Tuvalu Marine Life

an Alofa Tuvalu Project

with the Tuvalu Fisheries Department and Funafuti, Nanumea, Nukulaelae Kaupules

Scientific Report

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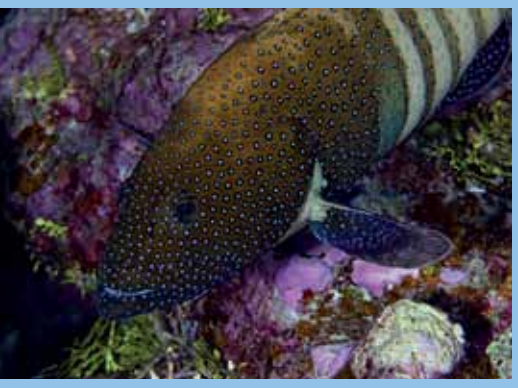





Part I: Biodiversity of Tuvaluan Reef Fishes
Part II: Marine Ressource Assessment in Conservation Areas
Part III: Documented Tuvalu Marine Life Inventory

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BIODIVERSITY OF TUVALUAN REEF FISHES

MARINE RESOURCE ASSESSMENT IN CONSERVATION AREAS

ACRONYMS

ANOVA: Analysis of Variance
BEST: A type of multivariate analysis that matches ecological communities with environmental variables
CA: Conservation Area
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora
COTs: Crown-of-Thorns starfish (*Acanthaster planci*)
FCA: Funafuti Conservation Area
FSPI: Foundation of the Peoples of the South Pacific International
GEF: Global Environment Fund
GPS: Global Positioning System
IUCN: International Union for the Conservation of Nature
LMMA: Locally-Managed Marine Area
MANOVA: Multivariate Analysis of Variance
SPC: Secretariat of the Pacific Community
SCUBA: Self-Contained Underwater Breathing Apparatus
TANGO: Tuvalu Association of Non Governmental Organisations
TML: Tuvalu Marine Life
UNDP: United Nations Development Programme
WoRMS: World Register of Marine Species

EXECUTIVE SUMMARY

Tuvalu, a small Pacific Island nation, is severely threatened by sea level rise and increased storm frequency predicted under ongoing **climate change**. Recent documented changes include a reduction in the islands' surface area available for cultivation, the decline of soil quality through **salinisation** and increased erosion and greater frequency of very high tides resulting in saltwater intrusion into freshwater lenses. As the supply of land-based food becomes more uncertain, Tuvalu reliance on marine resources is increasing (Mortreux and Barnett 2009).

Tuvalu Marine Life, an Alofa Tuvalu project (referred to in this report as "TML") aims to support the Tuvalu Fisheries Department in its management of Tuvalu's marine resources. Two components were developed in this second step of the project: 1) a field survey of the fish biodiversity of Tuvalu's reefs and lagoons, as well as documenting the species commonly caught by local fishermen and 2) a field survey of selected **macroinvertebrate** and fish densities in Tuvalu's lagoons, to assess the stocks of valuable species on each atoll and test the effectiveness of the Conservation Areas (CAs). The fish biodiversity component of the field surveys serves to update and expand existing species lists and provide additional information on fish biodiversity, abundance, community composition and distribution patterns. The marine resource assessment was the first survey of its kind on the outer atolls, whereas similar surveys were conducted in Funafuti at the time of the Funafuti Conservation Area (FCA) implementation in 1997 and over the following years. No previous datasets could be found to rigorously assess changes through time, therefore our comparisons were mostly qualitative.

The field surveys were carried out in Nanumea, Nukulaelae, and the capital atoll, Funafuti, between April 27th and May 27th 2010. For the fish biodiversity assessment, between 9 and 14 sites were visited in three major habitats (lagoon, sheltered outer reef, exposed outer reef) at each atoll, with one additional habitat (lagoon pinnacles) surveyed on Funafuti atoll. Globally accepted standard sampling protocols were used, including timed swims and belt transects, allowing the estimation of fish species richness and composition, **density** and **biomass**, **benthic** community structure, and the relationship between the fish assemblage and benthic communities. For the marine resource assessment, 9 stations were visited in Nanumea: 5 stations within the CA and 4 stations outside. Ten stations were visited in Nukulaelae (5 stations in the CA, 5 stations outside). In Funafuti 6 sites were visited, comprising 3 stations in each of three different habitats at each site: **reef flat, inner reef slope** (referred as 'reef slope' or 'slope') and **lagoon**, bringing the number of stations visited to 18 for Funafuti. Standard sampling protocols were also used to assess **benthic** structure, targeted macroinvertebrate density and targeted fish density. The lists of targeted animals were prepared in collaboration with the Fisheries Department and people of each atoll visited.

Main findings of the biodiversity survey:

A total of 317 fish species were recorded during this study; 66 species that had not previously been recorded in Tuvalu were added to the reviewed species list, bringing the overall total to 607. Applying the Coral Fish Diversity Index to this estimate brings the total expected number of fish species in Tuvalu to 711, which is similar to values estimated for Pacific island groups nearby. Species richness was variable between habitats and depths, with the lowest species richness found inside the lagoons of the three atolls, and in deeper areas of the outer reefs. The greatest differences in species richness were correlated with habitat complexity, with more complex habitats hosting greater numbers of species. Funafuti hosted the largest number of species recorded during these surveys, which probably reflects the greater sampling effort and the greater variety of different habitats.

At least 79 species of interest are listed on the IUCN Red List, of which 29 are included in one of the Near Threatened or Threatened categories (see Appendix 3 for the species list and IUCN classification). Most of the sharks and rays are identified as being in need of some degree of protection. Among the bony fish, the species of concern are the groupers *Epinephelus fuscoguttatus* (targeted by the CA survey component), *E. polyphekadion* (not targeted) and *E. socialis* (not targeted) and the bigeye tuna *Thunnus obesus* (not targeted) (Near Threatened), bumphead parrotfish *Bolbometapon muricatum* (targeted), and the groupers *Epinephelus lanceolatus*, *Plectropomus aerolatus* and *P. laevis* (Vulnerable, not targeted) and the Maori wrasse *Cheilinus undulatus* (Endangered, targeted).

Overall fish density was highest on Nanumea atoll and lowest on Funafuti atoll, with individual lagoonal sites tending to host the highest densities at each atoll. In contrast, fish biomass was highest in Funafuti and lowest in Nukulaelae. Despite the low fishing pressure on Nanumea compared with the more populated atolls, larger fish were scarce, and the combination of high densities and low biomass indicates large numbers of small fish. This pattern seems common of highly isolated, exposed oceanic reefs with small reef areas and small or closed lagoons. Funafuti had relatively high biomass and low density, indicating smaller numbers of larger fish than Nanumea. The larger size of this atoll and the higher diversity of habitat types are likely to have driven this pattern, despite the higher fishing pressure on Funafuti. Concerns exist about signs of **overfishing** in Funafuti, such as lower abundances and smaller individuals than in the past, especially in accessible areas.

Lagoons seemed to not only function effectively as fish nurseries, they also had distinctive fish faunas. While outer reef habitats of the three atolls had similar fish assemblages, the lagoon of each atoll had a unique fish community. Funafuti lagoon was especially distinct from the other two lagoons. The lagoons of Nanumea and Nukulaelae remain virtually closed to the surrounding ocean, while Funafuti lagoon has numerous channels and passes. Overall, fish communities were numerically dominated by damselfish, followed by wrasses, surgeonfish and parrotfish. All other fish families occurred in relatively low abundances.

The three surveyed atolls had similar overall levels of hard coral cover, but other benthic community characteristics varied. For instance, only Nukulaelae had measurable amounts of soft coral, and Funafuti had the highest cover of **coralline algae**. Macroalgal cover also varied among the three atolls, with the lowest cover of around 7% recorded on Nanumea, intermediate cover on Funafuti (~15%) and the highest cover, of around 20%, was found on Nukulaelae. As with the fish communities, lagoonal sites were not only different from sheltered outer reef sites, but each atoll had its own distinct lagoonal benthic characteristics.

The cover of coralline algae, sand and hard coral were the best predictors of the fish community composition. The cover of sand could well serve as a proxy for lagoonal area, as the outer reef slopes had virtually no soft sediment, while the lagoons of all three atolls consisted of a sand bottom with coral patches. Therefore, sand as a predictor of fish community structure fits well with the overall distinctiveness found in lagoonal fish faunas. Coralline algae tended to occur in higher cover in areas more exposed to wave action. Other studies have also found that certain fish species, such as small wrasses and triggerfish, are better adapted to high wave energy environments than others.

Together, the three surveyed Tuvaluan reefs boast high fish biodiversity. The highly unique fish communities found within each lagoon suggests that further surveys on the remaining six atolls are highly likely to add more species of fish to the list. In general, the fish densities and benthic communities recorded here reflect the relatively low fishing pressure and reasonably healthy reefs in most areas, although there are some signs of overfishing and nutrient enrichment near population centres. In particular, the predominance of smaller fish from lower levels of the food web is a clear signs of overfishing, especially in Funafuti. Some exposed reef sites showed signs of storm damage, and Funafuti lagoon near Fongafale showed strong evidence of pollution and nutrient enrichment, with turbid water and high macro-algal cover. Of special concern is the low number of sharks; these top predators are crucial to the health of the ecosystem and are highly vulnerable on a global scale. Removing sharks from the food web could result in changes throughout the food chain. The establishment of well-enforced, no-take Conservation Areas provides the best solution to safeguarding Tuvaluan fish biodiversity and stocks of valuable food fish.

Main findings of the Conservation Areas survey:

Coral cover was variable in Funafuti, ranging from 0.1% to 58%, with a mean cover of 15% for the whole atoll. Compared to previous surveys, coral cover seems to have declined. Coral cover was higher outside the Funafuti Conservation Area (FCA) (19%) than inside (11%), however this difference was not significant. Higher coral cover was measured on reef slope habitats. *Acropora* branching and **staghorn** corals were the dominant growth forms. Hard coral cover in Funafuti lagoon was higher than on the outer atolls, certainly a consequence of better water flow due to large passages all around the atoll and the diversity of habitats (channels, **pinnacles**, deep lagoon, coral bommies on a sandy lagoonal seabed) that support more diverse and denser coral communities.

On the outer atolls, hard coral cover was relatively low, with a mean cover of 6% and 11% in Nukulaelae and Nanumea, respectively. The Nukulaelae coral assemblage was dominated by branching forms, whereas in Nanumea encrusting, massive and bushy growth forms were common.

Algal cover tended to be higher within the FCA than outside, which was consistent with findings from the first marine survey of the FCA. The average total algal cover was 43% within the FCA and 29% outside the FCA, however this difference was not statistically significant. The highest total algae cover was observed on the reef flats of Fualopa, Tepuka and Fuafatu.

Other living organisms (sponges, ascidians, soft corals) were rare on the 3 atolls visited, except for Nanumea station "NNMCA4" that showed large mats of ascidians (*Didemnum* sp.) overgrowing rocks, dead corals, limestone or other living organisms (such as other ascidians).

Abiotic substrata (rocks, limestone, dead corals, rubble, sand and silt) covered about half of the seabed in Funafuti and almost three quarter in Nukulaelae and Nanumea.

The mean targeted total macroinvertebrate density was higher on Nukulaelae atoll than on Nanumea and Funafuti. Densities were similar inside and outside the CAs in Funafuti and Nukulaelae. In Nanumea, the mean targeted total macroinvertebrate density was lower within the CA than outside.

The mean edible macroinvertebrate density was considered similarly low at all stations visited in Nukulaelae and Funafuti. In Nanumea, most of the stations also exhibited low macroinvertebrate densities; only 3 stations showed high densities of Kohi and Hopu papa. Edible macroinvertebrate densities were similar inside and outside the CAs on the 3 visited atolls.

Giant clams (Fasua in Tuvaluan) and sea cucumber stocks have declined dramatically through the combined effects of increasing human populations, pollution, habitat destruction and poachers. Clams are listed in Appendix II of CITES (1983) and are considered vulnerable3 under the IUCN Red List of Threatened Species (1996).

Regarding specific macroinvertebrate species of interest, it can be noted that:

- No commercially valuable sea cucumber species were encountered. The only species noted in some numbers was the lollyfish (*Holothuria atra*), which reached very high densities at some stations. Leopardfish and curryfish were observed at very low densities.

- Giant clams were only observed in Funafuti lagoon, mainly within the FCA. Three species were identified: *Tridacna maxima* (the most abundant), *T. squamosa* and *T. derasa*. The highest density was recorded on the Fualopa reef slope. Fuafatu reef also exhibited quite high clam densities, in all habitats. Many dead clam shells were observed in Nanumea but no live specimens were found.

- No *Trochus* were found in Nanumea and few specimens were recorded in Nukulaelae, on the inner barrier reef flat exclusively. *Trochus* were observed in similar densities inside and outside the CA, the highest densities being recorded on the west-facing side of the atoll, which was considered the exposed side. In Funafuti, *Trochus* were found in low densities on almost all reef flats and some reef slopes and lagoon habitats, both inside and outside the FCA.

- *Spondylus* species (Hopu nifo, Sopuu) were quite abundant on the outer atolls. In Nanumea densities tended to be higher within the CA, whereas the opposite was observed in Nukulaelae. *Spondylus* were rare in Funafuti.

- *Chama* sp. (Hopu papa) and arks (Kohi) were only assessed in Nanumea, as Nanumean people eat them. Very high densities were recorded outside the CA.

- Only one pearl oyster was noted throughout the whole survey, in Funafuti lagoon.

- No crown-of-thorns starfish (*Acanthaster planci*) were noted in Nanumea and 2 specimens were seen in Nukulaelae, outside the survey **transects**. In Funafuti 7 specimens were counted, mainly at lagoonal stations.

• No *Drupella* snails, a coral predator, were recorded in Nukulaelae. In Nanumea they were only observed at one location (close to the American channel), in high density. In Funafuti lagoon, *Drupella* snails were observed in low densities. They were more frequent and more abundant outside the FCA than inside.

Mean targeted total fish densities were similar at all 3 atolls visited, though slightly higher in Funafuti than in Nukulaelae and Nanumea. Densities were similar inside and outside CAs on the 3 visited atolls.

Mean edible fish densities showed the same trend as above: densities were similar on all 3 atolls visited, though slightly higher in Funafuti and Nukulaelae than in Nanumea. Densities were similar inside and outside the CAs on all 3 visited atolls.

Regarding targeted fish communities composition the most abundant fish species overall were the lined bristletooth (*Ctenochaetus striatus*, Pone uli), parrotfishes (*Scaridae*, Laea), the steephead parrotfish (*Chlorurus microrhinos*, Homo), the convict tang (*Acanthurus triostegus*, Manini) and the humpnose bigeye bream (*Monotaxis grandoculis*, Muu). Funafuti also showed high densities of the striped surgeonfish (*Acanthurus lineatus*, Ponelolo) and the orangespine unicornfish (*Naso lituratus*, Manini lakau), whereas in Nanumea high densities of the blue-barred parrotfish (*Scarus ghobban*, Ulafi) and the ringtail surgeonfish (*Acanthurus blochii*, Maa) were also recorded.

Lastly, no clear pattern emerged from this survey about the effects of CAs on organisms targeted by locals. In Funafuti, stations outside the FCA showed the highest coral cover (Tepuka reef slope), the highest edible macroinvertebrate density (Teafualiku reef flat) and the highest total targeted fish density (Fualefeke reef slope); on the other hand, giant clams and *trochus* were found to be more abundant inside the FCA than outside (especially on the Fualopa reef slope), the Fuafatu reef slope hosted the highest edible fish densities and a healthy coral community; and the Tefala reef flat and slope had a high cover of crustose coralline algae and an abundant sea urchin population. In Nukulaelae, stations within the CA showed higher coral cover, higher densities of edible fish and macroinvertebrate and the presence of the rare marketable sea cucumbers. In Nanumea, one station (OCA1) was distinguished by high coral cover, high total and edible fish densities and high edible macroinvertebrate density, which is located outside the CA close to the American channel. Stations within Nanumea CA showed moderate coral cover, high edible fish abundances and high densities of Hopu nifo and Hopu papa (both edible bivalves).

INTRODUCTION

Small island nations are more vulnerable to human impacts and natural disturbances, and more reliant on a healthy marine environment for long-term survival, than larger nations (Kaly et al. 2002). Tuvalu, a small Pacific Island nation, is severely threatened by sea level rise and increased storm frequency predicted under ongoing climate change (Radanne 2006). Various indicators classify Tuvalu as the most vulnerable nation in the region (Hoegh-Guldberg et al. 2000; Kaly and Pratt 2000). With the highest point of elevation at 3m above sea level, Tuvaluan agriculture relies on predictable rainfall patterns and, on some atolls, on a clean freshwater lens.

Coral reefs are some of the most diverse habitats on the planet, and documenting patterns of biodiversity allows a better understanding of the health and resilience of coral reefs. Ecosystems with greater biodiversity tend to be more stable and productive, more resistant to human disturbance, and quicker to recover from disturbances. Furthermore, they offer a richer resource to local populations that rely on coral reefs for their primary source of protein. Measuring spatial patterns of biodiversity also helps to identify areas of conservation priority, potential nursery grounds and important habitats for rare and threatened species. Previous work on Tuvaluan reef fish biodiversity resulted in a comprehensive species list, but little insight into overall patterns of species assemblages. The first complete fish survey on Tuvaluan reefs recorded 358 species from 168 genera and 63 families (Jones et al. 1991). This number was progressively updated and wherever possible, deep-sea and open-water fish were added through fisheries surveys (Ellway et al. 1983, Seluka et al. 1998).

The use of marine resources forms part of the cultural identity of all Polynesian people. Tuvaluans possess an extensive traditional knowledge of their marine resources (Seluka et al. 1998) and have access to a traditional system of managing these resources sustainably (Dalzell et al. 1996). Despite this, increased overfishing and overharvesting has put pressure on the marine environment. An impetus exists for the improved understanding of patterns of biodiversity and improved management of resources through the protection of locally managed Conservation Areas, or CAs (Sauni et al. 2008). Such CAs have been recently implemented on all atolls and islands of the Tuvalu archipelago.

The *Tuvalu Marine Life* project (TML) aims to support the Tuvalu Fisheries Department in enhancing its knowledge and management of Tuvalu's marine life and resources. As a first step, an extensive review listed all marine species found in Tuvaluan waters, for a first glance at marine biodiversity (Job 2009). A revision before onsite survey found 1449 marine species, including 541 fish, 398 macroinvertebrates, 379 **cnidarians**, 59 algae, 41 seabirds, 21 marine mammals, 4 sponges, 4 turtles and 2 species of mangroves. Additionally, the first phase of the TML project was to propose and budget several field surveys to be conducted in line with local needs and existing strategies of marine resource conservation in Tuvalu. In agreement with all stakeholders (Fisheries & Environment Departments, TANGO, FCA and NBSAP officers), several priorities were identified for phase 2: 1) Field surveys should be conducted in Funafuti, Nanumea and Nukulaelae; 2) Field surveys should focus on fish; 3) Biodiversity assessments should include targeted marine resource surveys within defined CAs using low-cost and low-tech methods in which local islanders can be trained.

The Reef Fish Biodiversity Survey aims to update and expand existing reef fish species lists, and to provide additional information about abundance, species composition, biomass and distribution patterns of Tuvaluan reef fish.

The Conservation Areas Survey aims to assess stocks of targeted species of macroinvertebrates and fish using simple methods replicable by Fisheries officers and local islanders. This work includes training local people and 'refreshing' Fisheries officers in techniques used to assess marine resources within and outside CAs. The methods were chosen to be simple and accessible to non-scientists, but robust and reliable enough to enable the assessment of change in marine resources through time.

The goal includes estimating the quantity of edible, commercial or otherwise valuable fish (for food security purposes, handicraft, bait, etc.), as well as documenting the species commonly caught by local fishers. A list of targeted species has been produced for each atoll and additional species are added as indicators of reef health.

Tuvalu Marine Life

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Scientific Report - PART I

Biodiversity of Tuvaluan Reef Fishes

Dr. Daniela Ceccarelli












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1. METHODOLOGY

1.1. STUDY SITES

The field surveys were carried out in Nanumea, Nukulaelae, and the capital atoll, Funafuti (*Figure 1*), between April 27th and May 27th 2010, with between 6 and 10 days spent at each location.

