarp excavated in 2008 from a basal cultural layer about 100 m from Best's 1986 sample location dates to 660–550 cal BP (Addison et al. 2009; Addison and Kalolo 2009; Petchey et al. in review), further reinforcing the idea that the overlap in Best's basal dates is the actual period of initial colonisation. Many more dating samples from a variety of stratigraphically secure contexts on all three atolls will be required to resolve this question.

The Tokelauan language is typically Polynesian. It contains five vowel sounds (written as a, e, i, o and u), and ten consonants (written as f, g, h, k, l, m, n, p, t and v). The f is pronounced like wh, and the h is a glottal fricative, whereas it sounds the same as an English h before the vowels i and e. On the other hand, before the back vowels a, o and u, is pronounced more like h^y (Tokelau Dictionary 1986). The last century has seen an increase in cultural and linguistic influence on the Tokelauan language by Samoa, and this has affected some of the names of plants (Whistler 1988). Some Tokelauan fish names have also been affected or introduced from adjacent islands, mainly the northern Cook Islands, Tuvalu, Samoa and Tonga (Hooper 1994; Rensch 1994).

In a comparative linguistic analysis of Proto Polynesian and Proto Nuclear Polynesian fish names, Hooper (1994) checked for shared retentions and innovations, or borrowings between Polynesian islands. Her analysis indicates that out of 112 Proto Polynesian reconstructions for fish names. Tokelauan retains reflexes of 94 (84%), which is an extraordinarily high figure (Hooper 1994). As Hooper mentions, the high figure for Tokelauan could indicate either a more nearly complete inventory of local fish names than other islands, or the more conservative nature of the Tokelauan lexicon (Hooper 1994). In any case, it is clear that Tokelauan fishing terms and fish names are good candidates for inclusion in core vocabulary lists for the region.

Ecological background

Most of the *motus* of Tokelau's atolls are covered with dense groves of coconut palms except in some areas where littoral forest dominates. The most common terrestrial plant species are *Cordia subcordata*, *Guettarda speciosa*, *Hernandia nymphaeifolia* and *Pisonia grandis*, while *Pandanus tectorius* and *Tournefortia argentea* prevail on the margins of the littoral forest (Whistler 1988). The main food plants are mostly root crops (*pulaka, Cyrtosperma chamissonis* and *taamu, Alocasia macrorrhizos*) and fruit trees (screwpine, *Pandanus tectorius*; breadfruit, *Artocarpus altilis*; banana, *Musa* spp.; coconut, *Cocos nucifera*; and papaya, *Carica papaya*). *Pulaka* is cultivated in swampy pits excavated in the centre of some of sandy *motus*, whereas fruits trees are planted both around houses in villages and on *motus*.

Every island except Olohega has a large inner lagoon with a variety of fish and mollusc species. The major fish habitats in the lagoons support species of Holocentridae, Chaetodontidae, Pomacentridae, Muridae, Siganidae, and small-sized species of Serranidae, Lethrinidae, Balistidae and Labridae. Some species of *Tridacna* are widely distributed and are targeted by islanders when large enough to harvest and eat, whereas the harvest of small-sized individuals is prohibited. Pearl shell (perhaps *Pinctada margaritifera*) formerly inhabited the lagoons of Tokelau, and once was used to produce lure shanks, although this species was very limited in Atafu (Macgregor 1937). It may have been locally extirpated from Tokelau by the 1950s when it was reported that 10 years had passed since any pearl shell was found on Fakaofo (Van Pel 1958). Other important invertebrate species include about 10 species of crab, such as *tupa* (a land crab, *Cardisoma* sp.), *ugauga* (coconut crab, *Birgus latro*), and

4. Radiocarbon dating uses a known rate of decline of the naturally occurring radioisotope carbon14 to determine the age of carbon-containing materials, mainly from archaeological sites. Raw results of dating are generally given as "radiocarbon years before present (BP)". "Present" here is defined as AD 1950. Using standard curves, the raw radiocarbon dates (in BP years) must then be calibrated to give calendar dates. A BP date cannot be used directly as a calendar date because the level of atmospheric carbon 14 levels have fluctuated during the period that can be carbon dated. The notation "cal BP" indicates a date that has been calibrated to calendar years before 1950. Thus, "500 cal BP" means 500 calendar years before 1950
5. Reported at 2σ, calibrated using OxCal v3.10 with InterCAL04. (For justification for Northern Hemisphere curve see Addison and Asaua 2006, Petchey and Addison 2008.)

kamakama (rock crab, *Grapsus* sp.) are also common around the shorelines of lagoons, and are usually exploited as food or fishing bait.

The ocean side of the atolls are surrounded by narrow coral reefs that have a greater variety of fish and mollusc species than the lagoons. The major fish inhabiting the outer reefs are various species of Scaridae, Labridae, Balistidae, Acanthuridae, and small species of Carangidae, Serranidae, Lethrinidae and Lutjanidae, which swim mainly around reef edges. Of the molluscs, some species of Turbinidae and Trochidae inhabit mainly reef edges, but recently, only *Turbo* shells are taken for food. According to Passfield (1998), *Trochus* is not native to Tokelau, but was introduced from Fiji in 1986, as part of a development project. Some larger fish inhabit the outer reef waters, particularly between the reef edges and the open ocean. They include species of Carangidae, Scombridae, Lutjanidae, Serranidae, Sphyraenidae and sharks. Flying fish (*Cypselurus* sp.) and sea turtles are also captured mainly in this biotope.

Wild birds inhabit the islands, and Tokelauans still occasionally capture them for food (Huntsman and Hooper 1996; Matagi Tokelau 1991). Seabirds, such as terns and noddies (*lakia*), are caught generally with nets and nooses (Matagi Tokelau 1991). There are no terrestrial mammals native to Tokelau; all were introduced either by the early Polynesian settlers or later European visitors. Archaeological finds (Best 1988; Addison and Kalolo 2009) suggest that the first people to arrive in Tokelau brought with them the dog (*Canis canis*) and the Polynesian rat (*Rattus exulans*). Dogs were no longer present in Tokelau at the time of European contact. Tokelauans have no tradition of dogs, either as a source of food or of companionship, and they are not kept today. *R. exulans* are still found in Tokelau along with recently introduced rat species; rats are now considered a pest. Pig (*Sus scrofa*) was introduced to Tokelau after European contact. It is not known when chickens were introduced.

A brief sketch of Atafu

Atafu Atoll is located at the northwest end of Tokelau, the part of Tokelau farthest away from Samoa (600 km). There is ship transport roughly every two weeks between Samoa and Tokelau, and it usually takes about 48 hours to reach Atafu from Samoa, via Fakaofo and Nukunonu. As noted earlier, Atafu is the smallest atoll in Tokelau, both in lagoon size and land area. The only village is on an islet at the northwest corner of the atoll. The village is at the southern end, known as "Fale", while the north end is called "Vao", and the middle portion "Malae". The current human population is ~600. Atafu's other 41 islets are uninhabited (Fig. 2).

There are three subsistence activities on Atafu: fishing, root-crop cultivation, and fruit-tree harvesting. Coconut gardens are used for human and pig food. Traditionally, only men were allowed to fish on the outer reefs, whereas fishing and gathering in the lagoon and on the reef were also practiced by women and children. Large repertoires of fishing

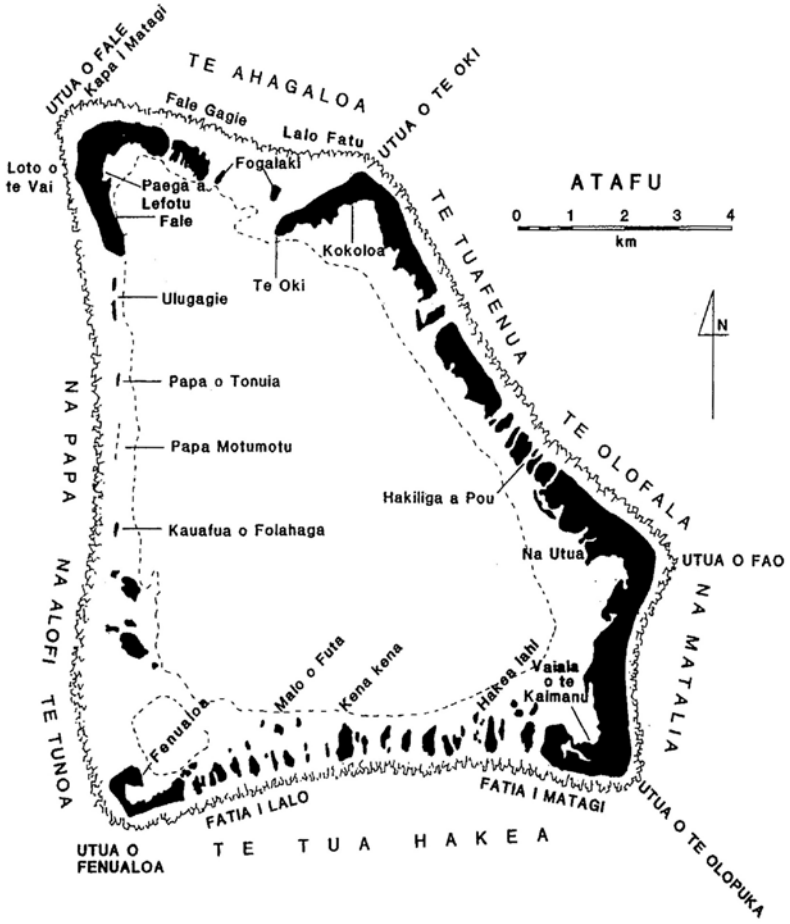

Figure 2. Atafu Atoll

techniques and strategies (~120) were formerly employed throughout the lagoon, inner reef, and outer reef to offshore zones of Atafu (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). A variety of coral reef fish, sharks, sea turtles, pelagic fish, and some invertebrates were caught using seines, hand nets, stone weirs, lines, spears, ropes, and lures. Molluscs, crabs and other marine resources were also gathered occasionally. The range of fishing techniques and strategies has considerably narrowed in recent decades (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008).

The major root crop cultivated on Atafu is giant swamp taro (*pulaka*, *Cyrtosperma chamissonis*), which is cultivated mainly on some of the larger islets on Atafu's west and southwest sides, where the Ghyben-Herzberg freshwater lens is easily accessible from the surface. Villagers must travel to the islets where their gardens are located to maintain and cultivate their land and crops. Beside root crops, fruit trees such as coconut, breadfruit, banana and pandanus are also cultivated, both in the village and on other islets. Among them, coconut has also been planted for copra production. Copra was the major commercialised economic crop on Atafu for some decades, but is no longer exported.

Some pandanus leaf crafts, such as hats and bags made by women, and wood carvings produced by men, are exported. An annual grant provided by the New Zealand government is used for building and running public services, including roads, hospital, power plant, and school. The main shop on Atafu is a cooperative run by the community, and it imports various foods and other products. These public services are administered by a council of male elders known as the Taupulega o Atafu. A council of women, the *fatupaepae*, and a men's society, the *aumaga*, are each responsible for coordinating other important economic, social and cultural activities.

Tokelauan fishing lore and fishing in Atafu

In Tokelau, traditional fishing lore and knowledge was closely related to the *tautai* title system. This title was a status that could be achieved only by men. It can be translated as "master fisherman" — someone who has a considerable amount of expertise in the entire spectrum of fish-catching methods and also the leadership skills and experience necessary for directing and managing fishing expeditions (Gillett 1985; Hooper 1985; Matagi Tokelau 1991). In the course of acquiring skills to become a *tautai*, a young man had one or two older *tautai* to act as teachers. Traditionally, until achieving *tautai* status, a young man was not supposed to take the stern seat in a canoe, the position from which all operations were directed (Hooper 1985). After years or decades of instruction, he would be eligible for a *kau kumate* ceremony in which the title of *tautai* was conferred. Details of the *kau kumate* ceremony are described by Hooper (1985) and in other documents (e.g. Matagi Tokelau 1991).

Tokelauans use the term *faiva* to refer to the capture of all edible animals; the most important of these activities is fishing (Gillett 1985; Matagi Tokelau 1991). Traditionally, a great range of fishing techniques was employed in Tokelau, including various methods of angling, netting, trapping and spearing. Gillett (1985) reported that since the 1980s, some traditional fishing methods, such as skipjack trolling with pearl shell lures, were no longer used in Tokelau. On the other hand, some new and modern fishing methods and gear are widely employed.

Three main types of fishing zones are identified on Atafu and other Tokelauan atolls: offshore (*tuakau*), reef (*uluulu*) and lagoon (*namo*). Although each is characterised by a set of distinctive fishing methods, there is considerable overlap in the types of fish that are commonly caught in them. In addition, land and beach zones are also recognised as part of fishing areas on Atafu (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008), particularly for fish bait, as important bait species such as coconut crab (*ugauga*) are caught ashore.