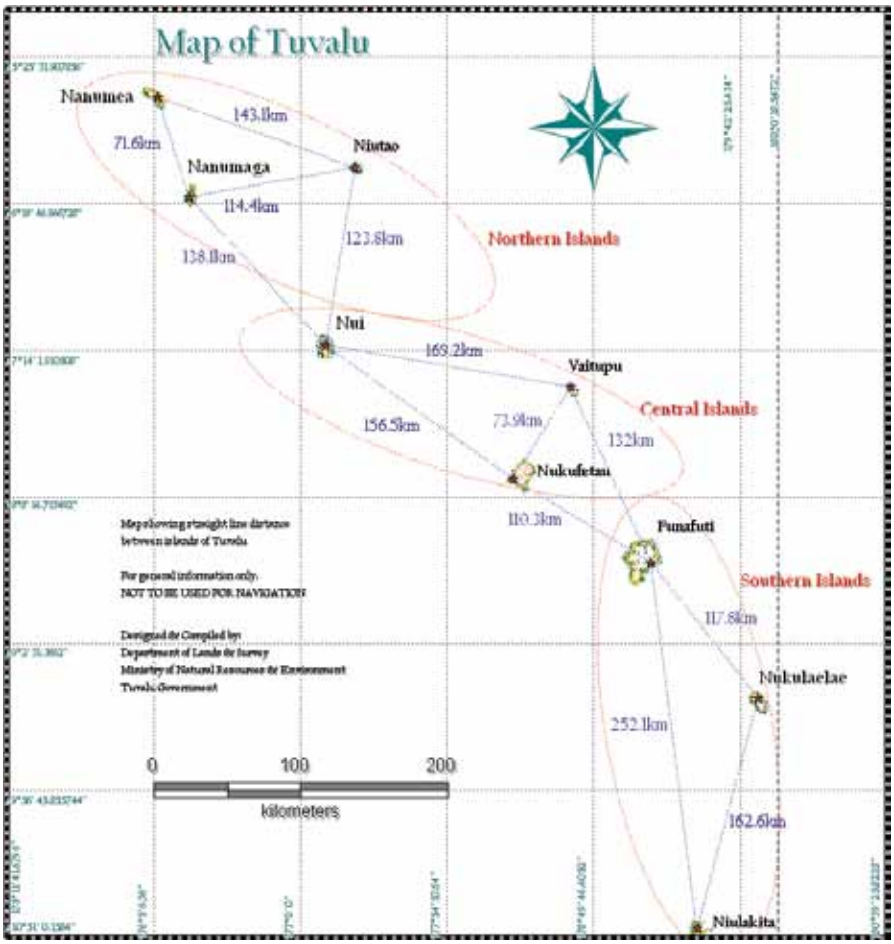


Figure 1. Overview map of Tuvalu, showing all nine atolls.

1.1.1. Sampling design

Biodiversity surveys were conducted using two standard methods: 1) timed swims with towed GPS to record reef fish biodiversity and large predators and herbivores (referred to as “Biodiversity”), and 2) replicated underwater visual census using belt transects to determine relative abundance and species composition of the mid-slope reef fish communities and the composition of the benthic community (referred as “Transects”). The use of these two methods allows for a comprehensive species list, statistical rigor, the identification of habitat associations, and the comparison between Tuvalu and other reefs on a regional scale. These two methods are widely used throughout the whole Indo-Pacific region and are recommended methods to survey tropical marine resources (English et al. 1997).

Whenever possible, the sampling design included (at least) three replicate sites in exposed, sheltered and lagoonal locations on each atoll, resulting in a minimum of nine sites per atoll. Weather conditions imposed a number of variations on the sampling design *(Table 1* and *Figure 2)*.

A total of 12 sites were surveyed on Nanumea atoll. Biodiversity swims were conducted at all 12 sites, including 6 sheltered sites (green dots in *Figure 3*), 3 exposed sites (red dots) and 3 lagoon sites (yellow dots), with an additional reef flat location surveyed on snorkel for the addition of reef flat specialists to the species list (pink dot). Transects for biomass and density assessments were laid out at 6 of the sites, including 3 on exposed sites and 3 on lagoonal sites.

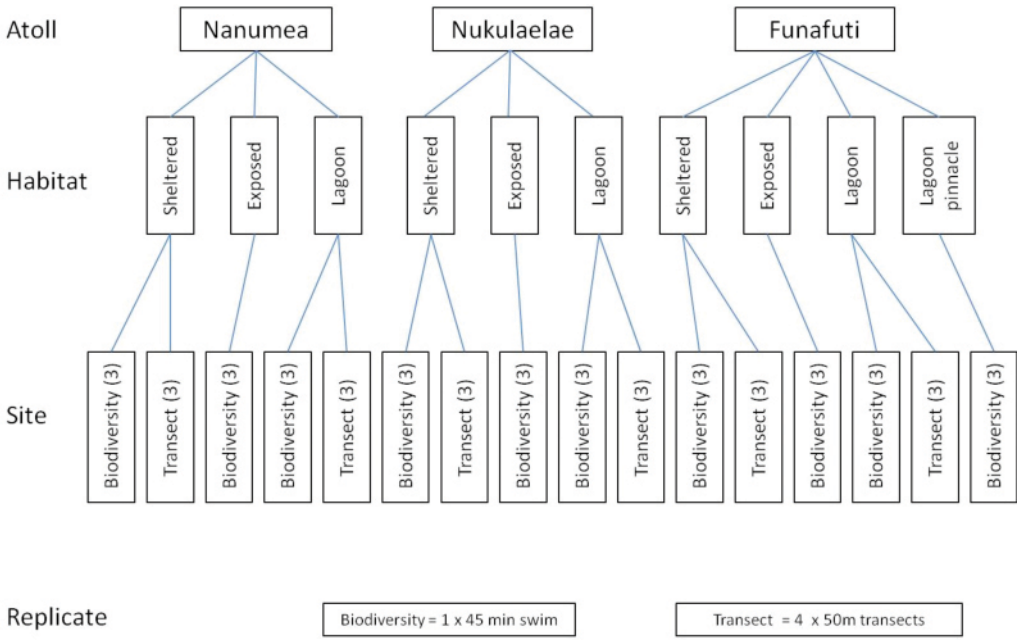


Figure 2. Illustration of the sampling design developed for the biodiversity assessment and transect surveys. The number of intended sites in each habitat is represented in brackets.

Site placement in Nukulaelae followed the intended framework *(Table 1)*. A total of 9 sites were surveyed. Biodiversity swims were conducted at all 9 sites, including 3 sheltered sites (green dots in Figure 5, 3 exposed sites (red dots) and 3 lagoon sites (yellow dots), with an additional reef flat location surveyed on snorkel (pink dot). Transects for biomass and density assessments were laid out at 6 of the sites, including 3 on exposed sites and the 3 lagoon sites *(Figure 6)*.

As Funafuti lagoon is much larger than the other two surveyed atolls, additional sites were chosen for fish biodiversity surveys to better capture the range of existing habitats, and therefore gain a better representation of fish communities. A total of 14 sites were surveyed. Biodiversity swims were conducted at all 14 sites, including 4 sheltered sites (green dots in *Figure 7*), 3 exposed sites (red dots), 4 lagoon sites (yellow dots) and 3 lagoon pinnacle sites (blue dots), with an additional reef flat location surveyed on snorkel (pink dot). Transects were laid out for fish biomass and density assessment at 8 of the sites, including 4 sheltered sites and 4 lagoon sites (*Figure 8)*.

Table 1. Number of sites completed in exposed, sheltered, lagoon and lagoon pinnacle habitats on each atoll surveyed.

Exposure	Nanumea	Nukulaelae	Funafuti
Exposed	3 Biodiversity	3 Biodiversity	3 Biodiversity
Sheltered	6 Biodiversity	3 Biodiversity	4 Biodiversity
	3 Transect	3 Transect	4 Transect
Lagoon	3 Biodiversity	3 Biodiversity	4 Biodiversity
	3 Transect	3 Transect	4 Transect
Lagoon Pinnacle			3 Biodiversity

Figure 3. Map of Nanumea sites for fish biodiversity surveys. The orange dashed line delineates the Conservation Area.

Figure 4. Map of Nanumea sites for fish transect surveys. The orange dashed line delineates the Conservation Area.

Figure 5. Map of Nukulaelae sites for fish biodiversity surveys. The orange dashed line delineates the Conservation Area.

Figure 6. Map of Nukulaelae sites for fish transect surveys. The orange dashed line delineates the Conservation Area.

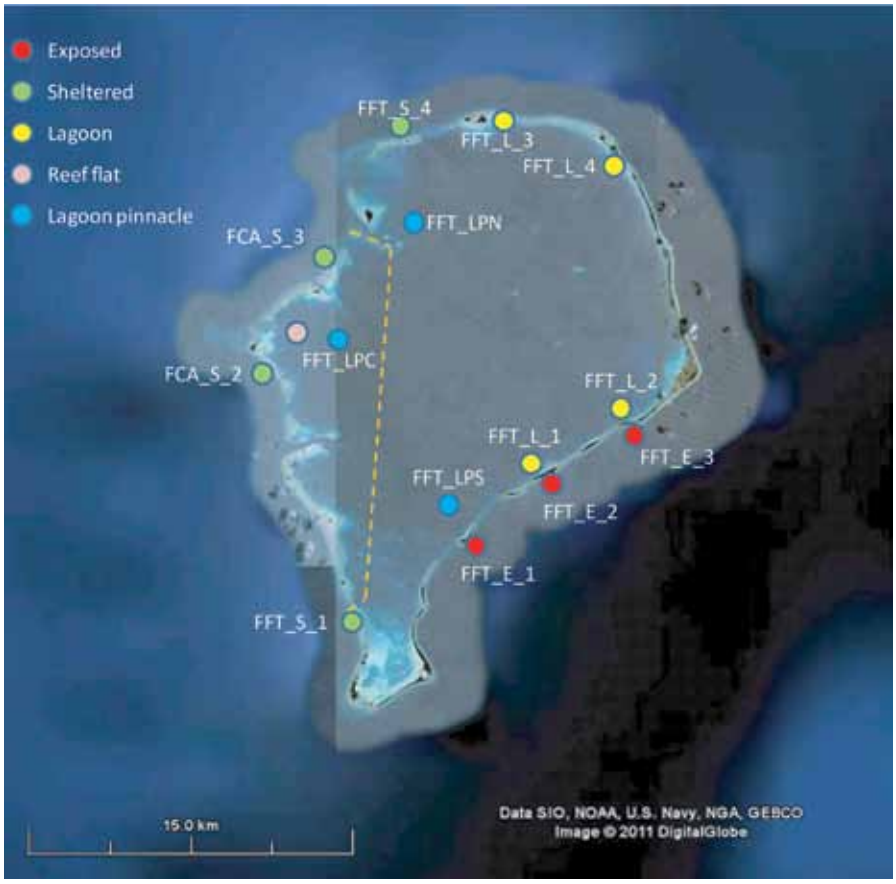


Figure 7. Map of Funafuti sites for fish biodiversity surveys.
The orange dashed line delineates the Conservation Area.

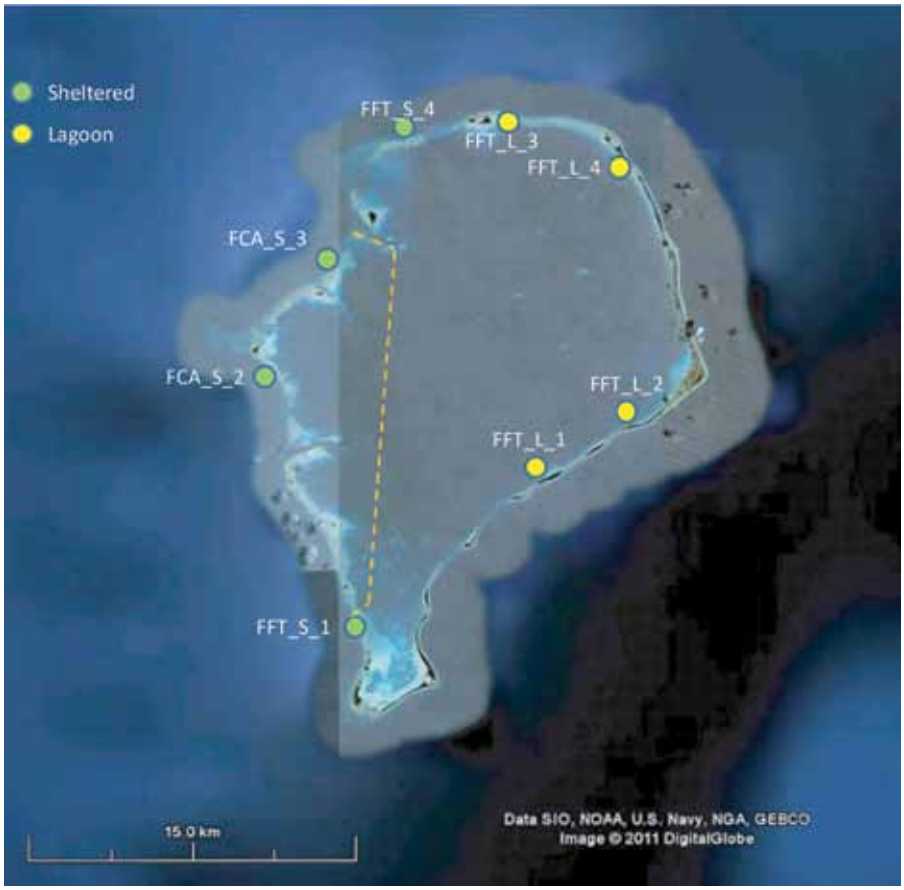


Figure 8. Map of Funafuti sites for fish transect surveys.
The orange dashed line delineates the Conservation Area.

1.1.2. Sampling protocol

Two SCUBA dives (see also *Table 2* and *Figure 2*) were performed at each site, including:

1. One fish biodiversity timed swim (45min), with towed GPS, to assess overall fish diversity and relative abundance, and the density of large predators and herbivores.

2. Replicate fish surveys along four 50m transects at each site, with the surveyor recording larger, more mobile fishes during the first pass and smaller, more site-attached fishes on the second pass (abundance and species composition).

3. Four replicate Point Intercept Transect benthic surveys along the same four 50m transects at each site to assess benthic % cover, particularly hard and soft corals, sponges and algae.

Table 2. Tasks to be performed at each site.

Personnel	Dive 1	Dive 2
D. Ceccarelli	Fish biodiversity timed swim (45min) with towed GPS, covering as many habitats as possible	50m transects, large fish (way out, 10m width) and small fish (way back, 2m width), 4 replicates
T. Vignaud	Photography	
S. Job		50m transects, benthos and reef complexity, 4 replicates

Timed swims were conducted to achieve a rapid visual assessment of fish biodiversity and relative abundance. During the timed swim (which generally covered 2,000m^2 depending on currents), the diver searched all site-specific microhabitats. All fish were identified to species level. The abundance of fish species was recorded on a log-scale (*Table 3*) and later converted to ranks or scores for ease of statistical interpretation of community structure.

Table 3. Abundance scale used in fish biodiversity timed swims.

Abundance Category	Number of Individuals
0	0
1	1
2	2-5
3	6-25
4	26-125
5	>125

Table 4. List of benthic categories used for transects.

Benthic category	Code
***Acropora* branching**	AB
Branching coral	BC
Coralline algae	CA
Dead coral	DC
Digitate coral	DI
Encrusting algae	EA
Encrusting coral	EC
Foliose coral	FC
Halimeda	HA
Macroalgae	MA
Massive coral	MC
Rubble	RB
Rock and limestone	RC
Sand	SD
Silt	SI
Sponge	SP
Turf algae	TA
Table coral	TC

Four replicate transects were laid out at each site. The abundance of larger, mobile fish species was recorded along 50 x 10m transects on the first pass, as the diver simultaneously deployed the transect tape. Smaller and more site-attached fishes (e.g. damselfishes) were recorded along a 2m belt along the same transect on the return pass. This widely used method will facilitate comparisons with fish diversity on other Pacific reefs, and will result in data that is publishable in the peer-reviewed scientific literature.

During both fish census methods, incidental sightings of all species were noted and the previous species list for Tuvalu was updated with this information.

At each site, four replicate 50m point-intercept transects were conducted for robust benthic cover and coral abundance estimates. Hard corals were identified to growth form level and other benthic organisms such as soft coral/sponges/algae were distinguished (*Table 4*).

Additionally, to measure the complexity of the reef framework, a 2m chain was used at every 10m point of the transect line. The chain was draped over the reef in a straight line underneath the transect tape, following the reef contours. The complexity index was calculated by subtracting the length of the tape at the endpoint of the chain (distance D1) from 2 metres (*Figure 9).*

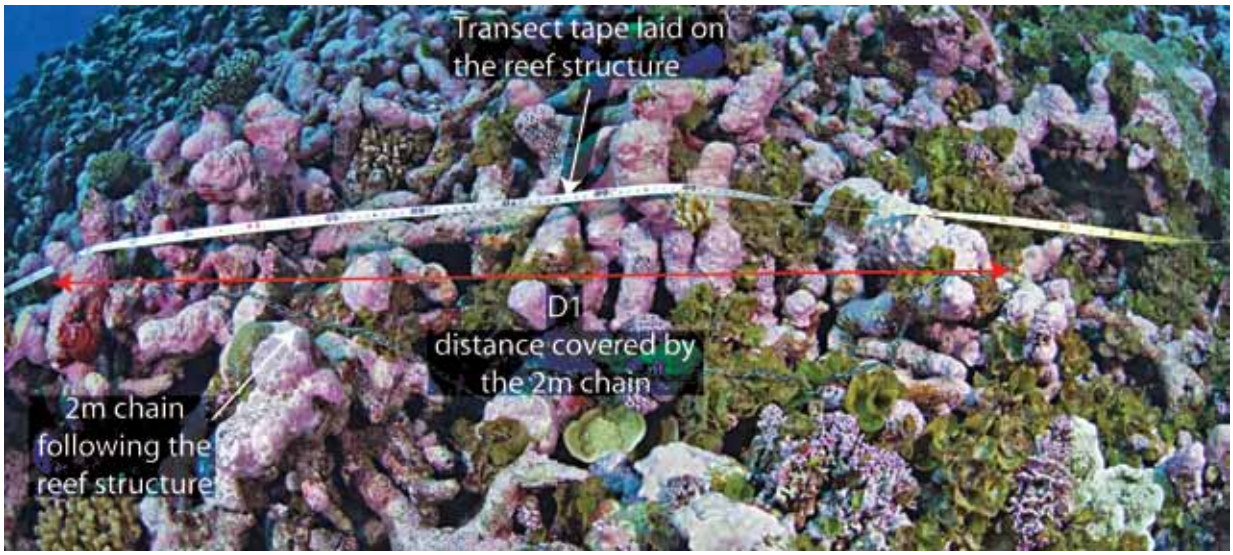


Figure 9. Illustration of the reef complexity method.

1.1.3. Data analysis

Fish species were analysed both individually and grouped taxonomically (by family) or by functional groups. Functional groups reflect the specific roles that different species play on the reef and can therefore provide a more useful measure of reef health and resilience than species composition alone. Thirteen different functional groups were distinguished (Table 5), and all species were assigned to functional groups as per currently recognised roles (Appendix 2).

Reef fish biodiversity patterns were described and compared between exposure regimes, atolls, previous surveys in Tuvalu and regionally relevant reefs.

Reef fish abundances of all species were reported as density estimates (individuals per hectare or 1000m^2). The diversity, density and biomass of reef fish were described spatially using multivariate techniques (e.g. non-metric Multidimensional Scaling). Density and diversity of reef fish were compared between exposure regimes, atolls, previous surveys and regionally relevant reefs, using Analysis of Variance (ANOVA) and Multivariate ANOVA (MANOVA), with appropriate transformations of data that did not conform to the test assumptions of normality and homoscedasticity.

The percentage cover of all benthic groups (especially hard and soft corals, algae and sponges) were compared between exposure regimes, atolls, previous surveys and regionally relevant reefs.

The relationship between habitat structure (benthic categories, complexity index) and the fish community was explored using BEST analysis and LinkTree, using Primer (Clarke and Gorley 2006).

Table 5. List of functional groups used to separate the roles of fish in this study, with a brief description of the role played by each group.

Functional Group	Code	Description
Benthic invertivore	Be	Prey on benthic invertebrates, including sessile and mobile species. Includes most wrasses, some emperors and sweetlips, butterflyfish and angelfish.
Algal cropper	Cr	'True' herbivores that feed on algal turfs.
Algal browser	Br	'True' herbivores that feed on macroalgae.
Detritivore	De	Grazers that remove detritus from algal turf with bristle-like teeth.
Scraping scarid	SS	Parrotfish that scrape hard substrata, removing algal turf and underlying sediment and detritus.
Excavating scarid	ES	Parrotfish that take deep, excavating bites and remove considerable amounts of live coral along with algal turf, detritus, and the carbonate substrate. Cause a large amount of bioerosion on coral reefs.
Facultative corallivore	FC	Butterflyfish that eat live coral polyps, but are also able to feed on other sessile and mobile benthos.
Obligate corallivore	OC	Butterflyfish that eat only live coral polyps. Respond rapidly to changes in live coral cover.
Omnivorous pomacentrid	OP	Damselfish that target a variety of food, from plankton, to turf algae, to mobile invertebrates, in an opportunistic manner.
Planktivore	Pl	Species that target plankton in the water column, generally feeding in large schools. Includes mostly damselfish, but also fusiliers, some surgeonfish and some triggerfish.
Territorial pomacentrid	TP	Damselfish (and one species of surgeonfish) that tend and defend algal 'farms' from other grazers. Can modify large tracts of reef.
Intermediate predator	IntP	Piscivorous fish, usually ambush predators, can fall prey themselves to large predators.
Large predator	LaP	Large piscivorous fish that may target intermediate predators and smaller fish, rarely fall prey to other reef fish (this group includes mainly large groupers and sharks).