Outer reef to offshore fishing

According to Atafu informants, offshore fishing is more important than reef or lagoon fishing, because of the relatively small size of their lagoon. In fact, the book written and published by the Atafu-born elders living in New Zealand (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008) reported 47 methods of offshore fishing on Atafu, compared with 29 methods for lagoon fishing and 45 for reef fishing. The number and variety in methods are largest for the offshore fishing zone. Most of the fishing activities observed during our stay on Atafu in August 2008 were on the outer reef or offshore.

Trolling with a hook or lure for *atu* (skipjack, *Katsuwonus pelamis*) and *kakahi* (yellowfin tuna, *Thunnus albacares*) has probably been the most important single type of fishing practiced traditionally on Atafu, both economically and socially (e.g. Gillett 1985; Macgregor 1973; Matagi Tokelau 1991; Hooper 1985, 2008; Hooper and Huntsman 1991). This pattern continues today. Skipjack fishing is called *alo atu*, or just *alo*. Decades ago this involved paddling through a group of shoaling fish while trolling with a hook and lure. Today, aluminium boats with outboard engines are commonly used for outer reef to offshore fishing, including *alo atu*, although some Atafu fishermen maintain the tradition of using wooden outrigger canoes (with outboard engines). Fishing for skipjack and yellowfin tuna

is traditionally a communal, family or fishing crew based activity, involving a number of boats (see also Hooper 2008 for the Fakaofo case in the 1970s), and the catch is distributed among the people in a process called *inati* (only when the catch is large) or simply by family or person who owns vessel.

Hahave (flying fish or *Cypselurus* sp.) are caught usually at night in waters close to the shore, using scoop nets called *heu* and torches. This fishing is called *lama hahave* (*lama* = torch) on Atafu, and traditionally coconut leaf torches were used (see also Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Catches of up to 300 fish per night are not uncommon (Passfield 1998). *Hahave* are available throughout the year, but are most abundant from July to October. At this season they are consumed in greater numbers than tuna (Passfield 1998), although they are a much smaller fish, growing to around 25 cm, and weighing about 300 g (Froese and Pauly accessed 2009). Similar fishing methods with scoop nets are also employed to catch *talagogo* (a seabird species, possibly *Sterna fuscata*) on the outer reefs during the day time.

Noosing *pala* (wahoo, *Acanthocybium solandri*) is also a well-regarded traditional fishing method in Tokelau (Matagi Tokelau 1991) and is called *takiulu*. A small baitfish, such as a flying fish, is towed behind a canoe to lure the *pala* into a prepared noose, which catches the fish by the tail. Groups of *hakula* (marlin, *Xyphias gladius*), *kakahi* (yellowfin tuna, *Thunnus albacares*), and *mago* (sharks) were also occasionally caught using this method. Among these, *hakula* is traditionally regarded as one of the sacred fish (*ika ha*) by the Atafu people and its meat is distributed equally to each household within the *inati* system. Both inshore and deepsea (80–100 fathoms) shark fishing with large hooks and lines is another popular fishing method, particularly for elders who relish shark meat, especially the liver. Deepsea shark fishing called *fakatu* (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008) is a rather new method developed in the early 20th century (MatagiTokelau 1991). *Pala* and *ono* (barracuda, *Sphyraena barracuda*) are also caught using this method.

Sea turtle (*fonu*) is one of the important catches in traditional fishing among all the atolls of Tokelau (Matagi Tokelau 1991). Although there are different methods for catching sea turtles, the most popular is to catch a pair of mating turtles, usually as two men swim to approach the turtles seizing each turtle (see also Macgregor 1937). There were also many traditional restrictions (*lafu*) for turtle fishing, such as a man whose wife was pregnant was not allowed to join a fishing party since his presence with the team would make the turtles timid and shy (Matagi Tokelau 1991). Turtle was regarded as one of the sacred marine resources (*ha*) by Atafu people, and the meat was equally distributed to each household within the *inati* system similar to other sacred species such as skipjack tuna and marlin. The season of turtle fishing is closely related to the turtle's mating period, usually September to November on Atafu. As in most Pacific Island countries, today turtle fishing is officially prohibited throughout Tokelau.

Longline fishing has also been an important fishing method (usually employed in the outer reef to pelagic zone) and includes a variety of techniques. *Makomako* is a longline fishing method in which as many as eight baited hooks in a cluster and separated by spreaders are let down to the bottom of the sea with a heavy sinker (*fatu makomako*) to depths of about 200–300 fathoms (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). A similar fishing method was also observed on Pukapuka in the northern Cook Islands, where *tuku moana* is deepsea handline fishing in depths up to about 300 fathoms, and involvinh the use of a special composite fishing apparatus (*taumakomako*) consisting of four or more hooks fixed by spreaders to a single line (Beaglehole and Beaglehole 1938; Hooper 1994).

Reef fishing

Fishing with nets (*kupega, heu, kalele*) is the most common reef fishing technique practiced today in Tokelau (see also Passfield 1998), although angling (*hi*) is also actively employed on Atafu (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). In the recent past, nets were made locally, using 30 kg breaking strain monofilament. Passfield (1998) reported that mesh size ranged from ½ inch (12.7 mm) to 4 inches (100 mm), with 2 inches (50 mm) being the most common size. Although most of the nets used today on Atafu are commercial products made of nylon, the nature of netting is quite similar to that in the recent or traditional past; nets are usually set on the reef flat to catch fish moving in and out of the lagoon. Fishing with a net attached to a circular wooden frame that can be closed by pulling a line is called *tata*, and is commonly employed in the reef zone.

Smaller and long-handled scoop nets (*heu*) are used by groups of two or three people to catch groupers (e.g. *Epinephelus melanostigma*, *Epinephelus merra*, *Epinephelus hexagonatus*) and squirrelfish (*Myripristis* sp.) on Atafu (see also Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Handle scoop nets (*kalele*) were frequently used for fishing in outer reef channels (e.g. Macgregor 1937), and this method is called *tatago* on Atafu. On Atafu today, large netting drives with seines (*talitali*) are also occasionally employed as a community fishing activity involving over 100 people (men and children but no adult women). The main fish captured by such netting are *ulahi* (*Scarus harid*), *umeihu* (*Naso unicornis*), *umelei*

(*Naso lituratus*), *kanae* (*Mugil cephalus*), and *nanue* (*Kyphosus cinerascens*).[6]

Fishing with a hook (*matau/kafilo*) and line (*uka*) is occasionally practiced on Atafu, mainly around reef channels. Among 45 traditional fishing methods mainly employed in reef zones, 13 are recognised as hook-and-line fishing (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Most of these hook-and-line fishing methods are named and identified with targeted fish names, such as *hi gatala* (*gatala = Epinephelus quoyanus*), *hi patuki* (*patuki = Cirrhitus pinnulatus* or hawkfish in general), *hi api* (*api = Acanthurus guttatus*), *hi mutu* (*mutu = Abudefduf* sp.), and *hi ulafi* (*ulafi = Hipposcarus longiceps* or *Scarus harid*). Lures are also used where the sea bottom is sandy (so that hooks do not get snagged).

Stone weir fish traps (*fota*) were also used as one of the traditional fishing methods on Atafu. However, the use of such stone weirs ended by the late 1970s. On Atafu, basically two types of *fota* were built and employed; the former one is called *tali aheu i na fota* and mainly targets schools of *Caranx* sp. The trap is a *fota* about 18 m long with the mouth facing the land and lagoon side. The other type is called *tali ihe i na fota* and mainly targets schools of garfish with a trap about 18 m long, with the mouth also facing toward land (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Our interviews with elder men confirm that there were at least two of each *fota* on Atafu in the late 1970s. Huntsman and Hooper (1996) report that traps were constructed beside the shallow passes in the reef to catch fish on their spawning runs from the lagoon to the sea. Although most traps were operated communally, some were owned and operated by individual families (Matagi Tokelau 1991).

A fishing method targeting octopus (*feke*) and crayfish (*ula*) was also mainly employed in the reef zone. The three main techniques used to take octopus (collectively called *fagota feke)*: are 1) *fagota feke*, using a wooden stick made from a *gagie* tree (*Pamphis acidula*) and fishing string called *kalava* made from the outer skin of a coconut frond petiole (which attracts the octopus so that it can be caught); 2) *taki feke*, using an octopus lure (*pule takifeke*) made from a large cowrie shell (*pule*) and pandanus leaf (*laufala*); and 3) *toko feke*, using a metal stick at low tide. A canoe was used occasionally for moving around the reef to seek octopus. Crayfish are captured using a method called *holi ula*, in which feet and hands are used to catch them during a rising tide on a moonlit night when they emerge to feed (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Among these, *toko feke* is the main method used today.

Lagoon fishing

On Atafu, lagoon fishing is not considered as productive as fishing in the open sea, and is often only done when the weather prohibits fishermen from going out to sea, especially during the hurricane season between November and April. A number of different species are caught with a hook and line. Among 29 fishing methods mainly employed in the lagoon, 16 are recognised as hook-and-line fishing (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Similar to reef fishing, most of these methods are named and identified with targeted fish names such as *hi kulapo* (*kulapo* = small-sized *Scarus harid* or *Hipposcarus longiceps*), *hi mu* (*mu = Monotaxis grandoculis*), *hi umu* (*umu = Balistoides viridescens*), *hi mutu* (*mutu = Abudefduf* sp.), *hi papo* (*papo = Cheilinus fasciatus*), and *hi kafa* (*kafa = Liza vaigiensis* or *Liza subviridis*).

Flying fish moving into the lagoon are also targeted by line fishing during the daytime, and this method is termed as *hi havane ite ao* (*ite ao* = during daytime). Line fishing is also employed at night to catch *gatala* (*Epinephelus quoyanus*) and *talatala* (*Myripristis violaceus*). The method used to catch *gatala* is termed *hi gatala i te tete*, and the other, for *talatala*, is termed *hi talatala*. Swimming fishing with goggles and a line is called *fakatakoto*. Octopus meat is used mainly as bait for this kind of fishing (MatagiTokelau 1991). Sometimes a sack of coral gravel is tipped into the lagoon to attract fish before the line is cast. This is known as *tuki akau* (Matagi Tokelau 1991) or *tuki toka* (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008).

Smaller hand and scoop nets (*heu*) have also been used by groups of two or three people in lagoon fishing. The main fishing method with *heu* is called *lama ihe*, which targets garfish or half-beaks (*ihe* = Hemiramphidae and Belonidae) inside the lagoon at night. Baskets (*faga*) made from the *gagie* tree are also used in lagoon fishing. Some net fishing, such as *tata* (see description in reef fishing) and *tali tafega*, which targets some fish species moving between the reef and lagoon during low tide, are used as lagoon fishing methods (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). Basket traps were also employed mainly in the lagoon on Atafu and

6. We had a chance to observe the large netting drive during our stay on 11 July 2009. The netting was practiced as the community fishing during the aumaga festival with over 100 men involved. Fishing started at around noon for about an hour to catch ~480–600 kg (25 baskets each of which was ~20–25 kg) of inshore fish. All the fish captured were distributed equally to each household within the *inati* system, and our count of each fish species confirms that *ulahi* (305 specimens), *umelei* (240 specimens), and *umeihu* (81 specimens) were the main fish caught, far exceeding other species in number and weight.

other atolls. Macgregor (1937) reported that he did not see basket traps at Atafu during his visit in 1932, although he saw a few of one type at Fakaofo and Nukunonu. Our interviews confirm that there were some at Atafu in the recent past, although none were seen on Atafu during our stay. Such basket traps might not be commonly used in Tokelau, particularly at Atafu, with the smallest lagoon.

Gathering molluscs is also part of lagoon fishing. Giant clams (*fahua*, *Tridacna maxima* and *Tridacna squamosa*) are harvested regularly from shallow parts of the lagoon, and they are levered from below the water with a knife-like instrument called a *nao*. This type of fishing is called *naonao fahua* (Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008). At present, there is some concern over the decline of clams (e.g. Toloa et al. 1994). The introduction of underwater goggles and the recent development of commercial harvesting for the export market have both contributed to this problem (e.g. Gillett 1985; Passfield 1998). The *taupulega* on Atafu has now imposed strict limits on *Tridacna* harvesting.

Seasonality, lunar cycle and fishing activity

Atafu and the other Tokelauan atolls are occasionally struck by cyclones from November to March, whereas rather mild southeast trade winds blow during May to November. The cyclone season is also the period of variable north and west winds that blow onshore at Tokelau's village islets, thus making access through reef passes problematical. Outer reef to offshore fishing on the inhabited side of islands is periodically difficult or impossible during this season, so fishing activities are more actively pursued from May to November, the season regarded as the best fishing season on Atafu and the other atolls (see also Gillett 1985; Hooper 1985; Matagi Tokelau 1991).

The annual cycle is divided into 12 months, similar to the western solar calendar, and month-to-month transitions are recognisd by the location of an associated star (Matagi Tokelau 1991). The monthly change does not correspond directly with fishing seasons, which in Tokelau are basically classified into two seasons, depending on the prevailing wind direction (May to November and November to March). The transitional period around April is generally a period of light winds and calm seas — an ideal time for voyaging.