2. RESULTS

2.1. BIODIVERSITY

A total of 317 species were recorded from 49 families, during 56 SCUBA dives in Nanumea, Nukulaelae and Funafuti. Despite the short duration of the survey trip in each place, **66 species that had not previously been recorded in Tuvalu were added to the previous species list, bringing to overall total for Tuvalu to 607 reef fish species.** Not all species on the existing species list were observed during our survey, but we attributed this to the short time spent in the field, and updated the species list on the assumption that all the previously recorded species are still present.

The new records added during this survey are common reef fish species or food fish caught by fishers. Of the major reef fish families, the overall species list now includes Labridae (60), Pomacentridae (40), Apogonidae (15), Acanthuridae (44) Serranidae (51), Chaetodontidae (32), and Lutjanidae (36). In accordance with previous surveys (Jones et al. 1991), no **endemic** species were recorded. The most recent complete fish survey before the present one recorded 358 species of fish from 63 families, during 300 SCUBA dives on Nanumea, Nui and Niutao (Jones et al. 1991)[1]. *Table 6* below presents the number of reef fish species known from each family for the 3 atolls surveyed, with an indication of the new records added during our survey.

Table 6. Number of species in each family of reef fish recorded in the present survey, with new records of species previously unrecorded on Tuvaluan reefs.

Location	Family (total # of species)	New records added
Nanumea	Acanthuridae (27)	*Acanthurus auranticavus*
		Ctenochaetus cyanocheilus
	Apogonidae (1)	
	Balistidae (8)	
	Blenniidae (4)	*Cirripectes chelomatus*
		Ecsenius opsifrontalis
		Ecsenius bicolor
	Caesionidae (2)	
	Caracanthidae (1)	*Caracanthus maculatus*
	Carangidae (5)	
	Carcharhinidae (3)	
	Chaetodontidae (19)	
	Chanidae (1)	
	Cirrhitidae (4)	
	Dasyatidae (2)	
	Ephippidae (1)	
	Exocoetidae (1)	
	Gerreidae (1)	
	Gobiidae (8)	*Asterropterix striatus*
		Enneapterygius sp.
		Paragobiodon echinocephalus
		Trimma halonevum
	Holocentridae (6)	
	Kyphosidae (2)	
	Labridae (34)	*Cheilinus oxycephalus*
		Halichoeres nebulosus
		Oxycheilinus unifasciatus
		Pteragogus cryptus
		Stethojulis interrupta
		Wetmorella albofasciata

[1] Some species recorded in previous surveys were not recorded in the present study; these are ignored in the overall species richness estimate.

Location	Family (total # of species)	New records added
	Lethrinidae (6)	
	Lutjanidae (10)	
	Microdesmidae (1)	
	Monocanthidae (1)	
	Mugilidae (2)	
	Mullidae (3)	
	Muraenidae (1)	
	Pempheridae (1)	
	Plotosidae (1)	
	Pomacanthidae (5)	
	Pomacentridae (26)	*Chromis atripes*
		Chromis vanderbilti
		Chromis weberi
		Chromis xanthura
		Chrysiptera unimaculata
		Plectroglyphidodon lacrymatus
		Pomacentrus coelestis
		Pomacentrus grammorhynchus
	Scaridae (21)	
	Scombridae (3)	
	Scorpaenidae (6)	*Sebastapistes cyanostigma*
	Serranidae (16)	*Balenoperca chabanaudi*
		Pseudanthias dispar
		Pseudanthias evansi
	Sphyraenidae (2)	
	Tetraodontidae (3)	
	Zanclidae (1)	
Nukulaelae	Acanthuridae (19)	*Acanthurus auranticavus*
		Ctenochaetus cyanocheilus
	Apogonidae (6)	*Apogon fragilis*
		Apogon fraenatus
		Apogon nigrofasciatus
		Archamia bleekeri
		Cheilodipterus artus
	Aulostomidae (1)	
	Balistidae (8)	*Pseudobalistes fuscus*
	Blenniidae (6)	
	Caesionidae (1)	
	Carangidae (6)	
	Carcharhinidae (3)	
	Chaetodontidae (19)	
	Cirrhitidae (2)	
	Dasyatidae (2)	
	Diodontidae (1)	
	Ephippidae (2)	
	Exocoetidae (1)	
	Gerreidae (1)	
	Gobiidae (5)	*Asterropterix striatus*
	Hemiramphidae (1)	
	Holocentridae (8)	*Neoniphon argenteus*
	Kyphosidae (1)	
	Labridae (35)	*Oxycheilinus orientalis*
		Oxycheilinus unifasciatus
		Wetmorella albofasciata
	Lethrinidae (11)	*Gymnocranius microdon*
		Lethrinus lentjan

Location	Family (total # of species)	New records added
	Lutjanidae (9)	*Paracaesio xanthura*
	Microdesmidae (2)	
	Monocanthidae (3)	
	Mullidae (8)	*Parupeneus ciliatus*
		Upeneus arge
	Muraenidae (1)	
	Pomacanthidae (5)	*Centropyge bispinosus*
		Centropyge heraldi
	Pomacentridae (28)	*Amblyglyphidodon leucogaster*
		Chromis atripes
		Chromis vanderbilti
		Chromis xanthura
		Chrysiptera unimaculata
		Plectroglyphidodon lacrymatus
		Pomacentrus coelestis
		Pomachromis richardsoni
	Scaridae (14)	
	Scombridae (4)	*Sarda orientalis*
	Serranidae (16)	
	Siganidae (1)	
	Sphyraenidae (2)	
	Tetraodontidae (2)	
	Zanclidae (1)	
Funafuti	Acanthuridae (27)	*Ctenochaetus cyanocheilus*
		Zebrasoma flavescens
	Apogonidae (9)	*Apogon fragilis*
		Apogon luteus
		Apogon monospilus
		Apogon nigrofasciatus
		Cheilodipterus macrodon
	Aulostomidae (1)	
	Balistidae (7)	
	Belonidae (2)	
	Blenniidae (5)	*Plagiotremus rhinorhynchus*
		Plagiotremus tapeinosoma
	Caesionidae (6)	
	Carangidae (6)	
	Carcharhinidae (3)	
	Chaetodontidae (20)	
	Chanidae (1)	
	Cirrhitidae (4)	
	Echeneidae (2)	
	Ephippidae (1)	
	Exocoetidae (1)	
	Gerreidae (1)	
	Gobiidae (12)	*Amblygobius nocturnus*
		Asterropterix striatus
		Eviota latifasciata
		Eviota prasites
		Eviota sigillata
		Eviota zebrina
	Holocentridae (10)	
	Kyphosidae (1)	
	Labridae (39)	*Labropsis australis*
		Oxycheilinus orientalis
		Oxycheilinus unifasciatus
		Stethojulis trilineata
		Wetmorella albofasciata

Location	Family (total # of species)	New records added
	Lethrinidae (7)	
	Lutjanidae (9)	
	Malacanthidae (1)	
	Microdesmidae (3)	
	Monocanthidae (2)	
	Mugilidae (3)	
	Mullidae (8)	*Parupeneus ciliatus*
	Muraenidae (1)	
	Mylobatidae (2)	
	Ostraciidae (2)	
	Pomacanthidae (6)	*Centropyge bispinosus*
	Pomacentridae (36)	*Amblyglyphidodon leucogaster*
		Chromis amboinensis
		Chromis atripes
		Chromis vanderbilti
		Chromis weberi
		Chromis xanthura
		Chrysiptera unimaculata
		Plectroglyphidodon lacrymatus
		Pomacentrus brachialis
		Pomacentrus coelestis
		Pomachromis richardsoni
	Scaridae (17)	
	Scombridae (2)	
	Scorpaenidae (1)	
	Serranidae (18)	*Balenoperca chabanaudi*
	Siganidae (3)	*Siganus canaliculatus*
	Sphyraenidae (2)	
	Synodontidae (2)	*Saurida gracilis*
	Tetraodontidae (4)	
	Zanclidae (1)	

At least 79 species of interest are listed in the IUCN Red List, of which 29 are included in one of the Near Threatened or Threatened categories (see Appendix 3 for the species list and IUCN classification). Most of the sharks and rays are identified as being in need of some degree of protection. Among the bony fish, the species of concern are the groupers *Epinephelus fuscoguttatus*, *E. polyphekadion* and *E. socialis* and the bigeye tuna *Thunnus obesus* (Near Threatened), bumphead parrotfish *Bolbometapon muricatum* and the groupers *Epinephelus lanceolatus*, *Plectropomus aerolatus* and *P. laevis* (Vulnerable) and the Maori wrasse *Cheilinus undulatus* (Endangered).

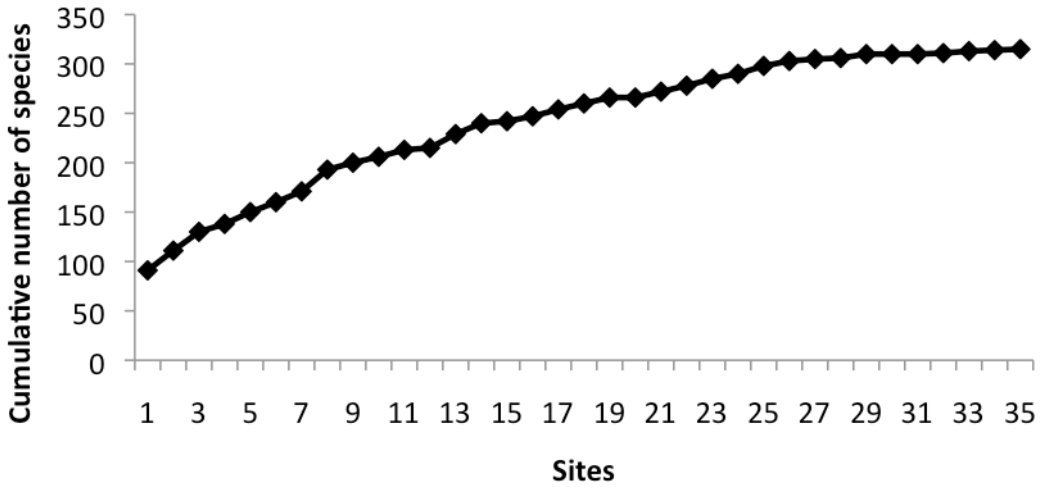


Figure 10. Species accumulation curve for all sites visited in this survey.

The species accumulation curve, which represents the number of new species added with each new site visited, suggests that a high number of additional species could be expected if more sites were visited *(Figure 10)*. A plateau, where only 1 or 2 new species are added with every dive, is generally reached after 50–60 dives in atoll environments (M. Beger, pers. comm.).

During this survey, 5-10 species per dive were being added when visiting a different habitat, particularly when visiting a new atoll.

Patterns of fish diversity among atolls

Species richness varied greatly between sites (from 38 species to 99), with the lowest diversity found inside the lagoons. Overall, **the greatest number of species overall (234) was recorded in Funafuti, followed by 207 in Nanumea and 194 in Nukulaelae**.

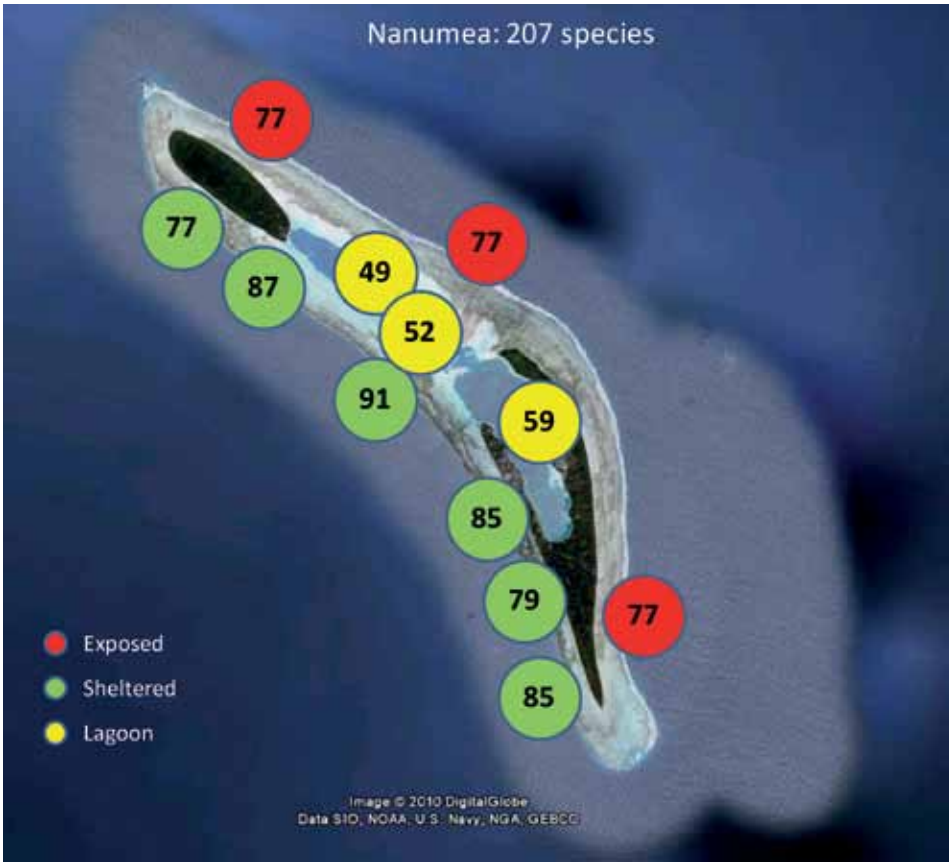


Figure 11. Species richness recorded on Nanumea atoll. The middle lagoon site is inside the Nanumea Conservation Area (52 species recorded).

Nanumea had an **intermediate level of species richness, with 207 species recorded.** It was variable between lagoon sites (49-59 species) and on the sheltered side of the atoll (77-91 species), but virtually uniform on the exposed side (77 species at all three sites.

This reflects the differences in habitat. The sheltered side of the atoll was characterised by a complex structure, including a tract of overhanging wall providing a range of niches and a variety of habitats *(Figure 15)*. The lagoon consisted of a sandy or silty bottom with coral heads and bommies, which varied among sites. In contrast, the exposed side of the atoll was relatively featureless, with extensive banks of rubble and tracts of coralline pavement with sparse turf *(Figure 15)*.

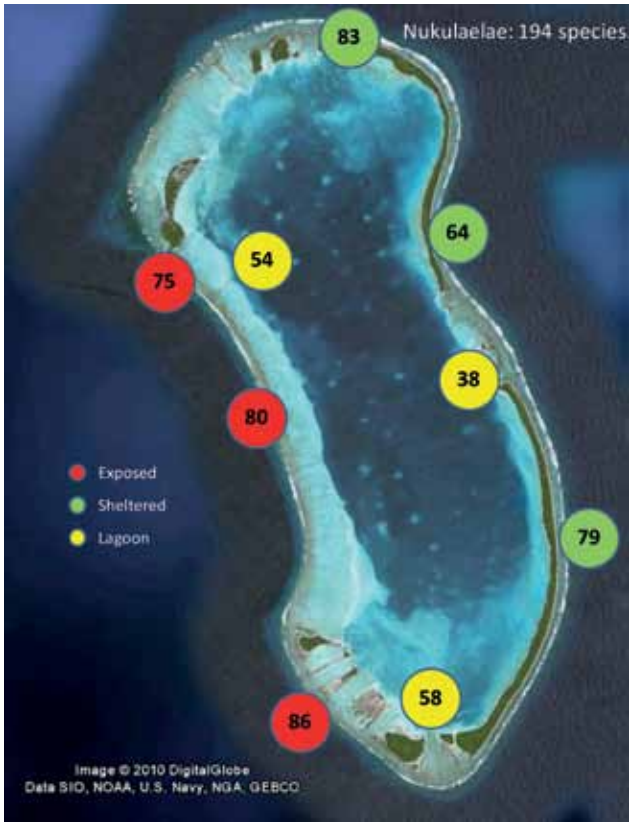


Figure 12. Species richness at all sites visited on Nukulaelae atoll. Two sites were located within the Nukulaelae Conservation Area, hosting 54 and 83 species.

Nukulaelae had the lowest species richness overall (**194 species**), but the distinction between sheltered and exposed sites was not as great as in Nanumea. Species richness in the lagoon varied between 75 and 86 species, on the sheltered side it ranges between 64 and 83 species, and the sheltered sites had between 38 and 58 species.

The lowest species richness outside the lagoonal areas was found at one of the sheltered sites, which was dominated by an extensive **monospecific** stand of staghorn *Acropora (Figure 15).*
The lagoon sites were less species-rich, especially areas dominated by sand and low-relief coral outcrops *(Figure 15)*.

Funafuti hosted the largest number of species recorded during these surveys **(234 species**), which probably reflects the greater sampling effort and more diverse habitats found in this opened atoll. Furthermore, in Funafuti we surveyed an additional habitat, lagoonal pinnacles, which was not present on the other two atolls. Due to the depth and structure of the lagoonal slope, there was little difference in species richness between the lagoon (71-99 species) and outer reef habitats (exposed: 81-95 species; semi-exposed: 84-97 species).

West-facing outer reef sites were more characteristic of exposed habitats, with high cover of coralline algae, while east-facing sites had delicate plate and staghorn *Acropora* corals *(Figure 15)* reminiscent of sheltered sites.

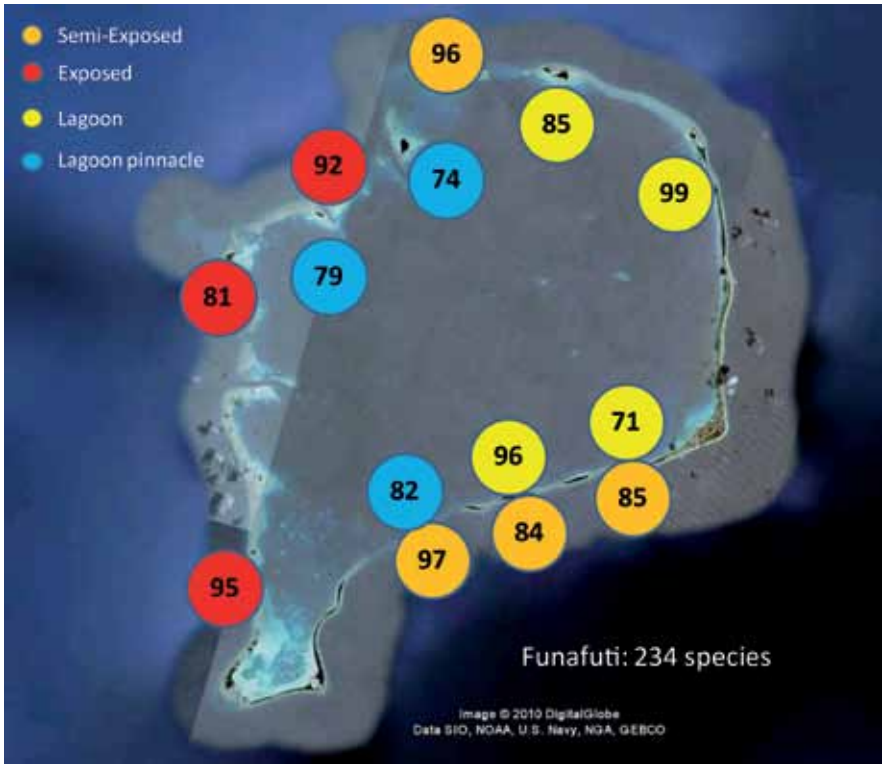


Figure 13. Species richness at all sites visited on Funafuti atoll. The two northern-most exposed and lagoon pinnacle sites are within the Funafuti Conservation Area (respectively 81, 92 and 79 species.

However, the shallower areas of east-facing sites also had a high degree of coralline algal cover and structural complexity, suggesting intense scouring during periods of heavy seas.

However, there were no visible differences in the species richness between the two sides of the atolls.

Lowest species richness records were from lago-onal pinnacles (74-82 species), which are isolated patches of habitat with a limited area.

Patterns of fish diversity among depths

Shallow and mid-depth habitats were significantly more species-rich than deeper sites. This pattern was consistent across the three atolls (Appendix 1, *Figure 14*).

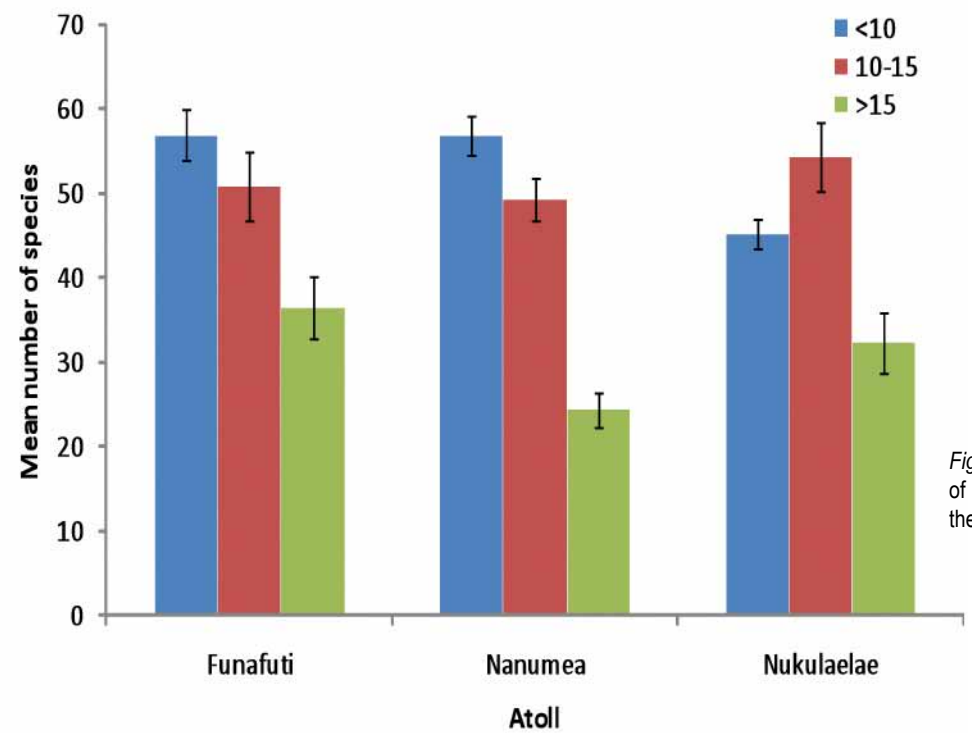


Figure 14. Depth distribution of species richness across the three atolls.

Patterns of fish diversity among status of protection

Species richness inside Conservation Areas appeared to be intermediate relative to the other sampled sites. That is, in Nanumea and Nukulaelae, lagoonal sites were sampled within the Conservation Areas, and species richness was typical of other lagoonal sites visited. In Funafuti, outer reef sites inside the FCA were not more diverse than outer reef habitats outside the FCA. These interpretations must be viewed with considerable caution as this survey was not targeting the differences between sites inside and outside Conservation Areas, and replication was inadequate for rigorous testing.

Figure 15. Habitats surveyed, clockwise from top left: Steep wall and complex habitat on Nanumea's sheltered side; Large outcrops on sand in Nanumea lagoon ; Featureless exposed face of Nanumea atoll ; Delicate branching and plate-forming corals on Funafuti's semi-exposed side ; Small coral outcrops on sand in Nukulaelae lagoon ; Monospecific *Acropora* habitat on Nukulaelae's sheltered side.

Total expected fish species richness: the Coral Fish Diversity Index

To address the limitations of compiling species lists in restricted amounts of space and time, a regression method, the Coral Fish Diversity Index (CFDI), exists for assessing expected species richness (Allen and Werner 2002). This estimate applies a correction factor to the combined diversity recorded for six families of large, easily identifiable reef fishes: Acanthuridae (surgeonfishes), Chaetodontidae (butterflyfishes), Labridae (wrasses), Pomacanthidae (angelfishes), Pomacentridae (damselfishes) and Scaridae (parrotfishes). Groups of fishes used to calculate the CFDI groups can be comprehensively documented over a short time.

Two formulas exist to calculate the CFDI, one for small areas (e.g. single reefs or atolls) and one for wider scale regions. The primary limitation of this method is that the final figure arrived at will increases depending on the amount of time spent searching for new species, until a plateau is reached. The time and effort taken for this plateau to be reached is also likely to depend on the level of experience of the observer, and the number of different habitats searched. For restricted localities such as atolls and islands of Tuvalu, the total number of species in these six families is the CFDI, and the relationship of this Index to total diversity was:

$$3.39 \times \text{CFDI} - 20.6$$

Estimated total fish diversity for Tuvalu using this formula is 711 species (Table 7). Given the time, habitats searched and expertise of the primary observers, the results obtained here are comparable to those reported in other locations.

Table 7. Number of species from six target fish families in Tuvalu, combining the results of this survey with previous species lists.

Fish families	Number of Species
Butterflyfishes (Chaetodontidae)	32
Angelfishes (Pomacanthidae)	13
Damselfishes (Pomacentridae)	40
Wrasses (Labridae)	60
Parrotfishes (Scaridae)	27
Surgeonfishes (Acanthuridae)	44
Total CFDI	216
Total expected number of fish species	**711**

2.2. FISH DENSITY AND BIOMASS

2.2.1. Patterns of fish density

Overall fish density (individuals per 1000 m^2) was slightly higher on Nanumea atoll (2,865.6 +/- 455.8SE) that on both Nukulaelae (1,965.2 +/- 355.3SE) and Funafuti (1,769 +/- 100.7 SE), which had values similar to each other (*Figure 16*, Appendix 1).

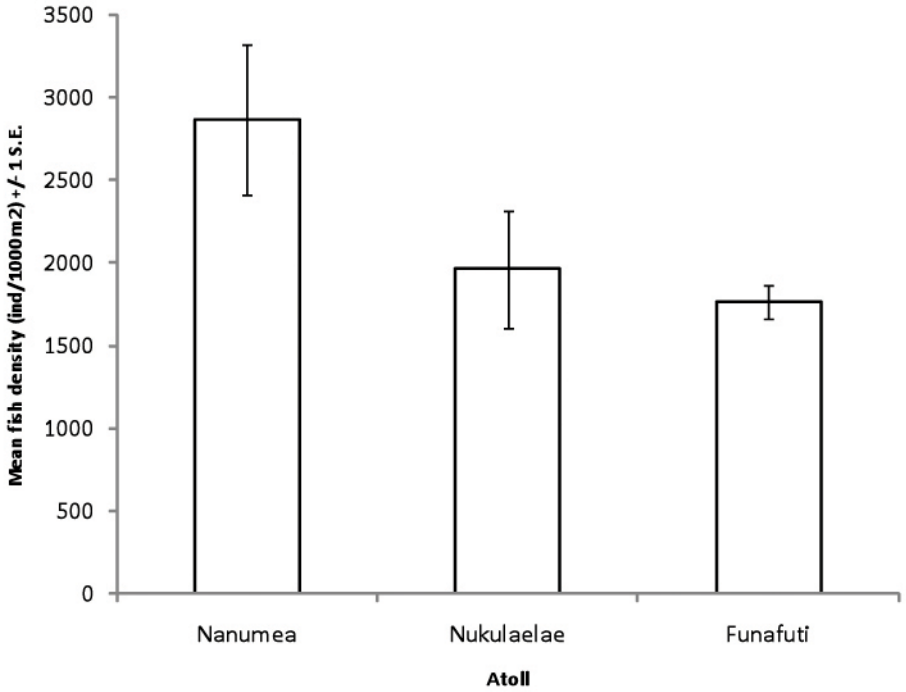


Figure 16. Mean density of reef fish on the three atolls surveyed in Tuvalu, calculated as the number of individuals per 1000m^2. Error bars represent 1 S.E.

Despite having lower diversity, the lagoon sites of Nanumea hosted the highest density estimates of the atoll (*Figure 17*, Appendix 1). This is probably due to the presence of dense schools of planktivorous pomacentrids and juvenile scarids associated with the larger coral outcrops in the lagoon. Densities across the sheltered outer reef sites were relatively uniform.

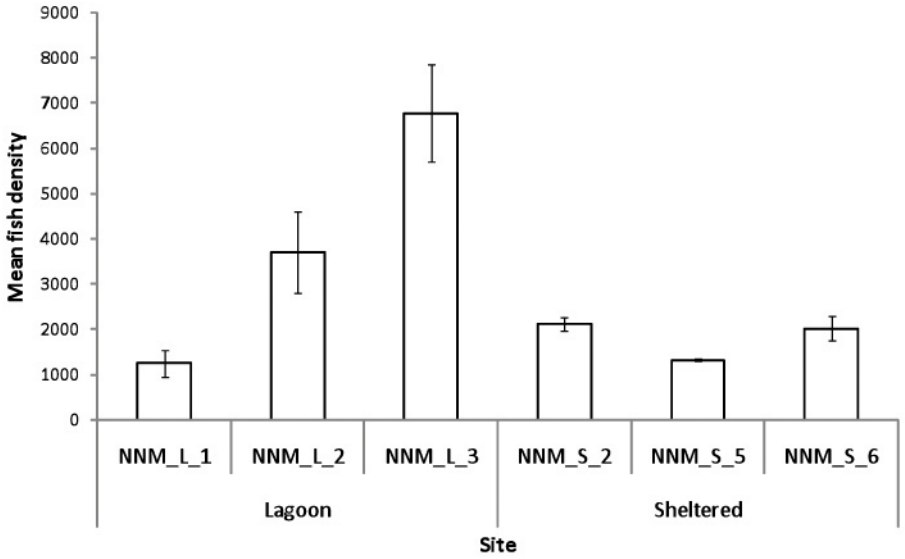


Figure 17. Mean density of reef fish across sites and habitats surveyed in Nanumea, calculated as the number of individuals per 1000m^2. The Conservation Area site is NNM_L_2. Error bars represent 1 S.E.

Fish density patterns in Nukulaelae were also uniform across sites, with the exception of one lagoonal site that had very high densities of fish (*Figure 18*). This is likely to parallel the pattern found in Nanumea, and reflects observations of **very high densities of small planktivorous fish and juveniles of larger fish in the two lagoons**. This is confirmed by patterns of biomass: lagoon sites with high densities tended to have low biomass, suggesting large numbers of smaller fish.

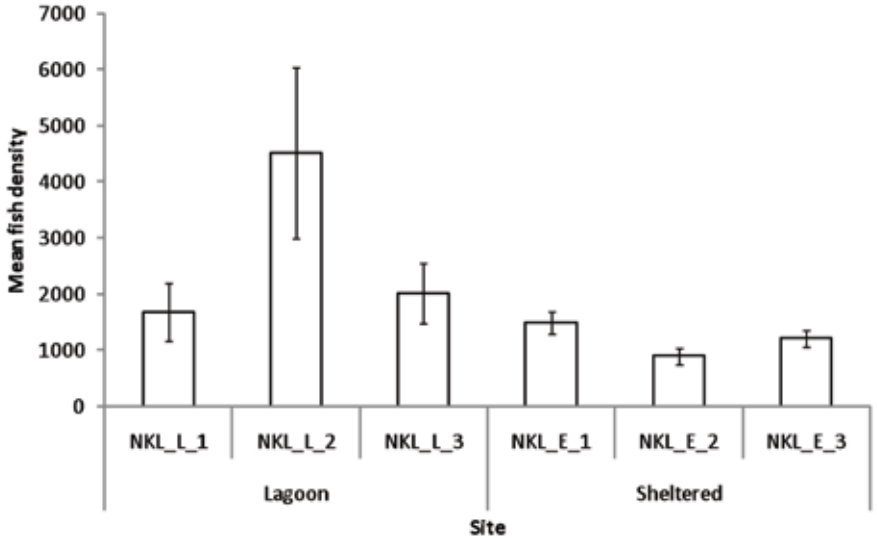


Figure 18. Mean density of reef fish across sites and habitats surveyed in Nukulaelae, calculated as the number of individuals per 1000m^2. The Conservation Area site is NKL_L_3. Error bars represent 1 S.E.

Funafuti atoll had the most uniform density estimates across all sites, except for a significantly lower fish density at one of the lagoon sites *(Figure 19)*. This site was characterised by relatively low coral cover and extensive patches of featureless sand.

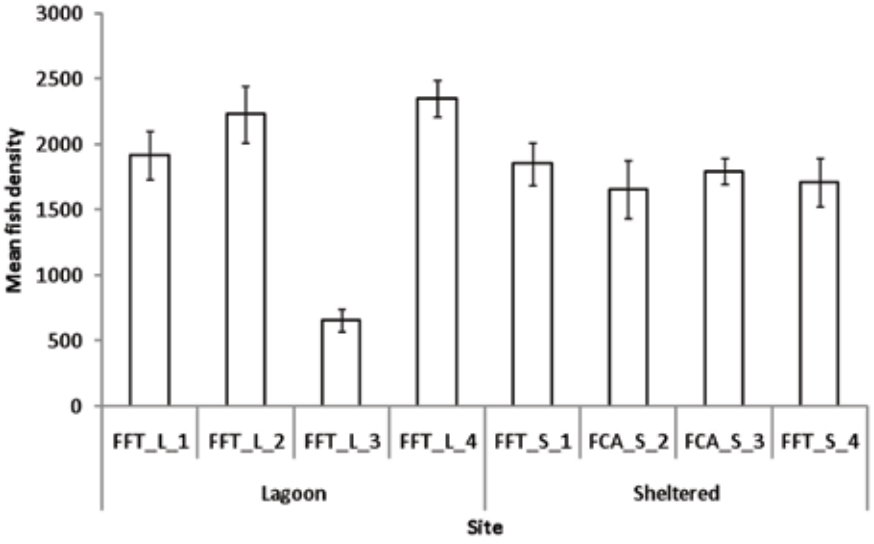


Figure 19. Mean density of reef fish across sites and habitats surveyed in Funafuti, calculated as the number of individuals per 1000m^2. The Conservation Area sites are FCA_S_2 and FCA_S_3. Error bars represent 1 S.E.

Overall fish density was highest on Nanumea atoll and lowest on Funafuti atoll, with individual lagoonal sites tending to host the highest densities at each atoll. Conservation Areas did not stand out as having particularly high fish densities.

2.2.2. Patterns of fish biomass

The surveyed sites across the three atolls had an overall average biomass of 560.2 kg per 1000m^2 (+/- 40.5 SE). **Funafuti had the highest average biomass across all surveyed sites** (691.4 +/- 59.6SE); **Nanumea had intermediate biomass** (530.4 +/- 67.7SE) and **Nukulaelae the lowest** (415.1 +/- 74.6SE). The bumpheaded parrotfish, *Bolbometapon muricatum*, and sharks were omitted from these estimates, due to the propensity for single individuals to disproportionately inflate the biomass for a particular site.

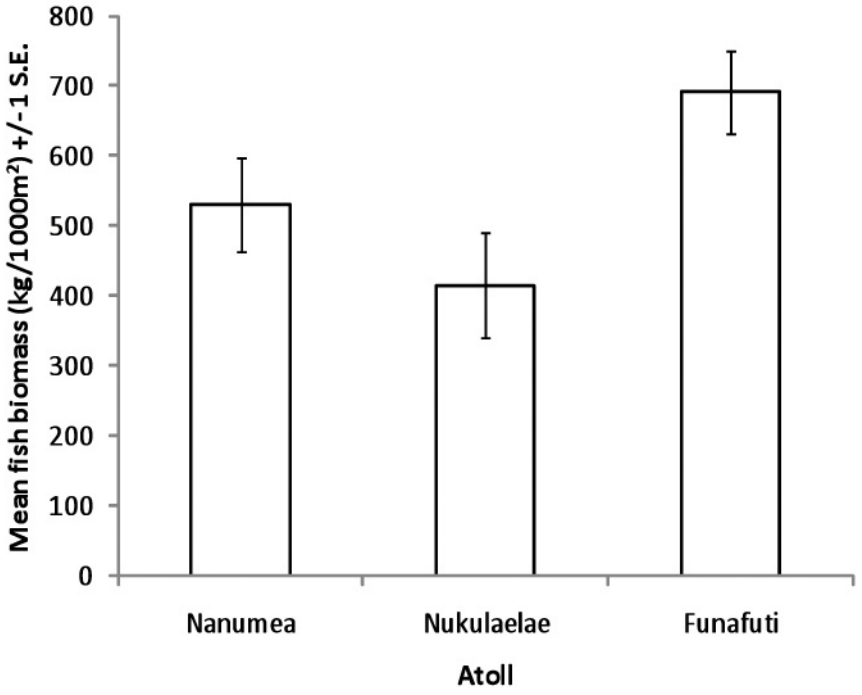


Figure 20. Differences in fish biomass on reefal and lagoon areas of Nanumea, Funafuti and Nukulaelae atolls. Biomass is measured in kg per 1000m^2. Error bars = 1 S.E.

Patterns of distribution of fish biomass did not differ significantly between habitats when habitats were pooled across atolls, but habitat differences varied between atolls (Appendix 1). **In Nanumea, the lowest biomass estimates were recorded in the lagoon, and the highest on the sheltered side of the outer reef.** Where sites had particularly low biomass *(Figure 21)* but high density *(Figure 17)*, this reflects the dominance of small fish at the site, such as planktivorous pomacentrids that are found in very large schools.

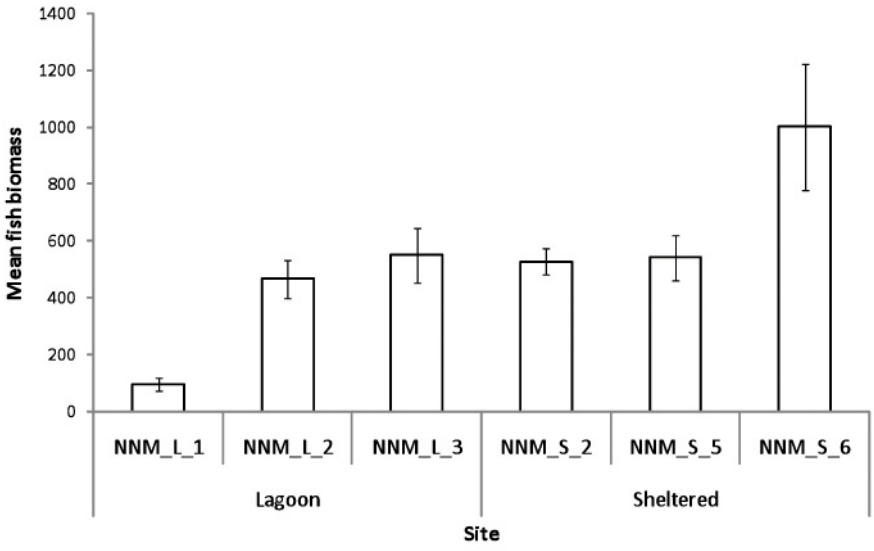


Figure 21. Mean biomass (kg/1000m^2) of reef fish across sites and habitats surveyed in Nanumea. The Conservation Area site is NNM_L_2. Error bars represent 1 S.E.

Nukulaelae had relatively low density *(Figure 18)* **and biomass** *(Figure 22)*, with one site standing out for both estimates. The exceptions were not the same, however: high densities with low biomass were recorded at the lagoonal site NKL_L_2, and low densities of high-biomass fish were found at the sheltered outer reef site NKL_E_1.

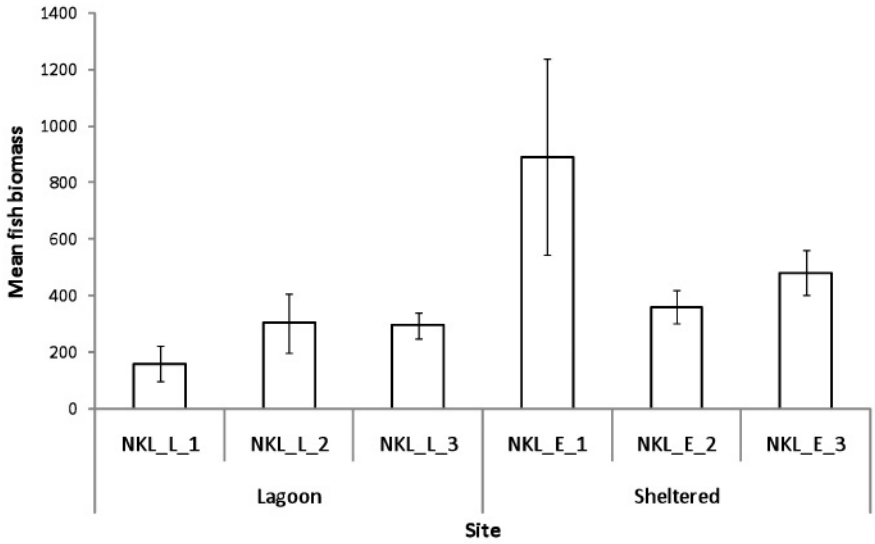


Figure 22. Mean biomass (kg/1000m^2) of reef fish across sites and habitats surveyed in Nukulaelae. The Conservation Area site is NKL_L_3. Error bars represent 1 S.E.

Funafuti atoll, while hosting relatively uniform densities across sites with the exception of one lagoonal site *(Figure 19)*, showed **a greater degree of variability in biomass** *(Figure 23)*. There were no overriding differences between reef and lagoonal sites overall. Low density but high biomass suggests **a greater abundance of large fish**, including herbivores, benthic carnivores and predators: Funafuti lagoon hosted large numbers of grazing parrotfish, possibly boosting biomass estimates.

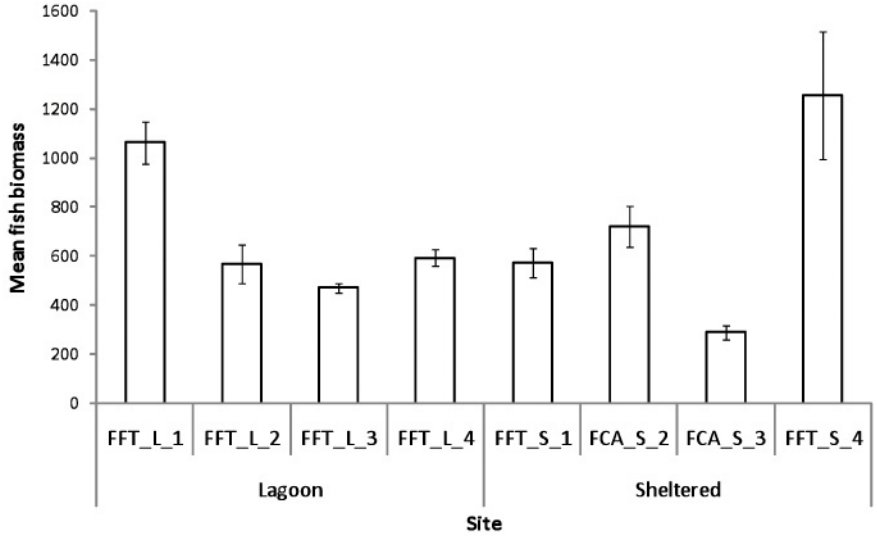


Figure 23. Mean biomass (kg/1000m^2) of reef fish across sites and habitats surveyed in Funafuti. The Conservation Area sites are FCA_S_2 and FCA_S_3. Error bars represent 1 S.E.