Fishing activities in Tokelau are more closely related to moon phase or the lunar cycle than to the annual calendar. The single moon phase is generally termed as 30 days, and the middle of the phase, which corresponds to the 14th and 15th nights, is the full moon. On Atafu and other atolls the moon phase is divided into three phases: 1) *po utua* (ocean nights), which corresponds to the 1st (*fakatahi*) through 10th (*magafulu*) nights when the new moon is seen in the western sky at sundown on the ocean side of the village islet; 2) the *po loto* phase (middle nights), which corresponds to the 11th (*fakatahi*) through 14th (*malama* = light; recognised as the full moon night) nights when the moon is seen overhead at sunset; and 3) *po o namo* phase (nights of the lagoon), which correspond to the 15th (*fakatahi*) through the 30th (*fanolao*) nights when the moon rises after sundown across the lagoon side (see also Macgregor 1937; Matagi Tokelau 1991).

These three phases are shown in Table 1, where it can be seen that the first night of each phase are similarly called *fakatahi* (*faka* = causative prefix; *tahi* = one). This means the terms of the moon are reset when the moon's location at sundown changes from the ocean side to the lagoon side of the village islet. Among these phases, the terms of the moon phases simply correspond to counting as 1 (*tahi*) to 10 (*fulu*) for the *po utua* phase, while some specific terms are used during the *po loto* phase in which the 13th night is termed as *utua* (=border of land and ocean, or reef channel), and the 14th night is termed as *malama*. During the *po o namo* phase, the 20th through 29th nights are reverse-counted from 10 to 1, and the 30th night is termed with the specific name of *fanola* (= fading moon night).

The detailed classification and terms of the lunar cycle on Atafu and other atolls in Tokelau partly indicates that the lunar cycle is important for fishing activities. This also corresponds to tidal cycles, which have a strong relationship with fish feeding and other behaviours, and is sometimes one of the factors regulating fishing activities. For example, a species of Siganidae (possibly *Siganus canaliculatus)* crosses between the outer reef and lagoon every month of the year, particularly during the 27th to 29th nights, whereas some species of Acanthuridae (*Acanthurus* spp.) can be caught in abundance during the 1st to 3rd nights and the 22nd to 25th nights. On the other hand, small Carangidae (*Caranx* spp.) up to 30 cm, and long-nosed emperors (*Lethrinus minatus*) cross between the outer reef and lagoon around the 15th and 16th nights and the 27th and 28th nights from May to November (see also Matagi Tokelau 1991).

Similarly, some offshore fish are known to exhibit seasonality (Table 1). For example, *pala* (*Acanthocybium solandri*) can be caught from the 1st to 22nd nights, while the best times to catch sharks are during the 1st to 10th nights and the 22nd to 30th nights. Although flying fish can be caught all year, the best times are between the 4th to 12th nights and the 17th to 18th nights from August to October. Because fishing for flying fish is practiced at night with a torch or lamp, the nights

Table 1. Moon phases and major targeted fish

Day	Tokelauan name	Phase	Moon location	Acanthurids	Scarids	Siganids	Caranx	Scads	Flyingfish	Lethrinids	Skipjacks	Sharks
1	*Fakatahi*	***Poutua***	ocean side			x					x	x
2	*Fakalua*					x					x	x
3	*Fakatolu*					x					x	x
4	*Fakafa*								x			x
5	*Fakalima*			x	x				x			x
6	*Fakaono*			x	x	x			x			x
7	*Fakafitu*			x	x	x		x	x			x
8	*Fakavalu*			x	x			x	x			x
9	*Fakaiva*			x	x	x		x	x			x
10	*Magafalu*			x	x	x		x	x			x
11	*Fakatahi*	***Poloto***	island	x	x		x		x	x		
12	*Fakalua*			x	x		x		x	x		
13	*Utua*											
14	*Malama*											
15	*Fakatahi*	***Po Onamo***	lagoon side									
16	*Fakalua*											
17	*Fakatolu*								x			
18	*Fakafa*								x			
19	*Fakalima*											
20	*Fakatutupu*											
21	*Magafulu*											
22	*Poiva*			x	x							x
23	*Povalu*			x	x						x	x
24	*Pofitu*			x	x						x	x
25	*Poono*			x	x						x	x
26	*Polima*											x
27	*Fanouluata*					x			x	x		x
28	*Fanolotoata*					x			x	x		x
29	*Mateiluga*					x						x
30	*Fanoloa*											x

After Gillett 1985; Matagi Tokelau 1991; our interviews in 2008

with a bright moon during the 13th to 16th nights are not selected. It is clear that the lunar cycle is strongly related to fishing activities in Tokelau. Such kinds of knowledge about the relationship between each fish species' behaviour and lunar and seasonal cycles have been passed down by Tokelauan males. On Atafu, the men's activity house at *lalopua* is the locus for such learning. One Atafu male aptly referred to it as "Atafu's university of traditional knowledge and practice".

Material culture and fishing

Gear and equipment associated with fishing have changed since prehistoric times, particularly after contact with the Western world. Historical evidence indicates that Tokelauans used lines, hooks, lures, rods, nets of various kinds, as well as traps and stone weirs before European contact (e.g. Hooper 1985; Macgregor 1937). Archaeological research on Fakaofo and Atafu by Best (1988) unearthed four

one-piece pearl shell or bone hook fragments and recovered a complete pearl shell lure shank. Traditionally, the hook portion of the lure was made from the shell of *fonu una* (hawksbill turtle or *Eretmochelys imbricata*), whereas in modern times cow horn, coconut shell, whale teeth, marlin spikes, aluminium and plastic are also occasionally used (Gillett 1985). Historically, lures have had the leader line attached to both the head of the pearl shell shank and to the base of the turtle shell hook. This conforms typologically to the typically western Polynesian types, such as those from Samoa, Pukapuka, Tuvalu, Wallis and Polynesian outliers in Melanesia (Anell 1955; Buck 1930; Gillett 1985; Macgregor 1937).

The records of the United States Exploring Expedition (Wilkes 1845; Hale 1846), which visited Atafu and Fakaofo in 1841, mention the people's extreme eagerness to trade for metal fish hooks and pieces of iron for making hooks. Gillett (1985) reported that pearl shell was also brought to Tokelau from Papua New Guinea by Tokelauan missionaries during the early 1940s. The shells were also imported from other locations, including Pukapuka and Nassau in the northern Cook Islands, and finished lure shanks from Samoa (Gillett 1985). This evidence indicates the eagerness of Tokelauans for exogenous materials for making fishing gear, especially pearl shell. This may suggest a motivation for extensive voyaging in prehistoric times, supporting archaeological evidence for Tokelau long-distance exchange in basalt and ceramics (Addison et al. 2009; Addison and Kalolo 2009; Best 1988; Best et al. 1992).

By the late 1960s, imported fishing equipment had almost entirely replaced items of local manufacture, except canoes. Cotton lines, which had supplanted lines made of coconut sennit or other braided fibres, such as *Hibiscus tiliaceus*, since the early 20th century, now have been completely replaced by monofilament nylon lines (e.g. Hooper 1985). Nets used to be locally made with braided sennit or other fibers, but now also have been replaced by nylon. Spears are not so actively used in Tokelau, whereas spearguns and goggles have been more widely used since their introduction during the 1940s.[7] The use of pearl shell lures had either stopped or dramatically decreased by the early 1970s (Gillett 1985; Hooper 1985), and subsequently, most hooks have been made from metal. The traditional pole for skipjack fishing was made from the wood of *puka* (*Hernandia nymphaeifolia*), although imported bamboo has been used in recent times (Gillett 1985), as well as fibreglass fishing poles.

A variety of woods were used to make fishing gear up until a few decades ago. For example, to build a traditional canoe, *kanava* (*Cordia subcordata*) was used for the hull and outrigger spars, *gagie* (*Pemphis acidula*) for attaching the spars to the outrigger, and *puka* (*Pisonia grandis* or *Hernandia nymphaeifolia*) for the outrigger (Gillett 1985; Whistler 1988). On occasion, breadfruit wood was also used for the hull (Huntsman pers. comm. 2009). All terrestrial resources are owned and controlled by *kaiga* (extended family unit), which is one of Tokelau's traditional social structures. Canoes were also unequivocally *kaiga* property in the past. Until the 1970s, each extended family had at least one canoe, and could hardly have existed as an independent unit without it (Hooper 1985). However, the number of traditional canoes has been decreasing since the 1970s, after the widespread introduction of aluminium skiffs and outboard engines.[8] Today on Atafu, traditional canoes are a common site beside houses and around the village, although most are in disrepair and seldom or never used. People mainly use aluminium skiffs, although several traditional canoes are regularly maintained and used. Both skiffs and canoes are propelled by outboard engines and are regarded as the property of individuals or of married couples now, and no longer of *kaiga* (see also Hooper 1985 for the Fakaofo case). This may be an example of the rapid replacement of traditional fishing gear and materials through the introduction of modern ones since the middle to late 20th century, which have simultaneously weakened the tight connections that formerly existed between material culture, the social system, and the island ecosystem.

Marine conservation measures

A number of measures are in place in contemporary Tokelauan society that act to limit the exploitation of certain taxa (McAlister 2002). One of the most important conservation measures is the periodic imposition of a *lafu*, or use restriction, on specific areas of the reef by the *taupulega* (Toloa et al. 1994). In addition to protecting fisheries that are periodically depressed because of human exploitation and seasonal changes, a *lafu* is sometimes declared to ensure that fish stocks are built up in anticipation of future needs for specific events, such as important festivals (Toloa et al. 1994). On contemporary Atafu, for example, private fishing is restricted on most of the reef fronting the islet where the village is located. Only communal fishing (*faiva fakamua*) is allowed there at certain times of the year.

7. Gillett (1985) suspects that the introduction of diving goggles to Fakaofo in the 1940s was a major factor contributing to the virtual absence of pearl shell in the lagoon by the 1950s.
8. For example, Hooper reported that about 60 canoes were in serviceable condition at Fakaofo in 1971, whereas their number had decreased to only 8 in 1981 (Hooper 1982).

The distinctive *inati* system of distribution practiced in the atolls is another aspect of Tokelauan fishing that is strongly related to marine conservation. All resident members of the village are assigned to an *inati* group, often on the basis of kin relationships, but sometimes for a variety of other reasons (Passfield 1998). In this system, certain types of fish are considered as *ha* (sacred), meaning that they must be shared among the village when they are caught. As described above, these sacred fish (*ika ha*) were traditionally *fonu* (sea turtle), *hakula* (billfish or marlin), and *atu* (skipjack tuna), and they were divided among the whole population through the *inati* system on Atafu and the rest of Tokelau (see Hooper 1985). Even today, *fonu* and *hakula* are still regarded as *ika ha*, whereas *atu* is usually not, except when there is an especially large catch. In effect, the *inati* system deters the exploitation of these taxa by reducing individual incentives for capturing certain animals. Other species, mainly reef fish, are also distributed through the *inati* system, particularly at the time of communal fishing.

Atafu classification of the marine ecosystem

Marine and coastal environments

Atafu people divide the space around them into several categories. For the marine ecosystem, the inner lagoon at the centre of the atoll is termed *namo,* and land is *laufenua*. The micro-environmental features of the lagoon are distinguished by depth, nature of the bottom, and coral development. The shallow water or tidal zone is termed *matafaga*, the much deeper but visible bottom zone is *aloalo*, and coral formations in the lagoon interior are termed *akau*. All other parts of the lagoon are called *namo*, and no specific terms were collected by our interview survey (Fig. 3). Similarly, the reef to outer reef zones that surround the *laufenua* are also distinguished by their micro-geographical changes and depth. The inner reef zone is termed *uluulu*, and the reef channel is *utua*. On Atafu, there are six *utua* and each has its own name. The reef edge partially higher than sea level at low tide is termed *fagautua*. Seaward of the *fagautua* is the *pufaiava*; then the *tafato* extends outward to a depth of about 20 m.

Classification of fish and molluscs

Knowledge of fish and fish behaviour on Atafu is extensive and elaborate, including a set of named categories related to lore and fish, which is ingeniously incorporated into the multiple facets of actual activities, such as fishing and gathering. We collected 164 fish names on Atafu, Hooper (1994) collected about 130 monomial fish names during fieldwork in Tokelau, and Rensch (1994) collected 239 fish names from the Tokelauan Dictionary (Tokelau Dictionary 1986) and other publications (Gillet 1985; Van Pel 1956) as well as from research in Tokelau (Appendix 1).