In summary, **fish biomass was highest in Funafuti and lowest in Nukulaelae. Areas of high biomass were localised at individual sites where large schools of benthic carnivores, predators or grazers aggregated (e.g. NKL_E_1, FFT_S_4). Conservation Areas did not stand out as having particularly high fish biomass.**

2.3. FISH SPECIES COMPOSITION

2.3.1. Reef fishes

Not only were the atolls overall characterised by different species compositions, but the individual habitats had distinct groupings of species as well *(Figure 24)*. Firstly, **the lagoons of all atolls formed separate groups from the outer reef habitats, and the lagoons of individual atolls also differed from each other**. That is, there was no overriding 'Tuvalu lagoon' fish fauna, but each atoll had its own distinct lagoon fish assemblage. Funafuti lagoonal habitats were further differentiated from its lagoon pinnacle habitats. The species characterising lagoonal areas of all three atolls were the damselfish *Pomacentrus amboinensis*, *P. pavo*, and *Dascyllus aruanus*; the blenny and goby *Ptereleotris microlepis*, *Amblygobius phalaena*, the wrasses *Labroides dimidiatus* and *Halichoeres trimaculatus*, the surgeonfish *Acanthurus xanthopterus*, the goatfish *Parupeneus barberinus,* the parrotfish *Scarus ghobban* and *S. schlegeli,* the grouper *Epinephelus merra* and the butterflyfish and angelfish *Chaetodon trifascialis* and *Centropyge bicolor*. Especially prevalent on Funafuti's lagoonal pinnacles was the fusilier *Pterocaesio trilineata*.

Outer reef habitats of all the atolls formed a more consistent group, but **Nanumea's sheltered habitats appeared somewhat distinct. Exposed and sheltered habitats of the three atolls did not form different groups**.
A different suite of common reef fish separated outer reefs from lagoons, including the damselfish *Chromis iomelas*, *C. atripes* and *C. xanthura*, the hawkfish *Paracirrhites forsteri*, the wrasse *Thalassoma quinquevittatum*, the angelfish *Centropyge flavissimus*, the triggerfish *Melichthys niger* and *M. vidua*, the grouper *Cephalopholis argus* and the surgeonfish *Acanthurus nigricans* and *Ctenochaetus cyanocheilus*. Similarities exist between these findings and those of previous fish surveys. For instance, Yeeting and Poulasi (2007) also found high densities of *Pomacentrus pavo*, *Chromis iomelas*, *Chromis margaritifer*, and *Plectroglyphidodon johnstonianus*. Additionally, they reported differences in the common fish fauna of lagoons and outer reefs.

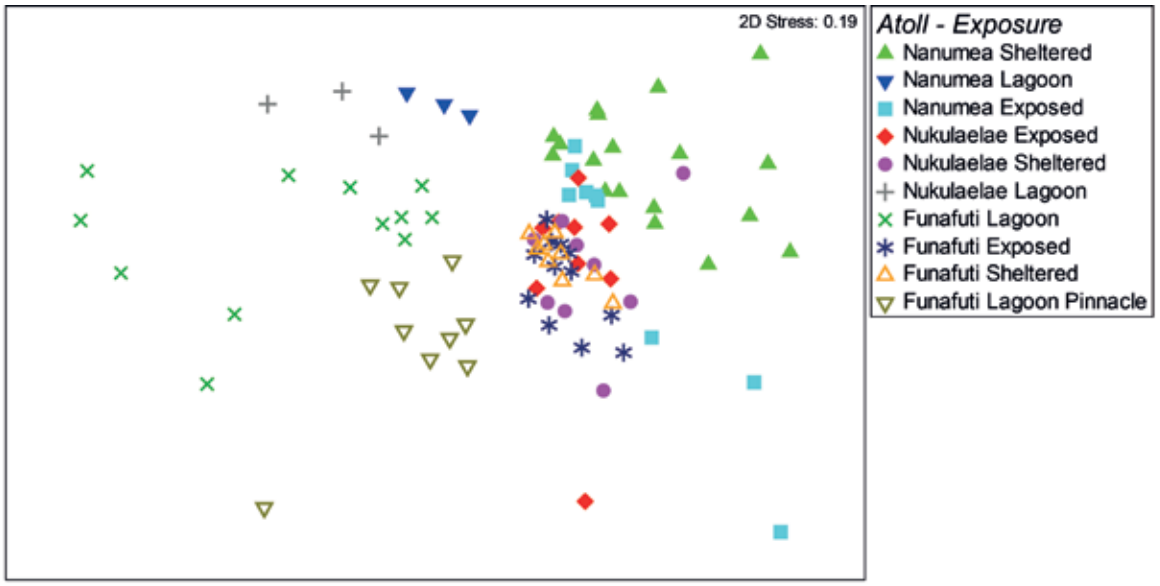
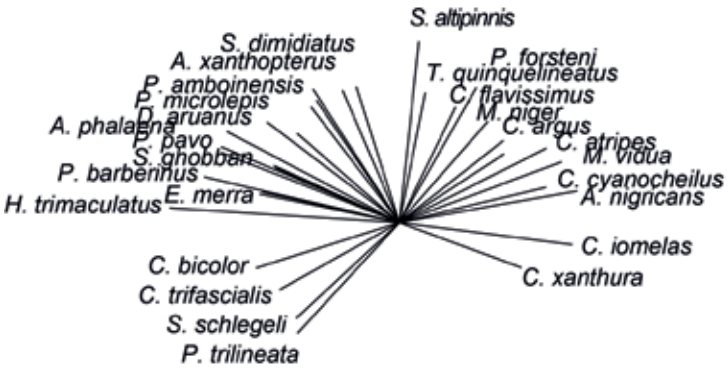


Figure 24. MDS plot showing distinctive fish faunas in different habitats of the three atolls. The plot above shows differences between habitats and atolls based on their fish species composition. Habitats with the most different assemblages appear as separate 'clouds'.

The figure shows the species that are most highly correlated with the different groups, and therefore have a strong role in defining the habitat as different. The direction of the vector shows which habitat / atoll has large proportions of that species, and the length of the vector shows how important that species is in driving the separation between groups.



Fish community composition also varied with depth, and this was strongest on Nanumea atoll (Figure 25). Here, all three depths hosted characteristic fish faunas, including a predominance of *Chromis iomelas* below 15m, higher numbers of *C. atripes* at mid-depth and the hawfish *Paracirrhites forsteri* and the parrotfish *Scarus altipinnis* at depths shallower than 10m. **Nukulaelae and Funafuti had a less pronounced depth distribution**, and they were more similar to each other overall. Five species defined these two atolls as different from Nanumea: the wrasse *Halichoeres trimaculatus,* the angelfish *Centropyge bicolor*, the parrotfish *Scarus schlegeli*, the butterflyfish *Chaetodon trifascialis* and the fusilier *Pterocaesio trilineata.*

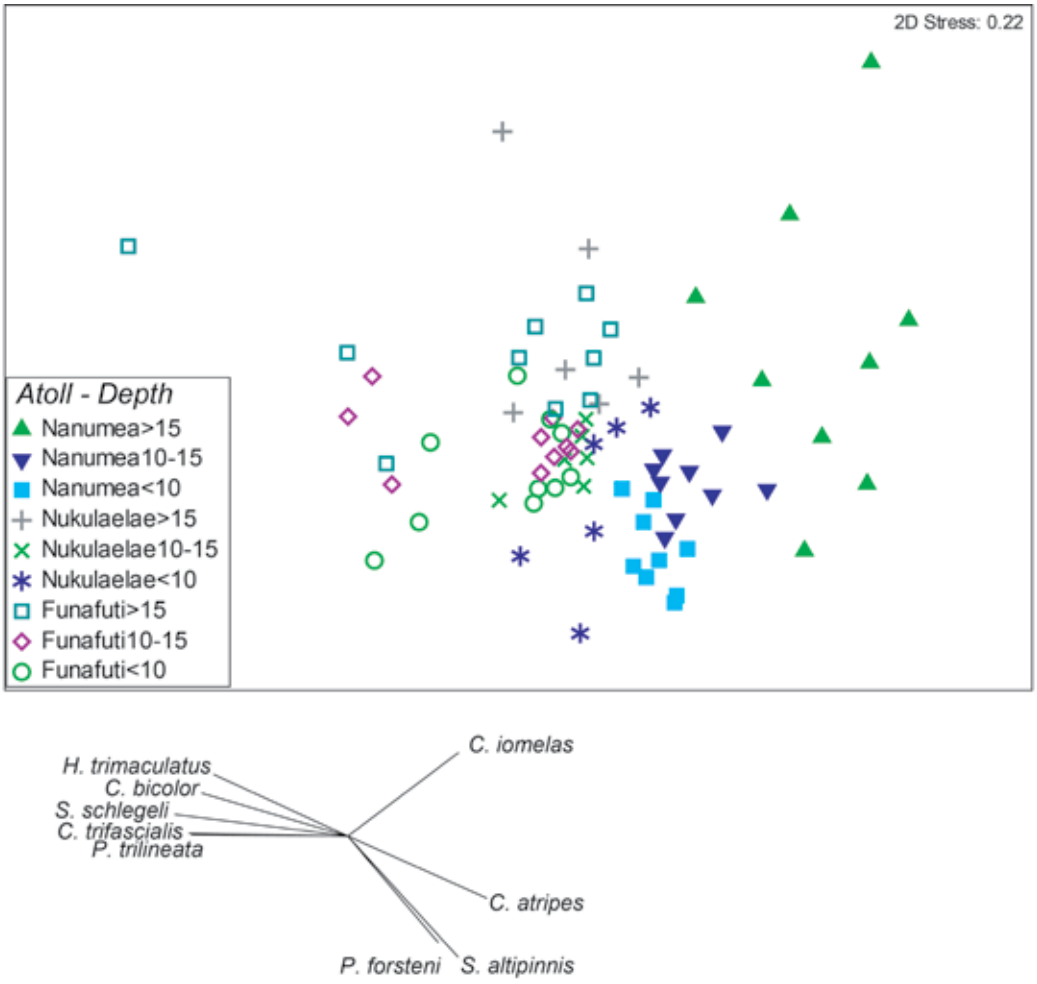


Figure 25. MDS plot showing distinctive fish faunas at different depths of the three atolls.

The highest density of fish for all three atolls was represented by damselfish species; they were twice as abundant on Nanumea as on the other two atolls *(Figure 26)*. **Wrasses, surgeonfish and parrotfish made up the next most abundant families**, and these were relatively uniform across the three atolls. **Representatives of the other fish families occurred in very low densities**. Almost all families were significantly different between atolls (Appendix 1).

Functional group composition was also dominated by damselfish groups on all three atolls *(Figure 27)*. **Omnivorous pomacentrids were by far the most abundant**, especially on Nanumea. **Grazing fish and benthic carnivores were also relatively well represented. The density of predatory fish was very low**, with slightly higher densities of intermediate predators than large predators at the top of the food web. **This may be a sign of overfishing, as these families are favoured food fish** (Sauni et al. 2008). Overall, the different atolls had a distinct suite of functional groups, rather than different species making up the same functional groups (Appendix 1).

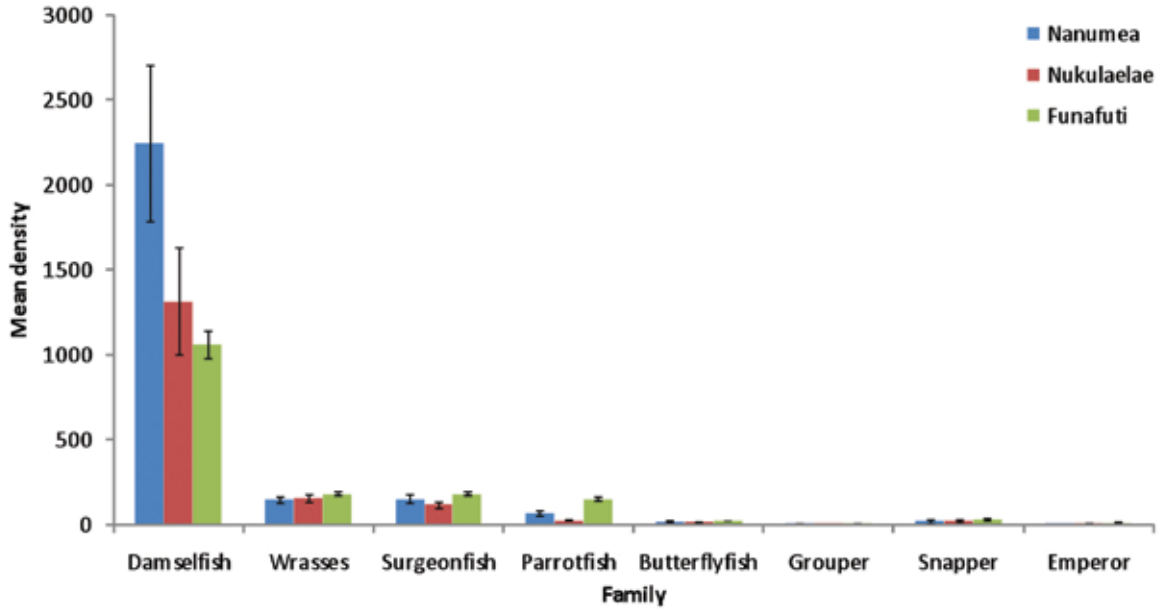


Figure 26. Mean fish density of the most important reef fish families at Nanumea, Nukulaelae and Funafuti.

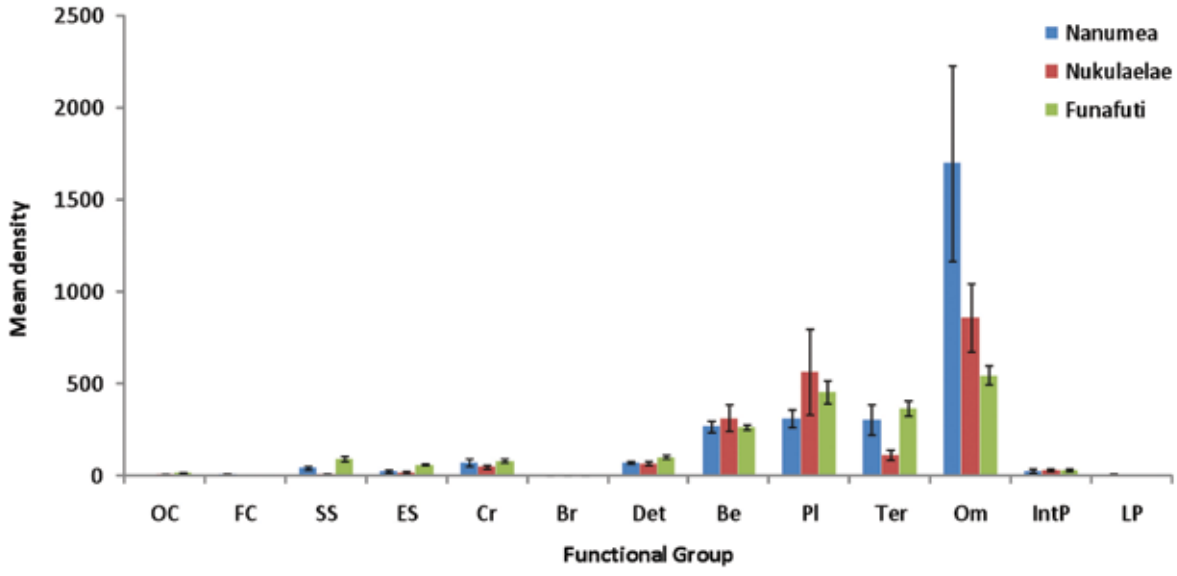


Figure 27. Mean fish density of the major functional groups of reef fish at Nanumea, Nukulaelae and Funafuti.

2.3.2. Sharks and rays

Shark diversity and densities were very low. A previous survey found only 16 individuals belonging to four species: grey reef shark (*Carcharhinus amblyrhynchos*), blacktip reef shark (*Carcharhinus melanopterus*), whitetip reef shark (*Triaenodon obesus*) and lemon shark (*Negaprion brevirostris*) (Wheeler 2007; Wheeler et al. 2010). During our survey, we counted 17 sharks of three species (grey reef shark, blacktip reef shark and whitetip reef shark). All shark species observed in Tuvalu (previously and during our survey) are listed on the IUCN Red List of threatened species, as 'Near Threatened' species. The very low abundance of reef sharks is of concern. Sharks are very vulnerable to overfishing; declines in reef shark numbers have been observed throughout the globe and linked to fishing, even in remote regions (Graham et al. 2010). Sharks play an important ecological role as apex predators, and declines in shark numbers often results in changes throughout the food chain. By feeding on the weak and wounded of prey species, sharks help keep the oceans in balance. Removing sharks from the food web could have catastrophic effects.

Ray diversity and densities were also very low. A previous survey documented one species of ray, the spotted eagle ray (*Aetobatus narinari*) (Wheeler 2007; Wheeler et al. 2010). During our survey, incidental sightings were recorded of two species of rays: manta ray (*Manta birostris*) and spotted eagle ray (*Aetobatus narinari*). About 10 individuals were observed. Of interest is the observation of a school of manta rays (at least 6 individuals were seen) in front of Falafatu islet. Anecdotal information indicates that these individuals belong to a resident population that moves in and out of Funafuti lagoon daily, with the tides. As for sharks, almost all species of rays are listed on the IUCN Red List of threatened species, as 'Near Threatened' species.

2.4. BENTHIC STRUCTURE

The three surveyed atolls had similar overall levels of hard coral cover (20-30%), but the study sites varied significantly in some aspects of the benthic communities (*Figure 28*, Appendix 1). Nukulaelae was the only atoll surveyed with measurable amounts of soft coral, and also had the highest cover of coralline algae. Macroalgal cover also varied among the three atolls, with the lowest cover of around 5% recorded on Nukulaelae and slightly higher cover (~10%) on Funafuti and Nukulaelae. The cover of turf algae, defined as a multi-species assemblage of fine filamentous algae typically forming a mat of 2 cm in height or less, was highest in Funafuti.

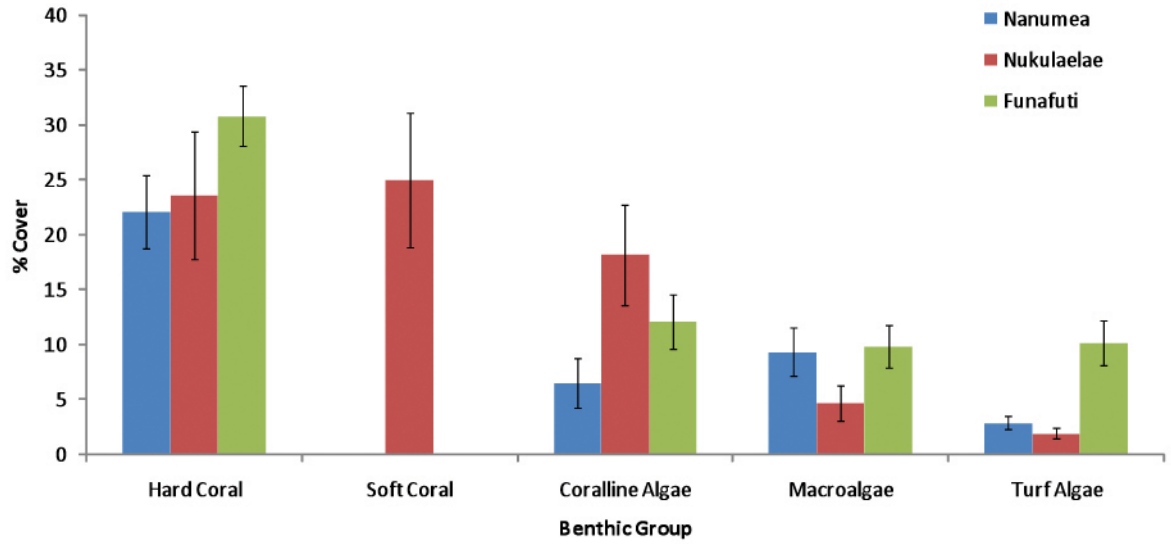


Figure 28. Percent cover (+/- 1 S.E.) of the five major benthic categories at surveyed sites of Nanumea, Nukulaelae and Funafuti atolls.

On Nanumea, lagoonal sites were dominated by sandy substrata, with hard coral covering between 5 and 12%, and macroalgae averaging around 20%. Sheltered sites of the outer reef tended to have very high hard coral cover (30-40%), with the only other dominant taxa being coralline algae.