In reference to Tokelauan fish names, Hooper (1994) indicates that four fish names are only found in Tokelau, Tuvalu and Pukapuka plus eastern Polynesian languages, and thus may not warrant a Proto Nuclear Polynesian reconstruction. These are *eve* (*Epinephelus hexagonatus* or *Epinephelus merra*), *komulo* (*Caranx sexfasciatus* or *Caranx ignobilis*), *pakeva* (*Carangoides ferdau* or *Carangoides orthogrammus*), and *tupoupou* (*Aulostomus valenti*). In 2008, however, we could not collect the name *tupoupou* on Atafu for several reasons: 1) the books we used lacked the exact species corresponding to this fish name; 2) the fish family including this species is not important as food or as a resource on contemporary Atafu (although these fish are commonly found in Atafu waters, according to our informants); and 3) the informants we selected did not know or had forgotten about the fish name at the time of our interview. For possibly the same reasons, we were unable to collect some fish names that are shown in the Tokelauan Dictionary and other publications and which

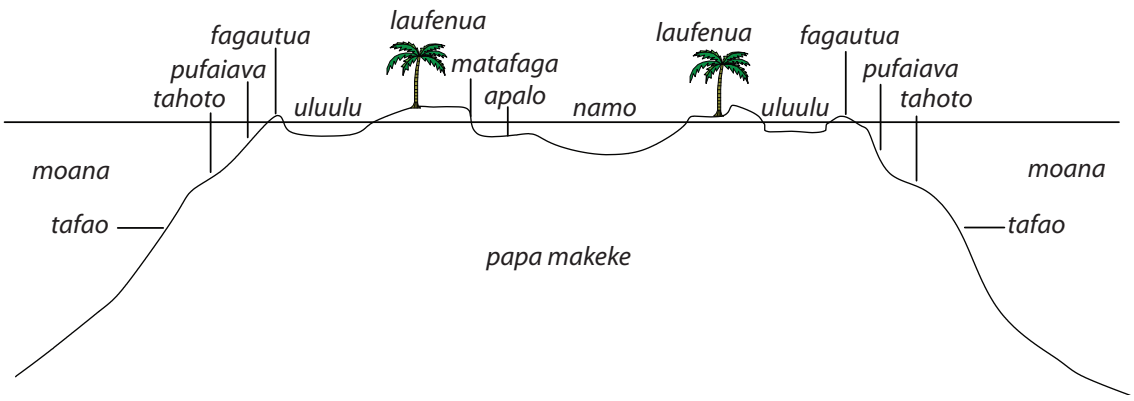

Figure 3. Atafu names and classification of atoll marine environments (drawn after Mafutaga-a-Toeaina-o-Atafu-i-Matauala-Porirua 2008).

are possibly common fish in Tokelau, including Atafu. To highlight these limitations, consider the case of *palu* (a species of oil fish, *Ruvettus pretiosus*). This fish and its name are also well known on contemporary Atafu, but we could not identify and collect a fish name during our interviews because, according to the informants, the exact species was not illustrated within the books we used during interviews.

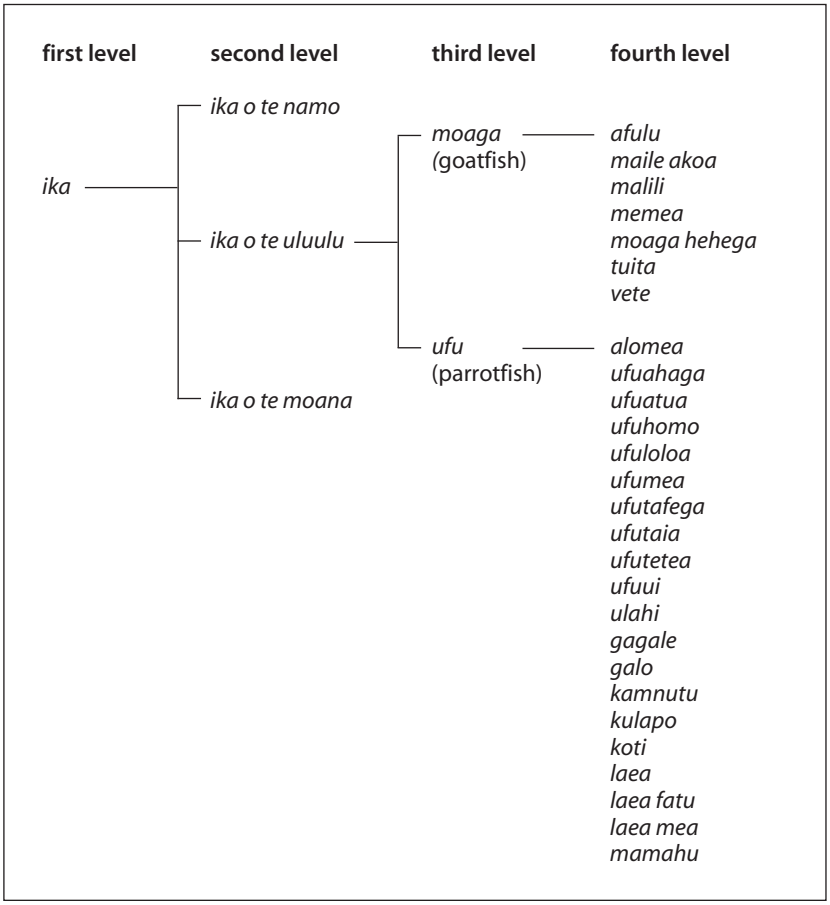

Figure 4. Schematic representation of a sample Tokelauan hierarchical classification of fish using goatfish and parrotfish from our 2008 Atafu interviews

On Atafu as well as the other Tokelau atolls, taxa for fish are generally organised into a hierarchy consisting of four levels (Fig. 4). A very general taxon, *ika*, is applied to a wide variety of fish species and also to marine mammals such as dolphin (*taka*) and whale (*tafola*), whereas *figota* is applied to all marine shell species in general. In Atafu and Tokelauan categories, *ika* are mainly divided into *ika o te namo* (fish of the lagoon), *ika o te uluulu* (fish of the reef), and *ika o te moana* (fish of the ocean) as the second level, while species included in those categories have their own names (e.g. Hooper 1994).

At the lower levels, each term is applied to particular groups or kinds of fish. Terms at the third level ("primary lexemes" in Hooper 1994:188) correspond to larger sub-groups or kinds of such fish as butterflyfish (*tifitifi*), parrotfish (*ufu*), squirrelfish (*malau*), and moray eels (*puhi*). At the fourth level ("secondary lexemes" in Hooper 1994:188), terms are applied to more specific groups or kinds of fish; for instance, the label *tifitifi taputapu* covers both Philippine butterflyfish (*Chaetodon adiergastos*) and threadfin butterflyfish (*Chaetodon auriga*), whereas *tifitifi kainiumata* applies to saddled butterflyfish (*Chaetodon ephippium*), and *tifitifi piu* for bluespot butterflyfish (*Chaetodon plebeius*), all of which are included into the *tifitifi* category at the higher level.

It should also be noted that terms at the second and third level are not always the same as the Linnaean system of categorisation, as in the case of *tifitifi taputapu*. For other examples, *ufu taia* is applied to two species of parrotfish: six-banded parrotfish (*Scarus frenatus*) and green-finned parrotfish (*Chlorurus sordidus*). *Maeva* is applied to three species of spinefoots: black spinefoot (*Siganus fuscescens*), golden-lined spinefoot (*Siganus lineatus*), and smudgespot spinefoot (*Siganus canaliculatus*). *Humu fagota* is applied to two species of triggerfish: white-barred triggerfish (*Rhinecanthus aculeatus*) and yellow-spotted triggerfish (*Rhinecanthus rectangulus*).

On the other hand, some fish species are possibly indicated by some different names. Although it is not obvious on contemporary Atafu, some fish names in the Tokelauan Dictionary (1986) and other documents (Hooper 1994; Rensch 1994) correspond to the same species. For example, saddle parrotfish (*Scarus sordidus*) is termed both as *ufu* and *ufuui*, and tattooed parrotfish (*Scarus jonesi*) is termed both as *kamutu* and *laea*. However, these differences could also be caused by the difference between each atoll in Tokelau, as it is unclear on which atoll these fish names were collected. As clearly shown in Appendix 1, many fish names collected on Atafu correspond to a similar type of fish indicated in the dictionary and other publications, but not exactly to the same species. In coming years, we anticipate collecting fish names on Fakaofo and Nukunonu to compare with our Atafu data.

On Atafu, lagoon to reef fish (a variety of small-sized species) mainly have second-level terms,

whereas most of reef edge to outer reef fish (a variety of large-sized species belonging to the families Carangidae, Scaridae, Lutjanidae, Acanthuridae, Serranidae, Labridae and Scombridae) are mainly termed only at the third level, and no terms correspond to larger sub-groups or to the Linnaean family level. Also, these fish groups have the most varied names in each family. For example, Carangidae has the most individual names, corresponding to 16 species; followed by Scaridae with 12 species individually named; Acanthuridae with 12 species named; Lutjanidae with 12 species named; Scombridae with 9 species named; sharks with 9 species named; and Serranidae and Labridae each with 8 species named. (These data are for Atafu only and exclude names possibly collected on other atolls in Tokelau [see Appendix 1].)

Further, some fish species mainly belonging to families that inhabit the reef edge to outer reef have two or more Atafu names according to their developmental stage or by their size (Table 2). For instance, red bass (*Lutjanus bohar*) has two names, *tatatata* (for the small size) and *fagamea* (for the large size); giant trevally (*Caranx ignobilis*) has four names, *lupohama* (baby size), *komulo* (small size), *uauaoge* (middle size), and *uluakata* (large size). Bluefin trevalley (*Caranx melampygus*), another species of Carangidae, also has four names, *lupoaheu* (baby size), *aheu* (small size), *amahua* (middle size), and *uluakata* (large size); thicklip trevally (*Carangoides orthogrammus*) has two names, *alaala* (small size) and *pakeva* (large size).[9] As these names show, *lupo* or *lupolupo* is a term for juvenile Caranx species, and *ulua* is for the mature or largest-growing species of the same genus (see also Hooper 1994; Tokelau Dictionary 1986). Flyingfish (*Cypselurus* sp.) also has three or four different names depending on its size: *hipa* (baby size); *malolo* (small size); *hahave* (middle size); and *tuali* (large size). In the Scombridae family, skipjack tuna (*Katsuwonis pelamis*), yellowfin tuna (*Thunnus albacares*), and dogtooth tuna (*Gymnosarda unicolor*) each have two different names according to their growth stages. Other instances are shown in Table 2.

Apart from the hierarchical classification mentioned above, some fish have names related to their character, shape, colour, behaviour and habitat. For instance, the black damselfish (*Neoglyphidodon melas*) is termed *leoleo akau,* which means "guard of coral" in Tokelauan, because this fish is usually found around coral and attacks people when they come too close. The duskyfin bigeye (*Heteropriacanthus cruentatus*) is termed *mata pula*, which means "open eye widely" as the fish has big eyes. In terms of shape and colour, the Indo-Pacific sailfish (*Istiophorus platypterus*) is termed *tua niu* which means "coconut leaf" because the fish has a large dorsal fin that looks like a coconut leaf. The giant moray (*Gymnothorax javanicus*) and yellow-edged moray (*Gymnothorax flavimarginatus*) are termed *puhi kukula* (*kukula* = red), and the painted moray (*Siderea picta*) is termed *puhi tea* (*tea* = white) because of their skin colour. The mottled moray is termed *puhi gatala* as its colour pattern is similar to that of a grouper species termed *gatala* (*Epinephelus quoyanus*). Hammerhead sharks (*Sphyrna* spp.) are termed *mata i ta liga,* which means "eyes on ears" as the eyes of this fish are on both sides of its wide head.

Table 2. Fish names for different developmental stages

Family	Scientific name	Baby size	Small size	Middle size	Large size
Carangidae	*Caranx melampygus*	*lupoaheu*	*aheu*	*amahua*	*uluakata*
	Caranx ignobilis	*lupohama*	*komulo*	*uauaoge*	*uluakata*
	Carangoides orthogrammus		*alaala*		*pakeva*
Scombridae	*Gymnosarda unicolor*		*tava tava*		*valu*
	Thunnus albacares		*kakahi*	*kakahi*	*takuo*
	Katsuwonis pelamis		*atu*	*atu*	*nakano*
Scaridae	*Scarus harid*	*alomea*	*kulapo*		*ulahi*
	Hipposcarus longiceps		*kulapo*		*ulahi*
Exocoetidae	*Cypselurus* sp.	*hipa*	*malolo*	*hahave*	*tuali*
Lutjanidae	*Lutjanus bohar*		*tatatata*		*fagamea*
Labridae	*Cheilinus undulatus*		*lalafi*	*lafilafi*	*malatea*
Kyophosidae	*Kyphosus bigibbus*		*gafu gafu*		*nanue*
Mullidae	*Parupeneus cyclostomus*		*moaga hehega*		*moaga aheu*
Sphyraenidae	*Sphyraena barracuda*		*ono*	*ono*	*pananua*

9. Hooper (1994) indicates that growth terms for *Caranx* species exist in many Polynesian languages and the same five words can occur at different levels in these systems.