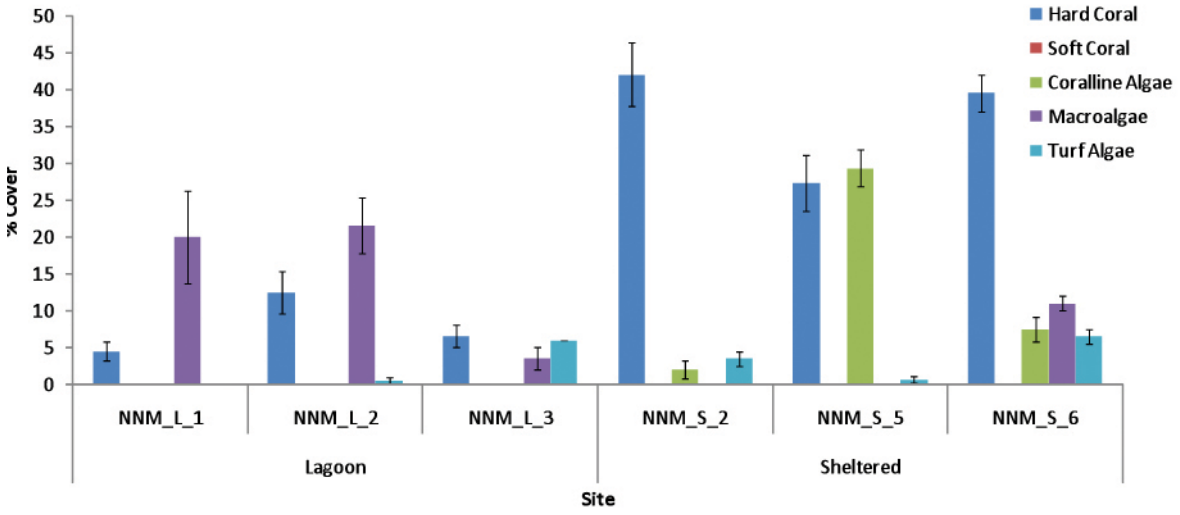


Figure 29. Percent cover (+/- 1 S.E.) of the five major benthic categories each site surveyed on Nanumea atoll. The Conservation Area site is NNM_L_2.

Nukulaelae lagoon was unusual in its high (40-70%) cover of soft coral at the lagoonal sites.
Soft coral virtually replaced hard coral as the main living taxa covering the reef patches. In contrast, very high hard coral cover was recorded on the sheltered outer reef sites, with up to 80% cover recorded at one site. Outer reef sites also had high cover of coralline algae, with low macroalgal cover throughout all sites.

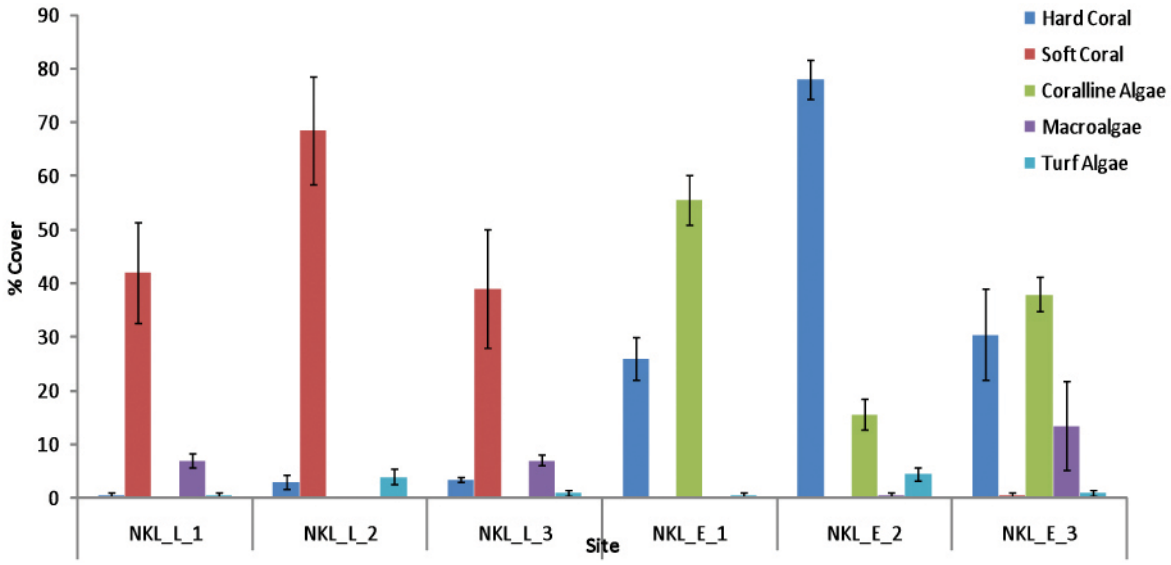


Figure 30. Percent cover (+/- 1 S.E.) of the five major benthic categories each site surveyed on Nukulaelae atoll. The Conservation Area site is NKL_L_3.

Funafuti atoll had high (20-50%) coral cover throughout both lagoonal and outer reef sites. Turf algae grew on dead surfaces, especially in the lagoon, while coralline algae covered much of the abiotic substrate of the outer reef. The growth of macroalgae was variable, with only one lagoonal site recording significant cover (~30%), and lower cover on the outer reef sites.

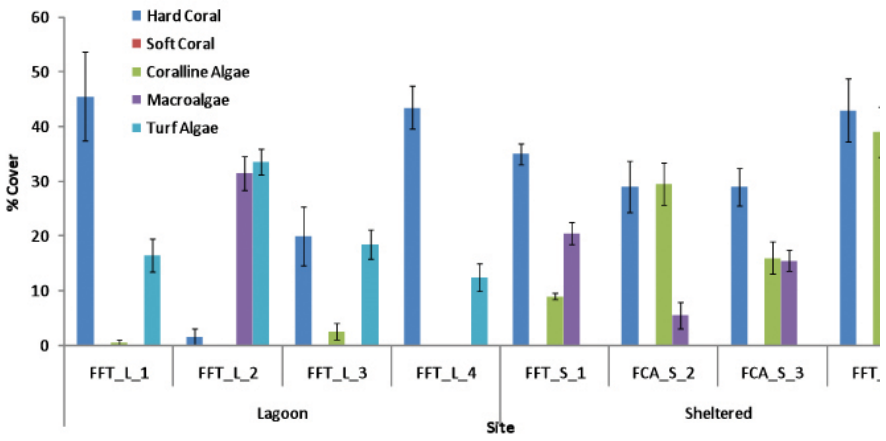


Figure 31. Percent cover (+/- 1 S.E.) of the five major benthic categories each site surveyed on Funafuti atoll. The Conservation Area sites are FCA_S_2 and FCA_S_3.

Overall, coral cover on the three atolls appeared healthy, despite localised overgrowth by fleshy macroalgae near human settlements. The next most abundant benthic cover was coralline algae on outer reefs and turf, macroalgae or soft coral in the lagoons. Conservation Areas did not show significant differences in benthic community composition when compared to similar habitats outside Conservation Areas.

Multi-dimensional scaling analysis showed in more detail which benthic categories were most influential in distinguishing the habitats *(Figure 32)*. Data clouds suggested that the **sheltered outer reef sites of the three atolls were similar to each other**, characterised by branching corals (CB), encrusting corals (CE), table corals (TC), crustose coralline algae (CA), and generally higher coral cover (HC) than lagoonal sites. One sheltered site at Nanumea and Nukulaelae atolls was particularly characterised by branching *Acropora* corals (AB).

Lagoonal sites were not only different from sheltered outer reef sites, but each atoll had distinct lagoonal benthic characteristics. Nanumea lagoon had high cover of macroalgae (MA) on rock (RC) and rubble (RB) substrates, while Nukulaelae lagoon was distinguished by large tracts of sand (SD) and a unique assemblage of soft corals (SC). Funafuti lagoon, with the highest overall cover of live coral (see above), also has large amounts of dead coral (DC) overgrown by turf algae (TA).

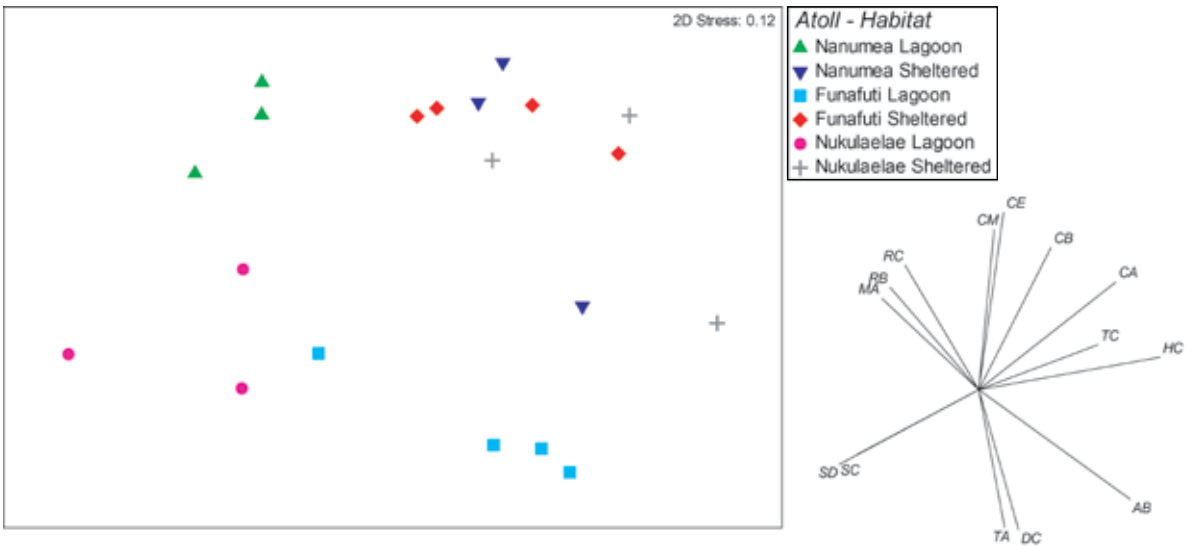


Figure 32. MDS plot showing distinctive benthic groups in different habitats of the three atolls. The plot above shows differences between habitats and atolls based on their benthic composition. Habitats with the most different benthos appear as separate 'clouds'. The figure shows the benthic groups that are most highly correlated with the different habitats, and therefore have a strong role in defining the habitat as different. The direction of the vector shows which habitat / atoll has large proportions of that benthic type, and the length of the vector shows how important that type is in driving the separation between habitats.

2.5. FISH-BENTHOS RELATIONSHIPS

Estimating benthic cover and fish density along the same transects allowed the analysis of the relationship between the fish species composition and elements of the benthic community in the different habitats surveyed on the three atolls. As with the fish biodiversity assessment *(Figure 24)*, data collected along the transects separated distinctly into three groups.

All sheltered reef habitats appeared uniform in terms of their fish species composition despite their latitudinal differences. The lagoons of Nanumea and Nukulaelae formed a separate group, characterised by small sand-dwelling species, juvenile parrotfish and small ambush predators (e.g. *Epinephelus merra*). The Funafuti lagoon formed a group on its own, with a distinctive fish fauna dominated by large schools of parrotfish and fusiliers, and large wrasses and groupers *(Figure 33)*.

BEST analysis showed that the **cover of coralline algae, sand and hard coral were the best predictors of the fish community composition** (R = 0.713). This means that different assemblages of species were more highly correlated with areas that had high coral cover than areas with low coral cover. The large contribution of coral cover in shaping the fish community is unusual, as it has been found in many studies that it is not live coral per se, but the overall habitat structure created by stands of live coral, that structure the fish community.

A LINKTREE analysis was conducted on the relationship between benthic structure and fish communities (Clarke and Gorley 2006). This analysis (essentially a regression tree approach) uses the benthic components to 'explain' the variation in fish communities, splitting sites based on which benthic characteristics are causing the greatest differences. The greatest separation (A) indicated by the model was between lagoonal habitats with low coral cover (<12.5%), and lagoon and reef with high coral cover (>20%). Three sites within the Funafuti lagoon therefore grouped with the reef sites in the initial split, but then formed a group on their own *(Figure 34)*. All lagoonal sites were further separated from each other based primarily on their cover of sand (B, D, E). The groupings within the reef sites were somewhat indistinct, as suggested also by the MDS analyses, which indicated a relatively uniform fish community among the reef sites of all three atolls.

In summary, **the outer reefs of the three atolls had similar benthic and fish community composition, but each atoll had a unique lagoon. Funafuti atoll had the most distinctive lagoon, as its structure was much more open than the other two atolls, and its larger size allowed for a greater diversity of habitats.**

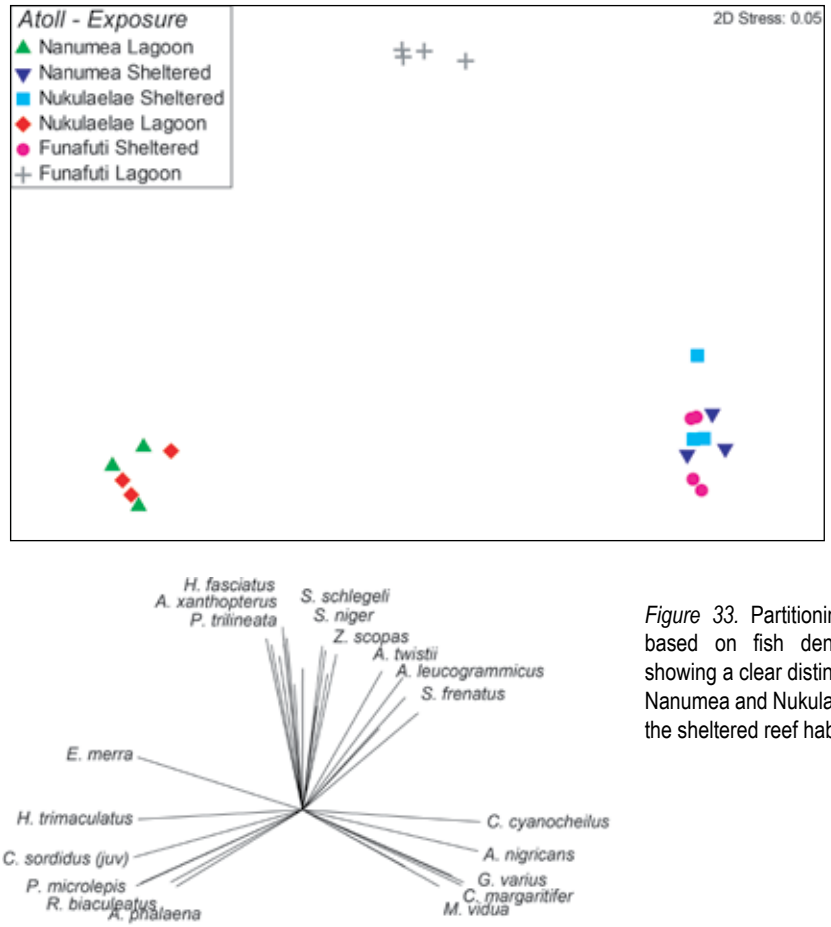


Figure 33. Partitioning of Tuvalu atolls and habitats based on fish densities obtained from transects, showing a clear distinction in fish communities between Nanumea and Nukulaelae lagoons, Funafuti lagoon and the sheltered reef habitats of all three atolls.

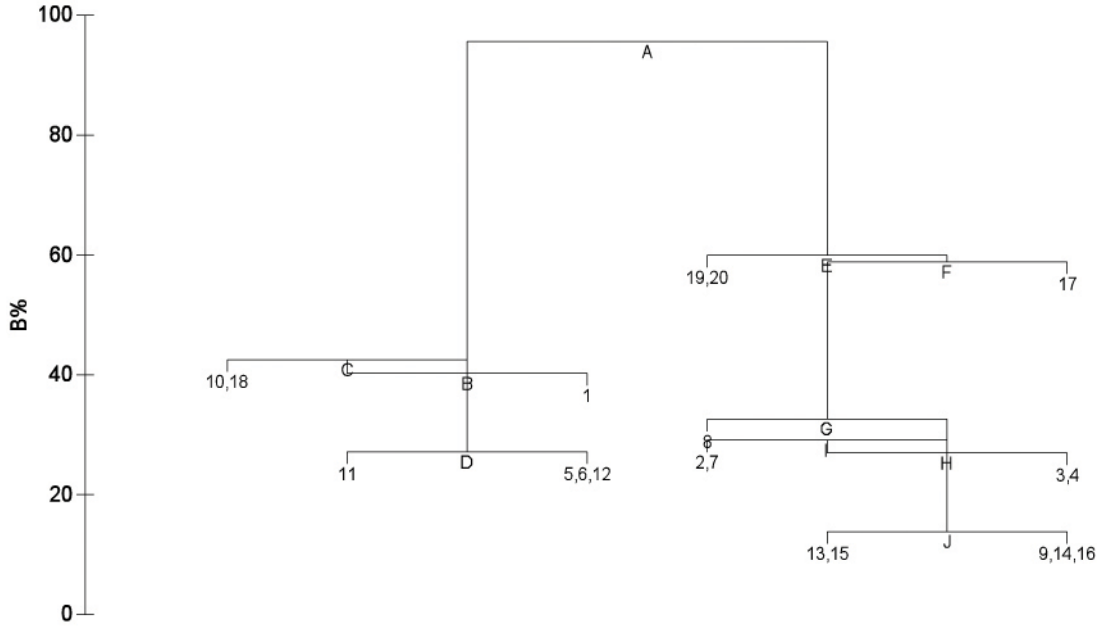


Figure 34. Regression tree analysis explaining the environmental factors driving the separation between atolls and habitats, based on differences and similarities in the fish community. Each split in the tree is designated with a letter (A, B, C, etc.), and numbers refer to sites. 1, 5, 6: Nanumea lagoon. 2-4: Nanumea reef. 7-9: Nukulaelae reef. 10-12: Nukulaelae lagoon. 13-16: Funafuti reef. 17-20: Funafuti lagoon. R-Statistics are given to define the strength of each split in the tree, and the variables responsible for separating sites are identified. HC: Hard coral; SD: Sand; CA: Crustose coralline algae.

A: R=0.87; B%=96; HC<12.5(>20)
B: R=0.27; B%=40; SD<47(>62)
C: R=0.29; B%=43; HC<1.5(>3)
D: R=1.00; B%=27; SD<2(>4.5) or HC<3(>3.5)
E: R=0.75; B%=60; SD>10(<6.5)
F: R=0.99; B%=59; CA>2(<0.5)
G: R=0.43; B%=33; HC>78(<43)
H: R=0.31; B%=27; CA>9(<7.5)
I: R=0.64; B%=29; HC<27.3(>29)
J: R=0.67; B%=14; CA<16(>29.5)

3. DISCUSSION

This ecological survey, focused on documenting the diversity of Tuvalu's reef fish, recorded 317 species from 49 families, during 56 SCUBA dives in Nanumea, Nukulaelae and Funafuti. Despite the short duration of the survey trip in each place, 66 species that had not previously been recorded in Tuvalu were added to the previous species list, bringing to overall total[2] for Tuvalu to 607 species. The commonly calculated Coral Fish Diversity Index (CFDI) brings the estimated number of reef fish species for Tuvalu to 711. The new records added during this survey are common reef fish species or food fish caught by fishers; their absence on previous species lists is testimony to the relatively low effort that has gone into documenting Tuvalu's marine life in the past. Also, many species have a localised distribution and were seen only on one of the three atolls; surveys of the other six atolls and islands of the Tuvalu archipelago is likely to reveal further previously unrecorded species. In accordance with previous surveys (Jones et al. 1991), no endemics were recorded. The most recent complete fish survey recorded 358 species of fish from 63 families, during 300 SCUBA dives on Nanumea, Nui and Niutao (Jones et al. 1991).

Variability in species richness between sites, and the generally low diversity found inside the lagoons, is a common pattern and has been noted before during surveys of Funafuti lagoon (Kaly 1997) and other Pacific atolls (Adjeroud 1997). Overall, the greatest number of species (234) was recorded in Funafuti, followed by 207 in Nanumea and 194 in Nukulaelae. This may have been proportional with the number of sites visited, lending support to the idea that visiting more sites would have added to the overall species count (Rosenzweig et al. 2003), especially if visual surveys have been supplemented with collections of cryptic or nocturnal species (Williams et al. 2010). Differences in species richness were most pronounced between complex and uniform habitats, reflecting the positive correlation between the level of topographic complexity and species diversity found by other studies (MacNeil et al. 2009).

A comparison between Tuvalu's CFDI of 711 and comparable Indo-Pacific locations shows that Tuvalu's fish diversity is close to the upper third of the regional estimates. This CFDI is similar to other Pacific Island nations of a similar distance from the Coral Triangle, the centre of diversity for coral reef fishes (Bellwood and Meyer 2009). The Coral Triangle is a roughly triangular area of the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste, which is said to host the highest biodiversity of corals and tropical reef fish in the world; diversity declines with increasing distance from this area *(Figure 35)*. Most species found in Tuvalu have a widespread Pacific Ocean distribution (Jones et al. 1991).

More species may be added to the Tuvalu biodiversity estimate by sampling all the atolls and islands and adding more microhabitats to the surveys. The species richness estimated here could further be enhanced through collections using clove oil; this is likely to add substantial numbers of nocturnal (e.g. *Apogonidae, Holocentridae*) and cryptic (e.g. *Gobiidae, Blenniidae*) fish to the estimate. Species found deeper than 20m would require specialised SCUBA equipment or drop cameras, and pelagic species would need to be sampled by fisheries observers during open-ocean longlining or netting operations.

Overall fish density was highest on Nanumea atoll and lowest on Funafuti atoll, with individual lagoonal sites tending to host the highest densities at each atoll (e.g. FFT_L_1). In contrast, fish biomass was highest in Funafuti and lowest in Nukulaelae. Areas of high biomass were localised at individual sites where large schools of benthic carnivores, predators or grazers aggregated (see above). Matching Nanumea's density estimate to the relatively low biomass values suggests large numbers of small fish, which was consistent with the large numbers of juveniles found in the lagoon and high abundances of small, wave-tolerant species found on the highly exposed outer slopes. Despite the low fishing pressure on Nanumea compared with the more populated atolls, larger fish were scarce, most likely due to the relatively small size of the atoll and low diversity of available habitats. This pattern seems common of highly isolated, exposed oceanic reefs with small reef areas and small or closed lagoons (Leis 1994; Ceccarelli et al. 2008).

Funafuti, despite the higher fishing pressure, had relatively high biomass and low density, indicating smaller numbers of larger fish than Nanumea. The larger size of this atoll and the higher diversity of habitat types are likely to have driven this pattern. Higher habitat complexity usually leads to higher densities of prey species that use the reef structure for shelter, which in turn supports higher densities of larger predatory fish. Given the confounding factors of the differences in habitat, no conclusions can be drawn about the effects of differing fishing pressure on the fish communities of Nanumea and Funafuti. However, previous reports have raised concerns about signs of overfishing in Funafuti, such as lower abundances and smaller individuals, especially in accessible areas of the more populated atolls (Maragos 1992; Kaly 1997; Sauni et al. 2008).

[2] Some species recorded in previous surveys were not recorded in the present study; these are included in the overall species richness estimate.

The three surveyed atolls had similar overall levels of hard coral cover (20-30%), but the study sites varied significantly in some aspects of the benthic communities: the lagoons in particular had distinctive benthic assemblages. Overall, coral cover appears similar to other atolls in the region, with Kiribati's reefs supporting an average of 30-70% live coral cover (Lovell 2000). Funafuti atoll had high (20-50%) coral cover throughout both lagoonal and outer reef sites. Previous surveys recorded coral cover of up to 55% on the lagoon slope (Kaly 1997). As with previous studies, it was found that macroalgal cover was higher close to inhabited areas, suggesting higher levels of nutrient in the water (Kaly and Jones 1993). No system exists in Tuvalu for treating wastewater, which enters the ocean and lagoon directly or through seepage of the freshwater lens. Lagoonal waters adjacent to populated areas are therefore highly likely to have elevated nutrient content. The high cover of macroalgae near Fongafale, inside Funafuti lagoon, is thought by some to be exacerbated by spearfishing which targets herbivorous fish (Gillett and Moy 2006). This area has also been associated with high densities of the coral-eating snail *Drupella* sp., which can also contribute to low coral cover and high macroalgal biomass (Fisk et al. 2006).

Fish and benthic communities were similar across the outer reefs of the three atolls, but each atoll had its own characteristic lagoon community. Lagoons are widely understood to provide unique environments and therefore host particular species assemblages. For instance, atoll lagoons are well known to act as nurseries (Leis 1994), and other surveys have found that lagoons contain distinct fish communities, with species that occur nowhere else (Williams et al. 2010). Water exchange time and lagoon size are good predictors of species composition (Leis et al. 2003). High island lagoons have different resident species than atoll lagoons. There are species that can complete their whole life cycles in atoll lagoons, with closed populations that remain isolated from outside sources of larvae (Planes et al. 1998; Leis et al. 2003).

The habitat variables that best predicted the composition of fish assemblages were live coral, sand and coralline algae. Each of these benthic categories serves as a useful proxy for the broader habitat. For instance, high cover of live coral was generally found in relatively sheltered environments, and is likely to support fish communities that rely on live coral colonies for food and / or shelter. However, the importance of live coral in determining fish species composition was surprising, because only fish species that rely directly on live coral for food are affected significantly by changes in the cover of living coral (Graham et al. 2009). It is therefore possible that rather than causing the changes in the fish communities, both coral and fish were responding to a third environmental factor. In the habitats sampled during this survey, determining environmental factors are likely to be exposure to wave action, temperature and nutrient content.

The cover of sand could well serve as a proxy for lagoonal area, as the outer reef slopes had virtually no soft sediment, while the lagoon of all three atolls consisted of a sandy bottom with coral patches. Therefore, sand as a predictor of fish community structure fits well with the overall distinctness found in lagoonal fish faunas. Coralline algae tended to occur in higher cover in areas more exposed to wave action, and are a good proxy for highly exposed habitats. Certain fish species are better adapted to high wave energy environments than others (Fulton and Bellwood 2004), creating distinct fish communities in exposed habitats.

The structure and composition of the atolls themselves are important drivers for the species richness, density and composition of fish communities. The size of the atoll and the lagoon as well as the openness of the lagoon, have been found to be the most important predictors of fish diversity (Galzin et al. 1994; Dufour et al. 2001; MacNeil et al. 2009; Dalleau et al. 2010). In open lagoons water circulation influences pelagic and benthic primary production. In healthy lagoon systems, predation pressure shapes the trophic web and community structure (Bozec et al. 2004). When predation is reduced, usually through the overfishing of predatory fish, trophic dynamics can change dramatically. On the outer reefs, the level of shelter can influence the composition of fish species, as sheltered habitats are important for fish species with lower swimming ability (Johansen et al. 2007).

Conservation Areas did not stand out as having particularly high fish diversity, density or biomass. This is probably due to two reasons. Firstly, sampling during these surveys was not carried out to facilitate comparisons between fish and benthic communities inside and outside Conservation Areas: a separate part of the project focused on this comparison (see part II – Conservation Areas). Therefore, the power of the sampling regime was not sufficient to detect anything but the largest differences. Secondly, Conservation Areas in Nanumea and Nukulaelae are relatively recent, and even in long-term closures to fishing in other locations there is a time lag between the cessation of fishing and measurable ecological change (Russ and Alcala 2004).

Table 8. Coral fish diversity index (CFDI) values for restricted Indo-Pacific localities, number of coral reef fish species as determined by surveys to date, and estimated numbers using the CFDI regression formula. Table modified from Allen and Werner (2002), with added values from Ceccarelli et al (2009).

Locality	CFDI	No. reef fishes	Estim. reef fishes
Milne Bay, Papua New Guinea	337	1109	1122
Maumere Bay, Flores, Indonesia	333	1111	1107
Raja Ampat Islands, Indonesia	326	972	1084
Togean and Banggai Islands, Indonesia	308	819	1023
Komodo Islands, Indonesia	280	722	928
Yap State, Federated States of Micronesia	280	787	928
Madang, Papua New Guinea	257	787	850
Nino Conis-Santana MP, East Timor	254	432	840
Mont Panié lagoon, New Caledonia	255	597	844
Kimbe Bay, Papua New Guinea	254	687	840
Manado, Sulawesi, Indonesia	249	624	823
El Nido-Bacuit Bay, Philippines	243	694	803
Capricorn Group, Great Barrier Reef	232	803	765
Chuuk State, Federated States of Micronesia	230	615	759
Ashmore/Cartier Reefs, Timor Sea	225	669	742
Kashiwa-Jima Island, Japan	224	768	738
North-East lagoon, New Caledonia	221	433	729
Scott/Seringapatam Reefs, Western Australia	220	593	725
Tuvalu	**216**	**607**	**711**
Samoa Islands	211	852	694
Chesterfield Islands, Coral Sea	210	699	691
Pohnpei and nearby atolls, FSM	202	470	664
Layang Layang Atoll, Malaysia	202	458	664
Sangalakki Island, Kalimantan,	201	461	660
Bodgaya Islands, Sabah, Malaysia	197	516	647
Pulau Weh, Sumatra, Indonesia	196	533	644
Izu Islands, Japan	190	464	623
Lihou Reef, Coral Sea	189	343	620
Coringa-Herald Reefs, Coral Sea	187	342	613
Christmas Island, Indian Ocean	185	560	606
Elizabeth-Middleton Reefs, Coral Sea	184	322	603
Sipadan Island, Sabah, Malaysia	184	492	603
Rowley Shoals, Western Australia	176	505	576
Cocos-Keeling Atoll, Indian Ocean	167	528	545
North-West Cape, Western Australia	164	527	535
Tunku Abdul Rahman Is., Sabah	139	357	450
Lord Howe Island, Australia	139	395	450
Monte Bello Islands, W. Australia	119	447	382
Bintan Island, Indonesia	97	304	308
Kimberley Coast, Western Australia	89	367	281
Cassini Island, Western Australia	78	249	243
Johnston Island, Central Pacific	78	227	243
Midway Atoll, Pacific, United States	77	250	240
Rapa, Easter Island, French Polynesia	77	209	240
Norfolk Island, Australia	72	220	223

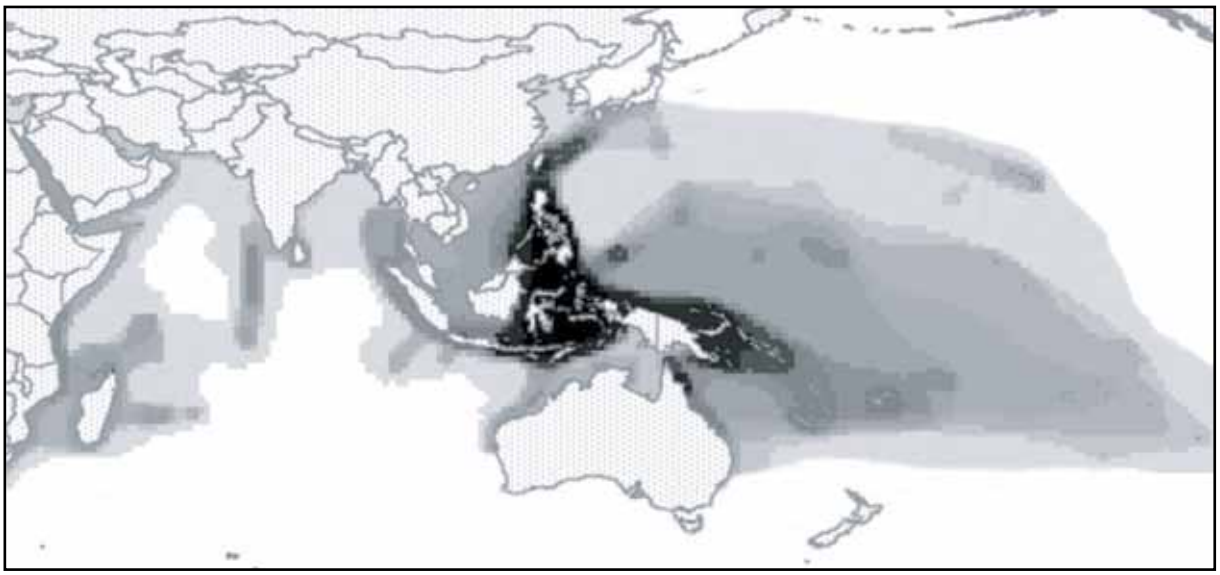


Figure 35. Map of the Indo-Pacific region showing diversity isopleths for tropical reef fishes. The lightest shade represents between 200 and 400 species and the darkest shade between 1300 and 1700 species (Allen 2008).

Tuvalu Marine Life

an Alofa Tuvalu Project

with the Tuvalu Fisheries Department and Funafuti, Nanumea, Nukulaelae Kaupules

Scientific Report - PART II

Marine Ressource Assessment in Conservation Areas

Sandrine Job









Tuvalu Fisheries Department
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1. INTRODUCTION

The Nanumea Conservation Area (CA) was established many years ago, but its management plan was initiated in May 2006, with the help of TANGO (Tuvaluan Association of NGOs), the Department of Fisheries, FSPI (Foundation for the South Pacific International) and an anthropologist from the University of Washington (Heather Lazrus), in response to a community request for assistance in managing fisheries sustainably. Since the establishment of the management plan, a resource assessment had been conducted at a few stations within the CA, but no data could be accessed to monitor changes through time. The Nanumea community requested a new assessment integrated in a monitoring program, including the training of local islanders in monitoring their own resources. To meet the community's needs and expectations, we used a simple and replicable methodology, which is designed to be conducted annually by local trained community members with the help of Fisheries officers. Nanumea CA covers about 2km^2 of the central lagoon, accounting for about 10% of the reef area of the atoll, encompassing marine and terrestrial habitats (including 2 islets).

The Nukulaelae Conservation Area management plan includes some regulations on fishing methods such as the ban of fishing nets (scoop and gill nets) and spear guns are forbidden during spawning time of groupers. No previous biological assessments have been conducted in the past, making this the first marine resource assessment (baseline survey) in Nukulaelae lagoon.

The Funafuti Conservation Area was the first marine protected area in Tuvalu. It was declared in 1996, but it has only been functionally operational since mid-1997 (Kaly et al. 1999). The FCA covers a total area of approximately 33km^2 of the western reef margin, accounting for 20% of the reef area of the atoll, encompassing marine and terrestrial habitats (including 6 islets). As described by Kaly (1997): "the boundaries of the conservation area have been set at 50m from the ocean side reef crest in the west, to the 30m depth contour on the lagoon side in the east. In the north-south direction, the conservation area extends from just north of Tepuka Vilivili to just south of Tefala islets. The marine habitats incorporated in the conservation area include channels from lagoon to ocean, ocean side and lagoon side reef crests, reef slopes, back reef areas and the sandy lagoon floor". The Funafuti Town Council, working in close collaboration with the traditional **Falekaupule** system of elders, is the executing agency for the FCA. The primary aim of the FCA was to preserve the marine and terrestrial biodiversity of Funafuti through the conservation of marine and terrestrial habitats closed to fishing and collection. Two years after closure (in 1999), a first assessment on the effectiveness of the FCA was conducted. The results showed that there were improvements in public awareness and enforcement even though poaching and violations of the FCA were still occurring. However, given the short time of closure at that time (2 years) combined with low rates of recruitment and the long life spans of many of the indicator organisms, it was expected that it would take at least 5 years to detect the effects of closure to fishing on biological organisms.

2. METHODOLOGY

2.1. STUDY SITES

The field surveys were carried out in Nanumea, Nukulaelae, and the capital atoll, Funafuti *(Figure 36)*, between April 27th and May 27th 2010, with 6 to 10 days spent at each location.

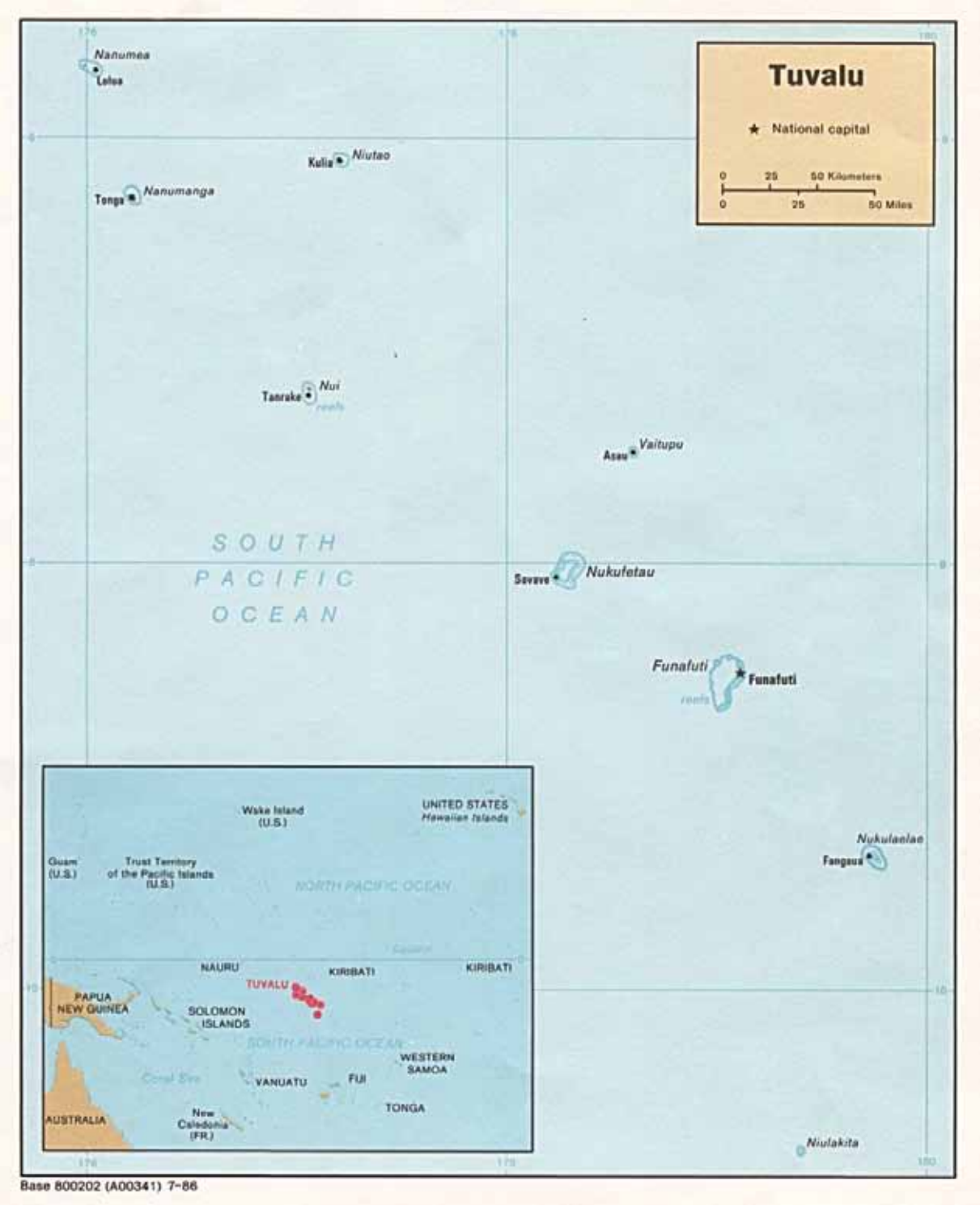


Figure 36. Overview map of Tuvalu archipelago.

2.2 SAMPLING DESIGN

CA surveys were conducted using standard methods:

1. Point intercept transects to assess the sessile benthic community
2. Belt transects to assess macroinvertebrate density
3. Underwater visual fish censuses to assess fish density and size

The use of these methods allows for statistical rigor in comparing results between locations and over time, and will assist the future comparison between Tuvalu and other reefs on a regional scale. These methods are widely used throughout the Indo-Pacific region and are the standard recommended methods to survey tropical marine resources (English et al. 1997).

On the outer atolls (Nanumea and Nukulaelae), the sampling design included three replicate 50m transects at each station. In Nanumea, we surveyed 5 stations within the CA and 4 stations outside the CA. In Nukulaelae, we surveyed 5 stations inside and 5 stations outside the CA *(Figure 37)*.

In Funafuti 6 sites were visited, comprising 3 stations in each of three different habitats at each site: reef flat, inner reef slope (referred as 'reef slope' or 'slope') and lagoon, bringing the number of stations visited to 18 for Funafuti. Seven 25m transects were surveyed at each station / habitat *(Figure 38)*.

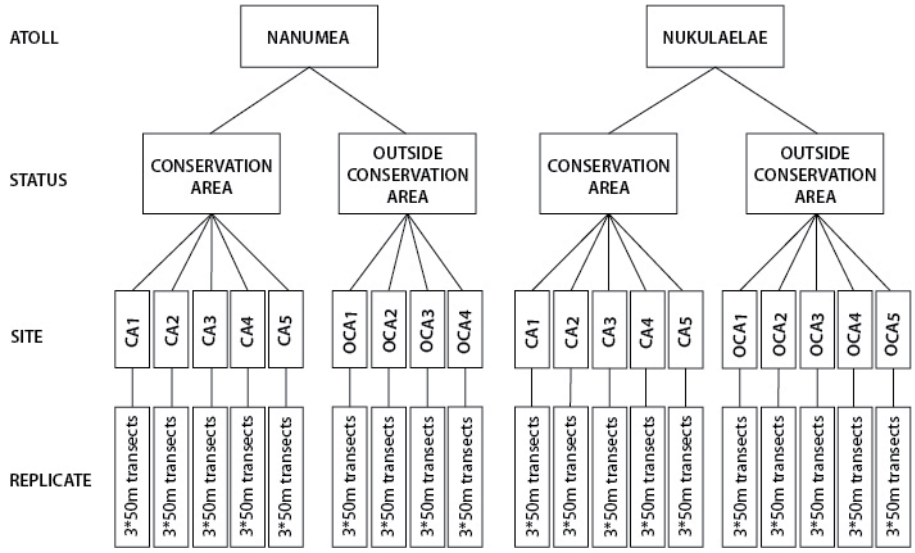


Figure 37. Illustration of the sampling design developed for marine resource assessment on the outer atolls.