Table 3. List of Atafu mollusc names

Tokelau name	Family	Scientific name	English name
aliao	Trochidae	any trochus	
alili	Turbinidae	any turban shell	
unga	Gastropoda		Other gastropoda shells
fao	Cypraenidae	*Cypraea* spp.	Cowrie shell
fao	Cassidae	*Cassis* spp.	Helmet shell
fao	Strombridae	*Lambis* spp.	Conch shell
fatifati afa	Conidae	*Conus pulicarius*	Flea-bitten cone shell
fahua	Tridacnidae	*Tridacna gigas*	Giant clam shell
fahua taka	Tridacnidae	*Tridacna gigas* (extra large)	Giant clam shell
favae	Conidae	*Conus mobile*	Necklace cone shell
fuiono	Collumbidae	*?*	
kahikahi	Cardiidae	*Fragum fragum*	White strawberry cockle
mimiha	Ellobidae	*Melampus* spp.	
makulu	Lottorinidae	*Littoraria coccinea*	Blight coccinea
mapu	Conidae	*Conus* spp.	Small cone shell
paelo	Conidae	*Conus lividus*	Livid cone
paua	?	*?*	Poisonous shell
pipi	Bivalva		All bivalva shells
pule	Cypraenidae	*Cypraea* spp.	Cowrie shell
tiolu	Conidae	*Vermetus* sp.	
valu	Conidae	*Conus connectens*	Comma cone shell
tuitui		*Echinometra* sp.	Sea urchin
vana		*Diadema* sp.	Black sea urchin

On the other hand, yellow-dotted Maori wrasse (*Cheilinus chlorurus*) is termed *taina o te puhi,* which means "cousin of *puhi* (moray eel)" because the fish's mouth looks similar to that of a moray eel. The ladder wrasse (*Thalassoma trilobatum*) or red-and-green wrasse (*Thalassoma purpureum*) are termed *hugale paea* or just *hugale*, which means a kind of "beauty" as their skin pattern is very colourful. In terms of behaviour and habitat, black marlin (*Makaira indica*) is termed *tiu vaka* (fast canoe) because this fish swims as fast as a canoe, and rosy snapper (*Pristipomoides filamentosus*) is termed *palu vaka alo,* which means "paddle of a canoe" as this fish also swims very fast, like a canoe being paddled. Pale soldierfish (*Myripristis melanostictus*) is termed *malau tafu* because this fish inhabits areas of stone (*fatu*) or coral, and barred garfish (*Hemiramphus far*) is termed *ihe fota* because this fish (*ihe* = garfish) is usually caught by stone weir (*fota*).

On Atafu, some fish families or groups have no name at either the third or fourth level. These fish belong to the families Haemulidae, Plotosidae and Ariidae although some of these species are named on other islands in western Polynesia (Rensch 1994). By our interviews, most of the answers for the absence of these fish names are explained by the scarcity of these fish or their absence in and around Atafu. Although an intensive biological survey is required to empirically document their absence or scarcity, their absence in names may indicate the small populations of these fish in Atafu waters.

Similarly, the same tendency is confirmed among the molluscan names of Atafu. Only 16 names were collected for molluscs (Table 3), compared with our collection of over 160 fish names (corresponding to about 200 species). Further, only two groups — *Tridacna* sp. (*fahua)* and *Turbo* sp. shells (*alili)* — are exploited as food. Other named molluscs are rather small in size, and are only used as material for ornaments. These small-sized gastropods are mainly spiral shells such as *Conus* spp. of which six are named. *Cypraea* sp., and *Strombus* sp., while small bivalves are all termed *pipi* in the third level with no names corresponding to family or species level except for *Tridacna* spp.

The idea that the very limited number of mollusc names on Atafu might be caused by the island's historic and cultural background with limited use of molluscan resources is confirmed by our interviews and observations. It may also be directly caused by ecological factors in the lagoon and coasts of Atafu Atoll, such as a limited number and species variety of molluscs, especially large-growing species used for food. Although further ecological and biological surveys are required to confirm this possibility, our short collecting surveys along the coasts both in the lagoon and on the reef confirmed that, except

for some *Tridacna* sp. and *Turbo* sp., most individuals encountered were small-sized *Conus* sp. and *Cypraea* sp., or small bivalves. Previous archaeological test excavations by Best (1988) on Atafu and Fakaofo and our 2008 excavations on Atafu (Addison et al. 2009; Addison and Kalolo 2009) also confirmed the very limited number of molluscan food shell remains, except *Tridacna* sp.

Discussion

The cognition or mental images of present Tokelauans about marine environments and resources provides some hints for reconstructing prehistoric fishing and maritime exploitation. For instance, the classification and diversity of fish and mollusc names on Atafu clearly shows the overwhelming importance of fish resources, as opposed to molluscs. An analysis of fish name classification enables us to consider people's preferences regarding fish and other marine resources. Also, the variety and character of fishing methods and fish name classification on Atafu reveal that there are more variations in names and fishing methods for larger pelagic fish species, such as those in the families Carangidae and Scombridae, and show a high dependence on outer reef and offshore resources. Such tendencies possibly indicate that outer reef and offshore resources were significant both economically and culturally in the past on Atafu.

McAlister's (2002) analysis of fish remains excavated from Fale Islet on Fakaofo Atoll (Best 1988) offers a contrasting situation. The major fish taxa in the assemblage were mainly reef and lagoon species in the families Scaridae, Serranidae and Holocentridae, while outer reef to offshore fish such as Scombridae and Sphyraenidae were very limited in number — both in the number of identified specimens and in the minimum number of individuals. Carangidae, which ranked the 6th in the number of identified specimens are complicated to interpret because they can be caught in most fishing zones and inhabit different zones at different life stages. McAlister's study is currently the only analysis of archaeological fish remains from Tokelau. Therefore, it is impossible to say whether the much higher dependence on reef and lagoon fish resources prehistorically on Fakaofo is replicated at other locations in Tokelau for the prehistoric period. Or, is the difference between modern Atafu and prehistoric Fakaofo not due to temporal changes, but rather represent fundamentally different long-term marine resource exploitation strategies employed by the two populations, as hinted at in Huntsman and Hooper's historical ethnography (Huntsman and Hooper 1996)?

Some ethnographic and historic documents recorded since the late 19th century report outer-reef fishing was also actively practiced and people's dependence both on lagoon-to-reef and outer-reef-to-offshore fish resources (Hale 1846; Macgregor 1937; Matagi Tokelau 1991; Wilkes 1845). Once considering these records, there might be another possibility that changes in resource exploitation from inshore and lagoon resources to offshore resources might have occurred at some periods in the past. Analysis of material excavated from each atoll will be required to begin addressing such topics with archaeological faunal assemblages.

In terms of exploitation of outer-reef-to-offshore fish, more variety and numbers are confirmed in names for Carangidae, Scombridae, Lutjanidae and sharks (see Appendix 1 for details), while there are few names for rays (cartilaginous fish related to sharks) in Tokelau including Atafu. The scarcity of names for rays on Atafu (and possibly other atolls in Tokelau) tentatively indicates less importance for rays as food items. Our interview surveys in Atafu also confirmed that people seldom catch and eat rays, hence rays are not regarded as an important food resource on Atafu today.

With regard to lagoon-to-reef exploitation, more variety of names are confirmed both in the third and the fourth levels ("primary and secondary lexemes" in Hooper 1994:188) for Scaridae, Labridae, Mullidae, Acanthuridae, Holocentridae and Balistidae (see Appendix 1 for detail), hence the importance of these fishes may be higher than other fishes, or alternatively, overall numbers of these fish resources may be higher on Atafu. The variety names for Labridae, Holocentridae and Balistidae as well as Carangidae, Scombridae, Lutjanidae and sharks which are caught mainly by line and trolling on other Pacific islands (Butler 1994; Kirch and Dye 1979; Masse 1986, 1989; Ono 2007, 2009; Ono and Intoh in press; Rolett 1998; Walter 1989), and the highest number and variety in line-fishing methods also indicate that line fishing and trolling have been more important and extensively used on Atafu. On the other hand, as discussed above, there are some fish families or groups which have no name either at the second or third levels, similar to the case for rays. These facts possibly indicate that these fishes are neglected as food resources by the people or simply that these fish resources are very scarce on Atafu.

More intensive biological survey is required to examine these alternative possibilities,. Also, more intensive interview survey and analysis is needed to focus on cultural factors behind fish names, such as the meaning or image of each fish by the people and the relationship with food or catch restrictions (e.g. Akimichi 1981; Nagatsu 1995). Hooper's (1985) and Gillett's (1985) studies focused on pelagic fishing on Fakaofo during the 1970s to 1980s. These data need to be supplemented with intensive observational

survey on the full range of fishing activities at different time intervals (e.g. week, month, year) and on each atoll in Tokelau. In sum, we need various kinds of ethno-ecological data, not only for Atafu, but also for the other atolls in Tokelau to achieve a satisfactory understanding of traditional and modern marine exploitation, people's cognition of marine environments, and the Tokelau marine ecosystem itself. We are also firmly convinced that ethno-ecology is an efficient method to approach both the past and present relationship between people and marine ecosystem.

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APPENDIX 1

Fish names in Atafu and Tokelau. Sources: Tokelau Dictionary 1986; Hooper 1994; Rensch 1994 (names in bold were only recorded in the Tokelauan Dictionnary).

Tokelau	Scientific names	English names
	Carangidae	**Trevallies**
aheu	*Caranx melampygus* (small)	Bluefin trevally (small)
alaala	*Carangoides orthogrammus* (small)	Thicklip trevally
alaala	*Caranx bucculentus*	Blue-spotted trevally
alalala	***Carangoides gilberti***	**Striped jacks**
amafua	*Caranx melampygus* (middle)	Bluefin trevally (middle)
atualo	***Megalaspis cordyla***	**Finny scad**
atule	***Selar crumenophthalmus***	**Silver scad**
atule	*Selar boops*	Oxeye scad
atule	*Selar crumenthalmops*	Pure-eyed scad
hoke	***Trachinotus baillonii***	**Blackspotted dart**
hoke	*Trachinotus botla*	Common dart
kamai	***Elegatis bipunnulata***	**Rainbow runner**
kanai	*Seriola lalandi*	Yellowtail kingfish
katalolo	*Carangoides talamparoides*	White-tongued trevally
katalolo	*Carangoides bajad*	Blue trevally
katalolo	***Trachinotus blochii***	
komulo	*Caranx sexfasciatus*	Bigeye trevally (small)
komulo	*Caranx ignobilis* (small)	Giant trevally (small)
lai	*Scomberoides commersonnianus*	Talang queenfish
lai	*Scomberoides tala*	Barred queenfish
lai	*Scomberoides lysan*	Double spotted queenfish
lupo (lupolupo)	***Caranx* sp. (very small >5 cm)**	
lupohama	*Caranx ignobilis* (very small)	Giant trevally (very small)
lupoaheu	*Caranx melampygus* (very small)	Bluefin trevally (very small)
pakeva	*Carangoides ferdau*	Black-spotted jack
pakeva	*Carangoides orthogrammus* (large)	Thicklip trevally
tafauli	***Caranx lugubris* (middle)**	**Black trevally (middle)**
uauaoge	*Caranx ignobilis* (middle)	Giant trevally (middle)
uli	***Decapterus pinnulatus***	Mackerel scad
uli	*Decapterus macarellus*	Mackerel scad
atuaalo	***Decapterus russelli***	
ulua	***Caranx* sp. (largest size >0.9 m)**	
uluakata	*Caranx ignobilis* (large)	Giant trevalley (large)
uluakata	*Caranx melampygus* (large)	Bluefin trevally (large)
uluatafauli	***Caranx lugubris* (large)**	**Black trevally (large)**
mago	***Elasmobranchi***	Sharks
ikapo	***Carcharhinus menissorah***	**Grey shark**
ikapo	*Carcharhinus amboinensis*	Pigeye shark
ikupi	*Alopias pelagicus*	Small-thoothed thresher shark
fakaulu	*Carcharhinus brevipinna*	Long-nosed grey shark
faime	*Rhincodon typus*	Wale shark
kanaelauvaka	***Galeocerdo cuvier***	**Tiger shark**
kapakan hakana	***Carcharhinus albimarginatus***	**Silvertip shark**
kapahan hakana	*Triaenodon obesus*	Whitetip shark
kili	***Carcharhinus melanopterus***	Black-tipped shark
kili	*Carcharhinus longimanus*	Oceanic whitetip shark
lalaila	*Carcharhinus albimarginatus*	Silvertip shark
malu	***Triaenodon obesus***	**Whitetip shark**
mata i talingga	*Sphyrna* spp.	Hammerhead sharks
mokoha	***Isurus glaucus***	**Mako shark**
palumago	**?**	**Huge oily shark**
tagutu	*Galeocerdo cuvier*	Tiger shark
toke kimoa	***Alopias vulpinus***	**Thresher shark**
	Scombridae	Tunas, mackerels, bonitos
atuaalo	*Grammatorcynus bilineatus*	Double-lined mackerel
atutaoa	*Thunnus alalunga*	Albacore
atu	*Katsuwonis pelamis* (middle)	Skipjack tuna (middle)
nakano	*Katsuwonis pelamis* (large)	Skipjack tuna (large)
kakahi	*Thunnus obesus*	Bigeye tuna
kakahi/ lalavalu	*Thunnus albacares*	Yellowfin tuna (small/middle)
kavalau	*Euthynnus affinis*	Mackerel tuna
pala	*Acanthocybium solandri*	Wahoo
takuo	***Thunnus albacares* (very large)**	Yellowfin tuna (very large)
takuo	*Thunnus maccoyii*	Southern bluefin tuna
tava tava	*Gymnosarda unicolor* (small)	Dogtooth tuna (small)
tuikaufoe	***Katsuwonis pelamis* (small)**	**Skipjack tuna (small)**
valu	*Gymnosarda unicolor* (large)	Dogtooth tuna (large)
	Lutjanidae	Snappers
utu	*Aprion virescens*	Green jobfish
fagamea	*Lutjanus bohar* (large)	
haputu	***Lutjanus rivalatus***	
havane	*Lutjanus kasmira*	Blue-striped seaperch
havane	*Lutjanus quinquelineatus*	Five-lied seaperch
havane	*Lutjanus russellii*	Striped seaperch
palu ave	*Etelis radiosus*	Pale snapper
palu hega		
palu kata		
palu loa		
palu makomako		
palu malau		**Big eye snapper**
palu utu	***Pristipomoides argyrogrammicus***	
palu vaka alo	*Pristipomoides filamentosus*	Rosy snapper
palu vaka alo	*Symphorus nematophorus*	Chinaman fish
palu vaka alo	*Lutjanus argentimaculatus*	Mangrove jack
taea	*Lutjanus gibbus*	Paddletail
taiva	*Lutjanus russellii*	Moses perch
tagau	*Lutjanus fulvus*	Yellow-margined seapearch
tatatata	*Lutjanus bohar* (small)	Red bass
	Serranidae	Groupers
fapuku/hapuku	*Epinephelus microdon*	Marbled sea bass
loi	*Cephalopholis boenack*	Peacock rockcod
mataele	*Cephalopholis urodeta*	Flag-tailed rockcod
kaupatuo	*Cephalopholis sonnerati*	Tomato rockcod
katakata	***Epinephelus melanostigma***	
gatala	*Epinephelus quoyanus*	Long-finned rockcod
gatala utuvai	*Epinephelus tauvina*	Reef cod
eve	*Epinephelus merra*	Honeycomb cod
eve	*Ephinephelus hexagonatus*	Hexagon rockcod
tonu	*Epinephelus macrospilos*	Large-spotted rockcod
malau	**Holocenturidae**	Squirrelfishes
anaoho	*Neoniphon opercularis*	Black-finned squirrefish
anaoho	***Flammeo opercularis***	**Banded soldierfish**
foto	*Sargocentron violaceum*	Violet squirrelfish
malau fatu	*Myripristis melanostictus*	Pale soldierfish
malau fagamea	***Myripristis adusta***	**Blackfin soldierfish**
malau kelekele	*Myripristis adusta*	Blackfin soldierfish
malau vale	*Myripristis hexagonatus*	Doubletooth soldierfish
malau mama	*Myripristis kuntee*	Crowned squirrelfish
malau naunefe	***Myripristis kuntee***	**Black-tip soldierfish**
malau loa	***Adioryx andamanensis***	**Red squirrelfish**
malau loa	*Sargocentron tiere*	Bluestripe squirrelfish
malau ta	*Sargocentron spiniferum*	Spiny squirrelfish
malau tea	***Myripristis pralinius***	**Scarlet soldierfish**
putala loa	*Sargocentoron rubrum*	Red squirrelfish
putala loa	***Flammeo sammara***	**Blotched soldierfish**
talatala	*Myripristis violaceus*	Violet squirrelfish

humu	**Balistidae**	Triggerfishes
umu	*Balistoides viridescens*	Blue finned triggerfish
humu ikutea	***Melichthys vidula***	Pinktail triggerfish
humu ikutea	*Sufflamen chrysopterus*	Black triggerfish
humu uli	*Melichthys niger*	Ebony triggerfish
humu fagota	***Rhinecanthus rectangulus***	Yellow-spotted triggerfish
humu fagota	*Rhinecanthus aculeatus*	White-barred triggerfish
humu lega	***Balistapus undulatus***	Red lined triggerfish
humu tagitagi	***Anameses scopas***	Black filefish
humu tuakau	***Melichthys niger***	Black triggerfush
tifitifi	**Chaetodontidae**	Butterflyfishes
tapukulu	*Chaetodon lunula*	Raccoon buteerflyfish
tifitifi kainiumata	*Chaetodon ephippium*	Saddled butterflyfish
tifitifi tapu tapu	*Chaetodon adiergastos*	Philippine butterflyfish
tifitifi tapu tapu	*Chaetodon auriga*	Threadfin butterflyfish
tifitifi piu	*Chaetodon plebeius*	Bluespot butterflyfish
	Pomacentridae	Damselfishes
ika tele lautau	*Hemiglyphidodon plagiometopon*	Lagoon damsel
leoleo akau	*Neoglyphidodon melas*	Black damsel
mutu	*Abudefduf sordidus*	Blackspot sergeant major
mutu lei	*Abudefduf* spp.	Sergeant major
o	***Lepidozygus tapeinosoma***	
	Sphyraenidae	Barracudas
ono	*Sphyraena barracuda* (middle)	Barracuda
haohao	*Sphyraena qenie*	Military sea-pike
pananua	*Sphyraena barracuda* (large)	Barracuda
tapatu	*Sphyraena forsteri*	Sea-pike barracuda (small)
tapatu	*Sphyraena jello*	Giant seapike
fai	**Dasyatidae**	Stingray
fai kili	*Dasyatis luhlii*	Bluespotted stingray
fafalua	***Aetobatis nari nari***	**Eagle ray**
fafalua	*Himantura undulata*	Leopard whipray
lautiapua	*Manta birostris*	Manta ray
	Xiphidae	Swordfish
hakula	***Xyphias gladius***	**Swordfish**
	Istiophoridae	Marlins
tuaniu	***Istiophorus gladius***	
tuaniu	*Istiophorus platypterus*	Indo-Pacific sailfish
tiuvaka	*Makaira indica*	Black marlin
hahave	**Exocoetidae**	Flyingfishes
hipa	*Cypselurus* sp. (very small)	Flyingfish (very small)
malolo	***Cypselurus* sp. (small)**	**Flyingfish (small)**
hahave	*Cypselurus* sp. (middle)	Flyingfish (middle)
tuali	*Cypselurus* sp. (large)	Flyingfish (large)
	Coryphaenidae	Dolphinfishes
mahimahi	*Coryphaena hippurus*	Common dolphinfish
	Echeneidae	
teletele vaka niu	*Echeneis naucrates*	Slender suckerfish
	Apogonidae	Cardinalfishes
fakupa	*Lepidaplois axillaris*	Black-spot pigfish
fakupa	*Apogon septemstriatus*	Seven-banded cardinalfish
	Priacanthidae	Bigeyes
mata pula	*Heteropriacanthus cruentatus*	Duskyfin bigeye
	Bothidae	Flounders
ali	***Bothus mancus***	**Left-eye flounder**
ali	*Bothus pantherinus*	Panther flounder
manoko	**Blennidae**	Gobbies & mud skippers
talau	*Mimoblennius atrocinctus*	Mimic blenny
	Zanclidae	Moorish idol
laulaufau	*Zanclus cornutus*	Moorish idol
kumikumia	***Zanclus* spp.**	**Yellow moorish idol**
	Fistulariidae	Flutemouth
taotao	***Fistularia petimba***	**Cornet fish**
tupoupou	***Aulostomus valentiti***	**Trumpet fish**
ufu	**Scaridae**	Parrotfishes
alomea	***Scarus harid* (young)**	**Yellow parrofish**
ufu	*Scarus sordidus*	Saddled parrotfish
ufuahaga	*Scarus microrhinos* (female)	Steephead parrotfish
ufuatua	***Bolbometopon bicolor***	**Two-coloured parrotfish**
ufuhomo	***Bolbometopon bicolor***	**Two-coloured parrotfish**
ufuloloa	***Scarus forsteri* (male)**	**Big belly parrotfish**
ufuloloa	*Scarus rubroviolaceus*	Ember parrotfish
ufumea	***Scarus rubroviolaceus***	**Meadow parrotfish**
ufutafega	***Scarus forsteri* (female)**	**Big belly parrotfish**
ufutaia	*Scarus frenatus*	Six-banded parrotfish
ufutaia	*Chlorurus sordidus*	Green-finned parrotfish
ufutetea	*Scarus schlegeli* (female)	Schlegel's parrotfish
ufuui	***Scarus sordidus***	**Saddled parrotfish**
ufuui	*Scarus dimidiatus*	Saddled parrotfish
ufuui	*Scarus chameleon*	Chameleon parrotfish
ulahi	***Scarus harid***	**Yellow parrofish**
ulahi	*Hipposcarus longiceps*	Long-nosed parrotfish
gagale	***Calotomus spinidens***	
galo	***Scarus globiceps***	**Brown parrotfish**
kamnutu	*Scarus jonesi*	Tatooed parrotfish
kulapo	***Scarus harid* (small)**	**Yellow parrofish**
kulapo	*Hipposcarus longiceps* (small)	Long-nosed parrotfish
koti	***Scarus venosus cuvier***	**Cut parrotfish**
koti	*Scarus schlegeli* (male)	Schlegel's parrotfish
laea	***Scarus jonesi***	**Tattooed parrotfish**
laea	*Scarus microrhinos* (male)	Steephead parrotfish
laea fatu	***Scarus lunula***	**Paumotu parrotfish**
laea mea	***Scarus* sp.**	**King parrotfish**
mamahu	*Cetoscarus bicolor*	Red-speckled parrotfish
	Labridae	Wrasses
uho ote puhi	*Novaculichthys taeniourus*	Carpet wrasse
uloulo	*Hologymnosus doliatus*	Pastel ringwrasse
uloulo	***Thalassoma fuscum***	**Fire wrasse**
gatuloa	***Epibulus insidiator***	
lalafi	***Cheilinus undulatus* (small)**	**Double-headed Maori wrasse**
lafilafi	***Cheilinus undulatus* (middle)**	**Double-headed Maori wrasse**
lautotonu	*Cheilinus unifasciatus*	Whiteband Maori wrasse
lolo	*Oxycheilinus bimaculatus*	Violet-lined Maori wrasse
malatea	***Cheilinus undulatus* (large)**	**Double-headed Maori wrasse**
molali	***Cheilinus trilobatus***	**Tripletail Maori wrasse**
motoa	*Thalassoma* spp.	Green moon wrasse etc
motoa	***Thalassoma hardwichei***	**Six-barred wrasse**
papo	***Cheilinus fasciatus***	**Scarlet-breasted Maori wrasse**
taina ote puhi	*Cheilinus chlorurus*	Yellow-dotted Maori wrasse
hoa ote puhi	***Hemipteronotus taeniourus***	**Bar-cheeked wrasse**
hugale paea	*Thalassoma trilobatum*	Ladder wrasse
hugale paea	***Halichoeres hortulanus***	**Rainbow wrasse**
hugale	*Thalassoma purpureum*	Red and green wrasse
hugale	***Thalassoma hardwichei***	**Six-barred wrasse**
ume	**Acanthuridae**	Surgeonfishes, unicornfishes
alogo	***Ctenochaetus striatus***	Lined bristletooth
alogo	*Acanthurus mata*	Yellowmask surgeonfish
apalani	***Acanthurus xanthopterus***	Yellowfin surgeonfish
apalani	*Acanthurus auranticavus*	Orange-socket surgeonfish
api	*Acanthurus guttatus*	White-spoted surgeonfish
ikumelo	*Acanthurus nigricans*	Whitecheeked surgeonfish
ume	***Naso unicornis***	Brown unicornfish
umeihu	*Naso brevirostris*	Longnosed unicornfish
umelei	*Naso lituratus*	Stripe-face unicornfish
maomao	*Acanthurus nigricauda*	Blackstreak surgeonfish
maninini	*Acanthurus triostegus*	Convict surgeonfish

pone	*Acanthurus achilles*	Red-spotted surgeonfish
ponelolo	***Ctenochaetus striatus***	Lined bristletooth
ponehamoa	*Acanthurus lineatus*	Blue-lined surgeonfish
tatifi	*Naso brachycentron*	Humpback unicornfish
tatifi	***Naso brevirostris***	Longnosed unicornfish
tatifi	***Naso herrei***	Long-horn unicornfish
tatifi	***Naso rigoletto***	Hunchback unicornfish
tatifi atu	*Naso annulatus*	Ringtailed unicornfish
tatifi atu	***Naso vlamingi***	Zebra unicornfish
moaga	**Mullidae**	Goatfishes
afulu	***Parupeneus bifasciatus***	**Doublebar goatfish**
maile akoa	*Upeneus vittatus*	Striped goatfish
maile akoa	*Upeneus sulphureus*	Sunrise goatfish
maile akoa	***Upeneus tragula***	**Bartailed goatfish**
malili	***Mullodichthys vanicolensis***	**Non-spotted goatfish**
memea	***Mulloidichtys auriflamma***	**Gold-lined goatfish**
moaga	*Parupeneus trifasciatus*	Three saddled goatfish
moaga	***Parupeneus bifasciatus***	**Doublebar goatfish**
moaga hehega	*Parupeneus cyclostomus* (small)	Gold-saddled goatfish
moaga aheu	*Parupeneus cyclostomus* (large)	Gold-saddled goatfish
tuita	***Parupeneus berberinus***	**Dot and dusk goatfish**
tuita	*Parupeneus macronema*	Stripe-spot goatfish
tuita	*Parupeneus indicus*	Indian goatfish
vete	***Mulloidichthys samoensis***	**Goatfish**
vete	*Parupeneus chrysopleuron*	Yellow striped goatfish
	Lethrinidae	Emperors
mu	*Monotaxis grandoculis*	Humpnose big-eye bream
gutula	*Lethrinus olivaceus*	Long-nosed emperor
nutuala	*Lethrinus miniatus*	Sweetlip emperor
filoa	***Lethrinus olivaceus***	**Long-nosed emperor**
filoa	*Lethrinus atkinsoni*	Yellow-tailed emperor
filoa	*Lethrinus* sp.	Blue-lined emperor
liki	*Lethrinus microdon*	Small-thoothed emperor
puhi	**Muraenidae**	Moray eels
fau ote kolo	*Echidna nebulosa*	Starry eel
puhi gatala	***Gymnothorax meleagris***	**Spotted moray eel**
puhi gatala	*Gymnothorax undulatus*	Mottled moray
puhi kaitamoko	*Echidna nebulosa*	Clouded reef eel
puhi kukula	***Gymnothorax javanicus***	**Giant moray**
puhi kukula	*Gymnothorax flavimarginatus*	Yellow-edged moray
puhi matamata	***Gymnothorax undulatus***	**Mottled moray**
puhi takuali		**Most dangerous moray eel**
puhi tea	*Siderea picta*	Painted moray
	Monacanthidae	Leatherjackets
humu kaleva	*Paramonacanthus filicauda*	Threadfin leatherjacket
humu kaleva	***Aluterus scriptus***	Figured leatherjacket
	Pseudomonacanthus peroni	Pot-bellied leatherjacket
	Mugilidae	Mullets
aua	***Neomyxus chaptalii***	Silvery mullet
aua	*Myxus elongatus*	Sand mullet
kafa	***Liza vaigiensis***	Diamond-scale mullet
kafa	*Liza subviridis*	Greenback mullet
kanae	***Mugil cephalus***	Sea mullet
kanae	*Valamugil buchanani*	Blue-tail mullet
	Ostraciidae	Boxfishes
moa moa	*Ostracion cubicus*	Yellow boxfish
moa moa	*Rhynchostracion nasus*	Small-nosed boxfish
tete	*Tylerius spinosissimus*	Fine-spined pufferfish
tete	*Arothron nigropuncatus*	Black-spotted toadfish
tete	***Arothron meleagris***	White-spotted pufferfish
	Tetraodontidae	Puffers
hue	*Anchisomus multistriatus*	Many-striped pufferfish
hue	***Anchisomus hispidus***	Stars and stripe toadfish
hue ate	***Arothron alboreticulatus***	Spotted and lined pufferfish
hue ate	*Arothron reticularis*	Reticulated pufferfish
huehega	***Arothron nigropunctatus***	Yellow pufferfish
	Kyphosidae	Sea chubs
nanue	*Kyphosus cinerascens*	Rudderfish
gagafu/gafugafu	*Pomacentrus pavo* etc.	Damselfish & sergeant-majors
gafugafu	*Kyphosus bigibbus* (small)	Southern drummer
nanue	*Kyphosus bigibbus* (large)	
	Cirrhitidae	Hawkfishes
patuki	*Cirrhitus pinnulatus*	Marble hawkfish
patuki laufala	*Paracirrhites forsteri*	Freckled hawkfish
patuki laufala	*Paracirrhites hemistictus*	Ornate hawkfish
ihe	**Hemiramphidae**	Garfishes
ihe fota	*Hemiramphus far*	Barred garfish
ihe lafa	***Hyporhamphus actus* (large)**	Half-beak
ihemulo	***Hyporhamphus actus***	Half-beak
	Belonidae	Longtoms
aku	*Tylosurus gavialoides*	Stout longtom
ihe loa	***Platybelone argalus***	
ihe loa	*Platybelone platyura*	Flat-tailed longtom
galio	*Ablennes hians*	Barred longtom
galio	*Strongylura leiura*	Slender longtom
galio	***Tylosurus crocodilus***	
maeva	**Siganidae**	Spinefoots
maeva	*Siganus fuscescens*	Black spinefoot
maeva	*Siganus lineatus*	Golden-lined spinefoot
maeva	*Siganus canaliculatus*	Smudgespot spinefoot
maeva	***Teuthis rostratus***	Spotted rabbitfish
	Scorpaenidae	Scorpionfishes
hakuhalulele	*Pterois volitans*	Red firefish
nofu	*Synanceia horrida*	Estuarine stonefish
nofu	*Synanceia verrucosa*	Reef stonefish
	Diodontidae	Porcupinefish
tautu	*Diodon hystrix*	Porcupinefish
	Caesionidae	Fusiliers
ulihega	***Caesio / Pterocaesio* spp.**	Fusiliers
ulihega	*Caesio lunaris*	Blue fusilier
	Pempheridae	Sweepers
manifi	*Pempheris schwenkii*	Striped bullseye
	Ophichthidae	Snake eels
palaoa	*Myrichthys colubrinus*	Harelequin snake eel
	Chanidae	Milkfish
ava	***Chanos chanos***	**Milkfish**
	Albulidae	Bonefishes
kiokio	***Albula neoguinaica***	**Bonefish**
	Gerreidae	Silver biddies
matu	***Gerres* sp.**	**Silver sand-eater**
	Kuhliidae	Aholeholes
hafole	***Kuhlia taehimura***	**Banded flag-tail**
	Kuhlia marginata	
	Gempylidae	Snake mackerels
palu	***Ruvettus pretiosus***	**Oilfish**
	Zeidae	Dories
humu kaleva	*Zeus faber*	John Dory
humu kaleva	***Alutera scripta***	**Figured leatherjacket**
	Others	
talitaliuli	***Naucrates ductor***	**Pilotfish**
	Labroides dimidiatus	**Paradisefish**

Local perceptions of sea turtles on Bora Bora and Maupiti islands, French Polynesia

Sarah Brikke[1]

Abstract

In many Pacific Island cultures, sea turtles are key figures that symbolise longevity, peace and strength. Nevertheless, their existence is now under threat. The qualitative research described in this article was undertaken on the French Polynesian islands of Bora Bora and Maupiti (see Figs. 1 and 2) to inventory local perceptions regarding sea turtles, and to better understand the relationship between them and humans. The information gathered provides a better understanding and assessment of the cultural heritage of sea turtles in French Polynesia. Special emphasis was placed on understanding the perceptions of children and their potential role as "ambassadors of the environment".

Introduction

Modern society is becoming increasingly conscious of the fact that natural resources are not limitless. As a result, the protection and conservation of nature have become major social objectives. The Secretariat of the Pacific Regional Environment Programme declared 2006 as the "Year of the Sea Turtle" in the Pacific, and initiated a project with three main objectives: 1) promoting the conservation of sea turtle nesting sites; 2) reinforcing national legislation and laws regarding sea turtles; and 3) encouraging sustainable management of sea turtles by facilitating a long-term partnership between local people and authorities for sea turtle conservation.

Sea turtles are an important component of global biodiversity (CITES 1973). However, because of both deliberate and accidental catching, fishing, and destruction of their feeding, nesting and resting areas and, more recently, pollution, most sea turtle populations have declined dramatically, and many face extinction (see: www.cites.org). To cope with this situation, legislation in French Polynesia has protected sea turtles since 1990, through a prohibition on capturing, transporting and trading them and their parts, including eggs. Moreover, since 1973, the Convention on the International Trade in Endangered Species (CITES) of Wild Fauna and Flora has regulated the trade of endangered species, and sea turtles are listed in appendix 1 of this convention (CITES 1973).

According to most interviewees on Bora Bora and Maupiti, the role of sea turtles in the social and cultural life of many coastal populations, and their importance as a protein source, is well recognised. For most Pacific Islanders, sea turtles are key figures in many cultures and traditions, with the animal symbolising longevity, peace and strength. For example, in Maori mythology, sea turtles were considered sacred, and as the "shadow of gods" from the ocean, their consumption was reserved for the upper class of society. The *rahui* (temporary bans on consumption) invoked by leaders, helped to regulate the consumption of sea turtles.

However, the spiritual significance of turtles has not protected them from heavy exploitation for both subsistence consumption and trade. For hundreds of years, sea turtles have been an integral part of the Pacific's culinary culture and history; turtle meat is a traditional food, their bones are used for making tools, and their shells are used for decorative or ceremonial purposes. They are called the "queen of foods" on Napuka (Tuamotu Islands) and in Fiji (Conte 1988), and were among the most sought after marine animals in ancient times (Conte 1988). Under the guise of tradition, fishermen today continue to justify their enthusiasm for killing sea turtles (Conte 1988).

Sea turtle population numbers are decreasing due to many factors, the main ones being the increasing human population in Pacific Island nations, coupled with the migratory nature of sea turtles and their low rates of natural reproduction. This has led to their exploitation at rates no longer compatible with their preservation.

Legislation and politics alone do not promote the efficient management and sustainable use of sea

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turtles. They must be complemented and reinforced by local studies that encourage local participation in environmental projects, and which sensitise people to the urgency of the conservation task. As part of such a thrust, the qualitative participatory study described here was conducted together with local people and in the primary schools of Bora Bora and Maupiti islands, in the Society Archipelago of French Polynesia. These two islands are particularly dependent on fishing and have traditionally consumed sea turtles. The choice of these two islands for the study was directed by the Department of Environment, Ministry of Sustainable Development, French Polynesia.

The project ran from 30 April 2006 through 2 June 2006, and had several objectives: 1) to identify the perceptions of local people regarding the cultural place of sea turtles in Polynesian society, the legal context and sanctions relative to sea turtle protection, and the relationship between sea turtles and local populations; 2) to sensitise local populations to the protection of sea turtles; and 3) to formulate recommendations to better protect and conserve sea turtles. A comprehensive study on the perceptions of local people toward sea turtles is essential in order to better integrate conservation plans for endangered species in the Pacific, and because the perceptions of local people in French Polynesia may provide a better understanding of the relationships between humans and sea turtles.

French Polynesia consists of 188 islands grouped into five archipelagos: Society, Austral, Gambier, Tuamotu and Marquesa. The Society Archipelago (Fig. 2) has the most modernised infrastructure, has more than 75% of French Polynesia's population, and has a significant tourism industry.

The legal context of sea turtle protection

CITES is the core international legislation related to the protection of endangered species. Deliberation 90-83 AT of 13 July 1990 covers three sea turtle species that occur in French Polynesian waters. In practice, this means a general prohibition on the capture, transport, keeping and trading of turtles and turtle parts throughout French Polynesia, regardless of size, season or condition.

Furthermore, sea turtles are protected in French Polynesia through the legislation of the Territorial Assembly (1990). Several pieces of territorial legislation protect turtles. Trading sea turtles was prohibited by deliberation 71-209 of 26 November 1971. Order 1156 CM of 18 October 1991 relates to the special authorisation required to take and keep sea turtles and their eggs for scientific purposes. Order 435 CM of 5 May 1994 relates to raising sea turtles in aquaria for educational or tourism purposes. Order 5139/VP of 27 September 1995, permits the keeping of sea turtles by an Order of the Territorial Government of French Polynesia.

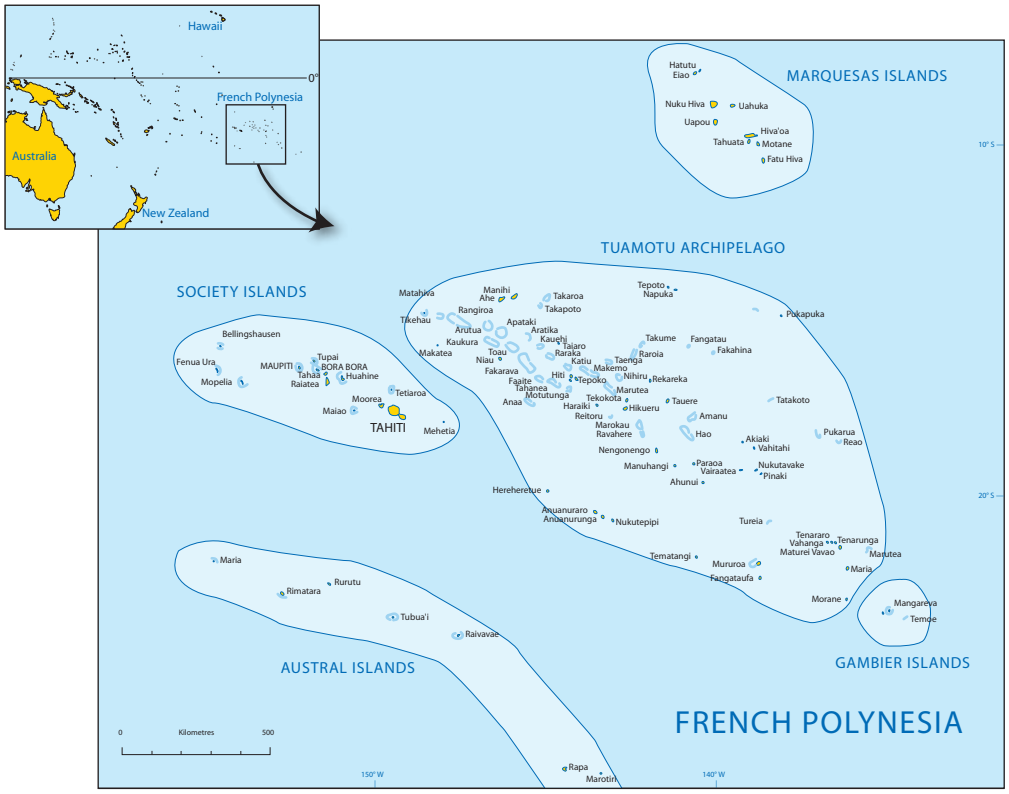

Figure 1. French Polynesia

Methodology

Adults and children residing on Maupiti and Bora Bora were selected as informants for this study. Two criteria were used to select adult informants. Those who were more than 30 years old were chosen randomly, and according to whether or not their profession was related to or concerned with sea turtles in French Polynesia. Interviews with adults lasted for about an hour. Most informants, however, were children, between the ages of 10 and 16, who were pupils of secondary schools on Bora Bora and Maupiti. On Bora Bora, 50 children participated in the project, and on Maupiti, 160 children.

Various qualitative methods were used to collect data. These included observation (behavioural observation, indirect observation, participant observation), questionnaires, interviews and the CAP ("connaissance, attitude, pratique") method developed by Decoudras (1997). The CAP method focuses on three concepts — knowledge (what people know), attitude (what people think), and practice (what people do) — to distinguish what people know, think and actually do.

In the schools, the project consisted of an environmental education workshop. Children were asked to draw on paper how they perceive turtles at present, and what they believe the situation of sea turtles will be in the future (Figs 3–6). Children were also asked to write a letter to a turtle as if it were a friend. A drawing competition was organised for each class that participated in the project. The goal of this workshop was, through interactive activities, to raise awareness of children regarding an endangered species. One secondary school class on Bora Bora was invited to assist with the release of a sea turtle at the Turtle Centre, located in Bora Bora Le Meridien lagoon.

Cultural dimensions of sea turtles in French Polynesia

The islanders of Bora Bora and Maupiti perceive sea turtles as an important component of their heritage and culture, and even as a symbol of French Polynesia. The sea turtle is perceived by informants as a sacred animal, almost mythic, as well as the "queen of the oceans", a symbol of fertility and femininity. The sea turtle is also perceived as a friendly, harmless, beautiful and majestic animal. Primary school children regard the sea turtle as a friend who should be loved and cared for. In the past, eating sea turtle meat was reserved for royalty, but has became more popular, especially for important events such as weddings or festive periods (*heiva*). This tradition is still deeply rooted in present-day behaviour, especially among people over 45 years old. Turtle flesh is considered to be one of the best testing meats.

The current exploitation of sea turtles

Harvesting sea turtles is strictly illegal both under international law and the Polynesian Environmental Code. However, sea turtle meat remains in high demand, and catching turtles provides an attractive and easy way to earn cash. The meat is sold for between XPF 2,000/kg and XPF 2,500/kg (equivalent to USD 24.5/kg and USD 30.6/kg), more than twice the price of swordfish meat. Turtle meat is usually sold in packets of 5 kg each. Everything except the shell is consumed. In the past, fishermen whose catch included sea turtles were highly respected.

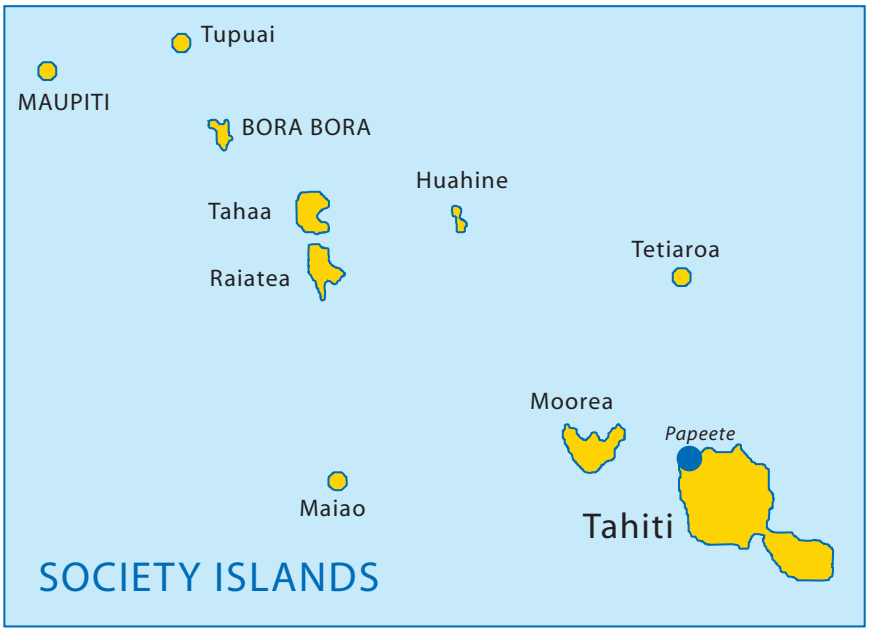

Figure 2. The Society Islands, French Polynesia

Children are acutely aware of what is happening. During the environmental education workshops, they were asked to draw how they perceived sea turtles now and in the future (Figs 3–6). Several individual responses are described below.

The drawing in Figure 3 was made by Teiki, a 10-year-old child. It shows the difference between the turtle's present situation

(left) and its perceived future (right). According to Teiki, Maupiti Islanders go to the ocean with their speedboats, and then dive to capture turtles by hand. Some say that many fishermen drown while trying to catch a turtle because turtles pull fishermen toward the bottom of the ocean. Teiki says that in the present, "*Il attrape la tortue*" (He catches the turtle), whereas in the future he says "*Il rellache*" (He releases the turtle). According to Teiki, there is hope for sea turtles in the future; he believes that men will no longer capture them, but will set them free.

In Figure 4, 12-year-old Poe Iti indicates very clearly what would happen to sea turtles if nothing was done to protect and conserve them. In the present (left) we see a picture of several turtles. Poe Iti writes at the bottom "*Il y a de tortue*" (There are turtles), whereas on the right (the future), he shows nothing (i.e. turtles are extinct), and writes "*Il n'y pas plus de tortue*" (There are no more turtles). Awareness and environmental education workshops are, therefore, a basic means of awareness regarding sea turtle protection.

Figure 5, by 11-year-old Moana, demonstrates another perception of the present and future situation of sea turtles. In the present, Maupiti Islanders "*Chasse au tortue*" (fish for turtles). We can see clearly in Moana's drawing that the fisherman comes with a motorboat and tries to catch the sea turtle underwater with a speargun. In the future,

Figure 3. The perception of the "present and future" situation of sea turtles, as depicted by Teiki, a 10-year-old child from Maupiti

Figure 4. The perception of the "present and future" situation of sea turtles, as depicted by Poe Iti, a 12-year-old boy from Maupiti

men seem to "*Cuisine tortue*" (Cook turtle) with fire. Indeed, according to Moana's perception, sea turtles will continue to be captured and eaten (i.e. the situation is not going to change).

In Figure 6, 11-year-old Matarii draws our attention to what is actually happening now in French Polynesia. Before, there were plenty of sea turtles. The right hand side of Matarii's shows that in the future, however, there will be very few turtles. The turtle at the bottom of the drawing is hiding from the fisherman, saying "*Maintenant je suis tout seul dans la mer*" (I am alone now in the sea). Fishermen use motorboats (the most commonly used boat is the *poti-marara*) and spearguns to capture sea turtles. This drawing is very detailed. Matarii seems to be very knowledgeable about sea turtle behaviour (e.g. it goes toward the bottom to escape capture),

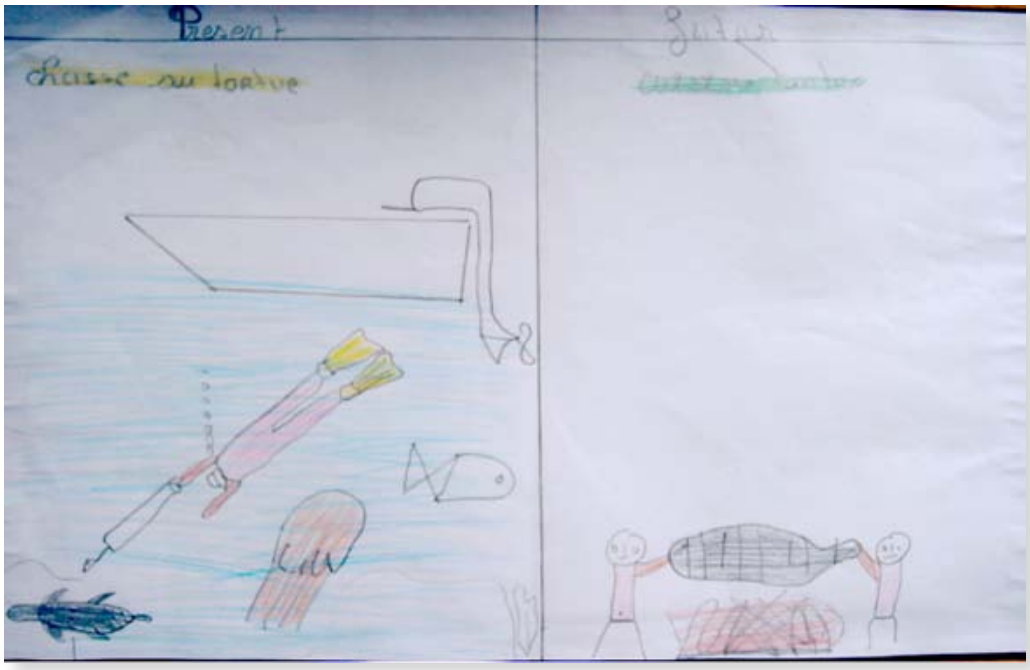

Figure 5. The perception of the "present and future" situation of sea turtles, as depicted by Moana, an 11-year-old child from Maupiti

Figure 6. The perception of the "before and after" situation of sea turtles, as depicted by Matairii, an 11-year-old child from Bora Bora

and draws in detail the boat and the fishermen's diving and fishing gear. This likely indicates that Matarii has already experienced sea turtle fishing.

Limits of regulations

Theoretically, the fine imposed on fishermen for taking sea turtles ranges from XPF 200,000–1,000,000 (equivalent of USD 2,450–12,250). However, fines are rarely imposed because authorities hardly ever control nesting sites, or monitor landings. As a consequence, poaching is easy and happens mostly at night, off the islands. This situation begs the question of whether tougher penalties would be effective, because the demand for turtle meat still exists and is rooted in local mores. Existing sanctions are not dissuasive, and fishermen continue to fish because they know the risk is slight. Further, poaching is uncontrollable and unmanageable given the fragmented, insular nature of French Polynesia combined with the lack of authority and strictness in regulating the trade of marine turtles, and the leniency with which the police deal with fishermen.

Future perspectives

Project interviewees on Bora Bora and Maupiti advocated a return to a quota system of turtles (by island), which is managed and controlled jointly by authorities and local people. However, turtle nesting sites need to be identified and classified. Awareness campaigns are important both in terms of supply and demand. Fishermen should also be sensitised and empowered. Schools play an important role in making children understand endangered species and in raising awareness about the conservation, protection and caring for nature in general.

Conclusion

This study enabled an inventory of the perceptions of local people on Bora Bora and Maupiti toward sea turtles, which reveals the types of relationships between these species and humans. The role of children as "ambassadors of the environment" is of great importance. Having identified their perceptions and the importance that they attach to sea turtles, we can better understand and assess the cultural heritage of sea turtles in French Polynesia.

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