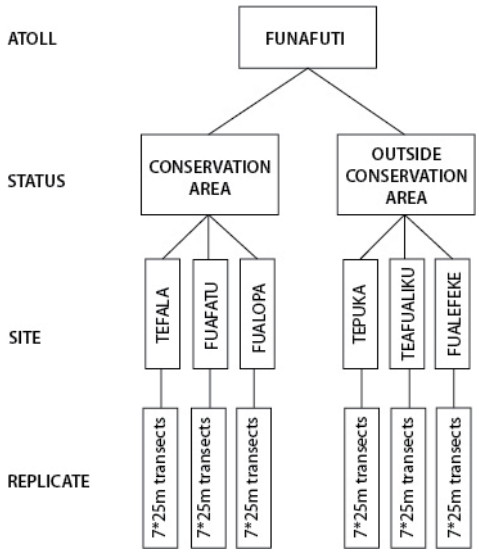


Figure 38. Illustration of the sampling design developed for marine resource assessment in Funafuti.

2.3. SAMPLING PROTOCOL

2.3.1. Benthic assessment

Benthic composition was assessed with the Point Intercept Transect method. This involved recording the benthic composition every 50 cm directly below the transect tape *(Figure 39)*. The benthic community was characterised using life-form categories *(Table 9)*. This allows the collection of useful information by persons with limited experience in the identification of coral reef benthic communities. The method is used to quantitatively assess average percent live coral cover and other components of the benthic community.

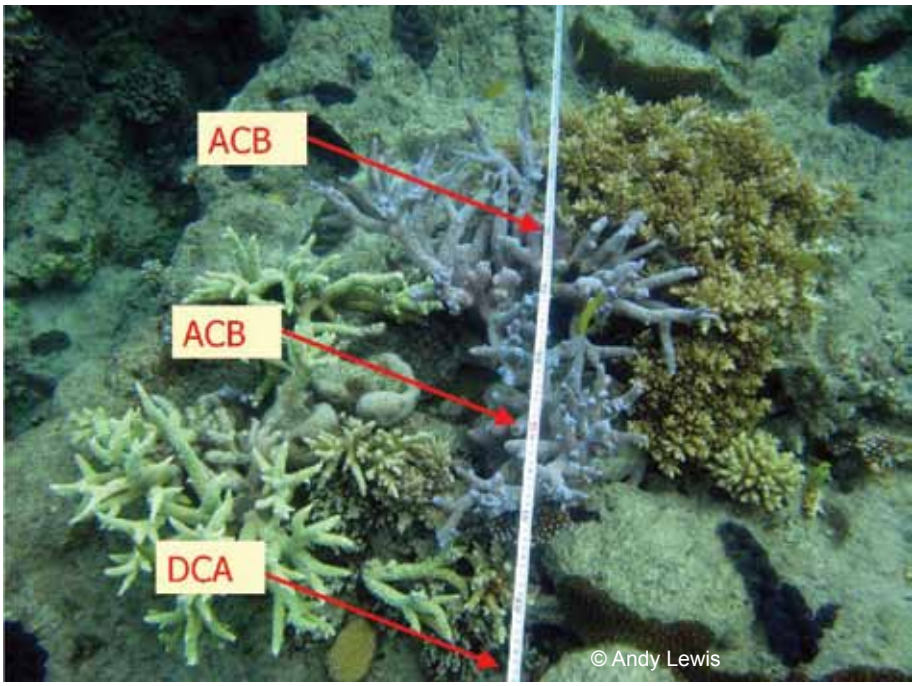


Figure 39. Illustration of the Point Intercept Transect method.

Table 9. Categories used to describe benthic composition.

Nanumea/Nukulaelae surveys		**Funafuti survey**	
Code	Benthic category	Code	Benthic category
BC	Branching Coral	**ACB**	*Acropora* Branching
EC	Encrusting Coral	**ACD**	*Acropora* Digitate
FC	Foliose Coral	**ACS**	*Acropora* Submassive
MC	Massive Coral	**ACT**	*Acropora* Table
TC	Table Coral	**BC**	Branching Coral
OC	Other Coral	**EC**	Encrusting Coral
SC	Soft Coral	**CHL**	Blue Coral
SP	Sponge	**MC**	Massive Coral
OL	Other Living Organisms	**SC**	Soft Coral
MA	Macroalgae	**SP**	Sponge
TA	Turf Algae	**DC**	Dead Coral
SG	Seagrass	**DCA**	Dead Coral with Algae
DC	Dead Coral	**CA**	Coralline Algae
RC	Rock	**HA**	*Halimeda*
RB	Rubble	**MA**	Macroalgae
SD	Sand	**AA**	Algae Assemblage
SI	Silt	**TA**	Turf Algae
		RC	Rock
		RB	Rubble
		SD	Sand
		SI	Silt

2.3.2. Macroinvertebrate assessment

Macroinvertebrates were counted along belt transects 4m wide, 2m on each side of the transect line *(Figure 40)*. Data recorded were abundance (number of animals of selected species within the belt transect) and the size of valuable sea cucumbers, clams and *Trochus* (top shells) *(Figure 41)*.

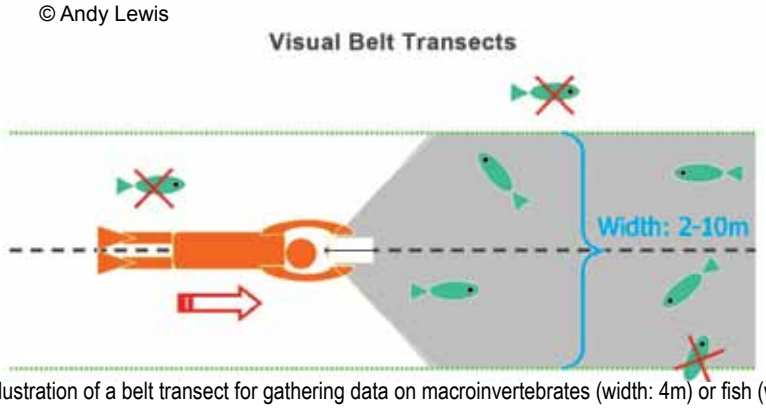


Figure 40. Illustration of a belt transect for gathering data on macroinvertebrates (width: 4m) or fish (width: 10m).

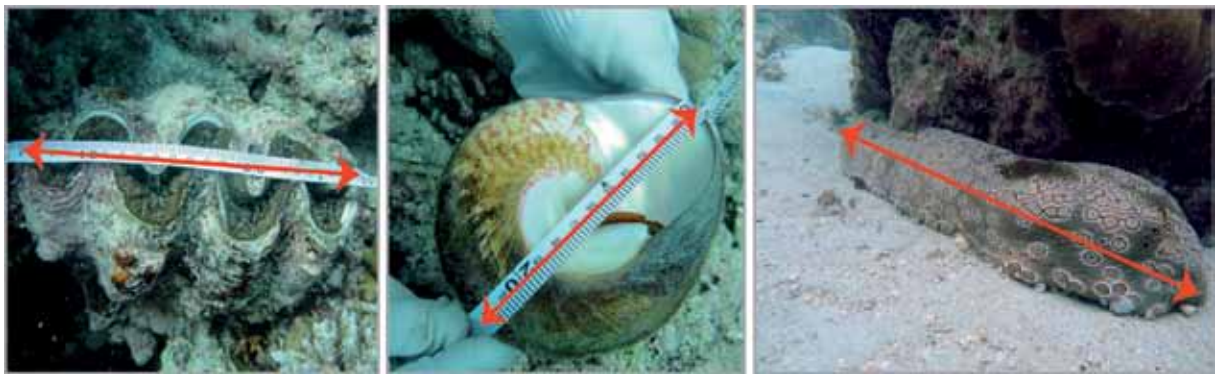


Figure 41. Size measurements of clams, *Trochus* and sea cucumbers.

The surveys included only target species of macroinvertebrates used as food, bait, handicraft, or of other commercial value, or useful as indicators of reef health or disturbance. The list of target macroinvertebrates is given in *Table 10*, along with the Tuvaluan name and justification for their selection.

Table 10. List of targeted macroinvertebrate species and the justification for their selection.

Nanumea name	Latin name	Common name	Justification
Alili	*Turbo sp.*	Turban shell	Food source
Kalea	*Lambis sp.*	Spider shell	Food source and handicraft
Panea	*Strombus luhuanus*	Strawberry conch	Food source
Munikau	*Trochus niloticus*	Top shell	Food source
Pule	*Cypraea sp.*	Cowrie	Handicraft
Fasua	*Tridacna sp.*	Clam	Food source
Tifa	*Pinctada margaritifera*	Black lip pearl oyster	Food source, handicraft and commercial value
Hopu nifo	*Spondylus cf. varius*	Thorny oyster	Food source
Hopu teka	*Spondylus cf. variegatus*	Thorny oyster	Food source
Hopu papa	*Chama imbricata*	Oyster	Food source
Feke	*Octopus sp.*	Octopus	Food source
Tapa tapa	*Panulirus sp.*	Lobster	Food source
Uga	*Conus sp.*	Cone	Handicraft
Loli	*Holothuria atra*	Lollyfish	Ecological function

Nanumea name	Latin name	Common name	Justification
Funafuna faiu	*Holothuria fuscogilva, Holothuria whitmaei*	White and black teatfish	Commercial value
Funafuna	*Holothuria sp., Bohadschia sp., Actinopyga sp., Thelenota sp.*	Sea cucumber	Ecological function and commercial value
Kalauna	*Acanthaster planci*	Crown-of-thorn starfish	Ecological function
Drupella	*Drupella cornus*	Coral-eating snail	Ecological function
Vana	*Echinometra mathaei, Diadema savignyi, Echinothrix diadema, Echinostrephus aciculatus*	Sea urchin	Ecological function
Kohi	*Arca ventricosa, Barbatia sp. and Septifer sp.*	Ark and mussel	Food source
Nukulaelae name	**Latin name**	**Common name**	**Justification**
Alili	*Turbo sp.*	Turban shell	Food source
Mataga	*Lambis sp.*	Spider shell	Food source and handicraft
Panea	*Strombus luhuanus*	Strawberry conch	Food source
Munikau	*Trochus niloticus*	Top shell	Food source
Pule	*Cypraea sp.*	Cowrie	Handicraft
Fasua	*Tridacna sp.*	Clam	Food source
Tifa	*Pinctada margaritifera*	Black lip pearl oyster	Food source, handicraft and commercial value
Sopuu	*Spondylus sp.*	Thorny oyster	Food source
Feke	*Octopus sp.*	Octopus	Food source
Ula	*Panulirus sp.*	Lobster	Food source
Fakamili	*Conus sp.*	Cone	Handicraft
Loli	*Holothuria atra*	Lollyfish	Ecological function
Funafuna faiu	*Holothuria fuscogilva, Holothuria whitmaei*	White and black teatfish	Commercial value
Funafuna	*Holothuria sp., Bohadschia sp., Actinopyga sp., Thelenota sp.*	Sea cucumber	Ecological function and commercial value
Kalauna	*Acanthaster planci*	Crown-of-thorn starfish	Ecological function
Drupella	*Drupella cornus*	Coral-eating snail	Ecological function
Sipo	*Cerithium nodulosum*	Nodulose coral creeper	Bait
Vana	*Echinometra mathaei, Diadema savignyi, Echinothrix diadema, Echinostrephus aciculatus*	Sea urchin	Ecological function
Funafuti name	**Latin name**	**Common name**	**Justification**
Alili	*Turbo sp.*	Turban shell	Food source
Mataga	*Lambis sp.*	Spider shell	Food source and handicraft
Panea	*Strombus luhuanus*	Strawberry conch	Food source
Munikau	*Trochus niloticus*	Top shell	Food source
Pule	*Cypraea sp.*	Cowrie	Handicraft
Fasua	*Tridacna sp.*	Clam	Food source
Tifa	*Pinctada margaritifera*	Black lip pearl oyster	Food source, handicraft and commercial value
Sopuu	*Spondylus sp.*	Thorny oyster	Food source
Feke	*Octopus sp.*	Octopus	Food source
Ula	*Panulirus sp.*	Lobster	Food source
Fakamili	*Conus sp.*	Cone	Handicraft
Loli	*Holothuria atra*	Lollyfish	Ecological function
Funafuna faiu	*Holothuria fuscogilva, Holothuria whitmaei*	White and black teatfish	Commercial value
Funafuna	*Holothuria sp., Bohadschia sp., Actinopyga sp., Thelenota sp.*	Sea cucumber	Ecological function and commercial value
Kalauna	*Acanthaster planci*	Crown-of-thorn starfish	Ecological function
Drupella	*Drupella cornus*	Coral-eating snail	Ecological function
Sipo	*Cerithium nodulosum*	Nodulose coral creeper	Bait
Vana	*Echinometra mathaei, Diadema savignyi, Echinothrix diadema, Echinostrephus aciculatus*	Sea urchin	Ecological function

2.3.3. Fish assessment

Fish counts were made using an underwater visual census protocol which involved swimming along a transect tape and recording all selected species seen within a 10 meter belt (5m on each side of the transect line) *(Figure 40)*. The purpose of this evaluation was to estimate the quantity of edible, commercial or otherwise valuable fish, from the perspective of food security. As for macroinvertebrates, only target species were recorded, including species that represent a food source (edible and commercial species), a bio-indicator of reef health (such as butterflyfishes) or a potential disturbance (such as poisonous fishes). The list of target species and their classification is given in *Table 11*.

Table 11. List of targeted fish species and the justification for their selection (E: Edible, EP: Edible but Poisonous, EC: Edible and Commercially important, I: Indicative of reef health)

Nanumea name	Latin name	Common name	Justification
	ACANTHURIDAE	**SURGEONFISHES**	
Maa	*Acanthurus blochii*	Ringtail surgeonfish	EC
Ponelolo	*Acanthurus lineatus*	Striped surgeon fish	E
Manini	*Acanthurus triostegus*	Convict tang	E
Pone uli	*Ctenochaetus striatus*	Lined bristletooth	EP
	SCARIDAE	**PARROTFISHES**	
Laea	*Bolbometopon muricatum*	Bumphead parrotfish	EC
Homo	*Chlorurus microrhinos*	Steephead parrotfish	EC
Ulafi/ika hole	*Scarus ghobban*	Blue-barred parrotfish	EC
	CARANGIDAE	**TREVALLYS**	
Ulua	*Caranx melampygus*	Bluefin trevally	EC
	SERRANIDAE	**GROUPERS**	
Loi	*Cephalopholis argus*	Peacock grouper	EP
Palati	*Epinephelus fuscoguttatus*	Brown-marbled grouper	EC
Gatalaliki	*Epinephelus hexagonatus*	Hexagon grouper	EC
Gatalaliki	*Epinephelus merra*	Honeycomb grouper	EC
Gatala	*Epinephelus sp.*	Groupers	EC
	CHAETODONTIDAE	**BUTTERFLYFISHES**	
Koile	*Chaetodon auriga*	Threadfin butterflyfish	I
Koile	*Chaetodon bennetti*	Eclipse butterflyfish	I
Koile	*Chaetodon ephippium*	Saddled butterflyfish	I
Koile	*Chaetodon lunula*	Racoon butterflyfish	I
Koile	*Chaetodon lunulatus*	Redfin butterflyfish	I
Koile	*Chaetodon rafflesi*	Reticulated butterflyfis	I
Koile	*Chaetodon reticulatus*	Dotted butterflyfish	I
Koile	*Chaetodon semeion*	Chevroned butterflyfish	I
Koile	*Chaetodon trifascialis*	Latticed butterflyfish	I
	KYPHOSIDAE	**SEA CHUBS**	
Nanue	*Kyphosus sp*	Sea chubs	EC
	LETHRINIDAE	**EMPERORS**	
Filoa/Kapatiko	*Lethrinus xanthochillus*	Yellowlip emperor	EC
Muu	*Monotaxis grandoculis*	Humpnose bigeye bream	EC
	LUTJANIDAE	**SNAPPERS**	
Utu	*Aprion virescens*	Green jobfish	EC
Takape	*Lutjanus fulvus*	Blacktail snapper	EC
Taiva	*Lutjanus monostigma*	Onespot snapper	EP
	HOLOCENTRIDAE	**SOLDIERFISH/SQUIRRELFISHES**	
Malau puku	*Myripristis sp*	Soldierfishes	EC
Taa Malau	*Sargocentron spiniferum*	Sabre squirrelfish	EC
	EPHIPPIDAE	**BATFISHES**	
Laulaufou	*Platax orbicularis*	Circular batfish	E
	BALISTIDAE	**TRIGGERFISHES**	
Umu	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	E
Sumu	*Rhinecanthus aculeatus*	Picasso triggerfish	E

Nukulaelae name	Latin name	Common name	Justification
	ACANTHURIDAE	**SURGEONFISHES**	
Kapalagi	*Acanthurus blochii*	Ringtail surgeonfish	E
Ponelolo	*Acanthurus lineatus*	Striped surgeon fish	EC
Kapalagi	*Acanthurus olivaceus*	Orangeband surgeonfish	E
Manini	*Acanthurus triostegus*	Convict tang	EC
Pone uli	*Ctenochaetus striatus*	Lined bristletooth	EC
Manini Lakau	*Naso lituratus*	Orangespine unicornfish	EC
Ume	*Naso unicornis*	Bluespine unicornfish	EC
	SCARIDAE	**PARROTFISHES**	
Laea	*Bolbometopon muricatum*	Bumphead parrotfish	E
Homo	*Chlorurus microrhinos*	Steephead parrotfish	E
Laea	*Chlorurus japanensis*	Japanese parrotfish	E
Ika hole	*Scarus ghobban*	Blue-barred parrotfish	EC
	CARANGIDAE	**TREVALLYS**	
Aseu	*Caranx melampygus*	Bluefin trevally	EC
	SERRANIDAE	**GROUPERS**	
Loi	*Cephalopholis argus*	Peacock grouper	E
Fapuku	*Epinephelus fuscogutattus*	Brown-marbled grouper	EC
Gatalaliki	*Epinephelus merra*	Honeycomb grouper	E
	CHAETODONTIDAE	**BUTTERFLYFISHES**	
Moipepe	*Chaetodon auriga*	Threadfin butterflyfish	I
Moipepe	*Chaetodon citrinellus*	Speckled butterflyfish	I
Moipepe	*Chaetodon ephippium*	Saddled butterflyfish	I
Moipepe	*Chaetodon lunula*	Racoon butterflyfish	I
Moipepe	*Chaetodon lunulatus*	Redfin butterflyfish	I
Moipepe	*Chaetodon rafflesi*	Latticed butterflyfish	I
Moipepe	*Chaetodon reticulatus*	Reticulated butterflyfish	I
Moipepe	*Chaetodon semeion*	Dotted butterflyfish	I
Moipepe	*Chaetodon trifascialis*	Chevroned butterflyfish	I
Moipepe	*Chaetodon ulietensis*	Pacific double-saddle butterflyfish	I
	LABRIDAE	**WRASSES**	
Tagafa	*Cheilinus undulatus*	Humphead wrasse	E
	MUGILIDAE	**MULLETS**	
Kanase	*Crenimugil crenilabis*	Fringelip mullet	EC
Kafakafa	*Liza vaigensis*	Diamond-scale mullet	EC
	MULLIDAE	**GOATFISHES**	
Afulu	*Parupeneus barberinus*	Dash-dot goatfish	EC
Afulu	*Parupeneus sp*	Goat fishes	E
	LETHRINIDAE	**EMPERORS**	
Tanutanu	*Lethrinus harak*	Thumbprint emperor	EC
Kapatiko	*Lethrinus xanthochillus*	Yellowlip emperor	EC
Muu	*Monotaxis grandoculis*	Humpnose bigeye bream	EC
	KYPHOSINAE	**SEA CHUBS**	
Nanue	*Kyphosus sp*	Sea chubs	EC
	LUTJANIDAE	**SNAPPERS**	
Tagau	*Lutjanus fulvus*	Blacktail snapper	E
Taea	*Lutjanus gibbus*	Humpback snapper	EC
Taiva	*Lutjanus monostigma*	Onespot snapper	EP
	HOLOCENTRIDAE	**SOLDIER/SQUIRRELFISHES**	
Malau puku	*Myripristis sp*	Soldierfishes	EC
Taa Malau	*Sargocentron spiniferum*	Sabre squirrelfish	E
	BALISTIDAE	**TRIGGERFISHES**	
Umu	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	E
Sumu	*Rhinecanthus aculeatus*	Picasso triggerfish	E
	SIGANIDAE	**RABBITFISHES**	
Maiava	*Siganus argenteus*	Forktail rabbitfish	EC

Funafuti name	Latin name	Common name	Justification
	ACANTHURIDAE	**SURGEONFISHES**	
	Acanthurus achilles	Achilles tang	EC
Ponelolo	*Acanthurus lineatus*	Striped surgeonfish	EC
	Acanthurus nigricans	Whitecheek surgeonfish	E
Kapalagi	*Acanthurus sp.*	Surgeonfishes	E
Manini	*Acanthurus triostegus*	Convict tang	EC
Pone uli	*Ctenochaetus striatus*	Lined bristletooth	EP
Manini lakau	*Naso lituratus*	Orangespine unicornfish	EC
Pokapoka	*Naso sp.*	Unicornfish	EC
Ume	*Naso unicornis*	Bluespine unicornfish	EC
	SCARIDAE	**PARROTFISHES**	
Laea	*Chlorurus sp.*	Parrotfishes	E
Ulafi	*Scarus ghobban*	Blue-barred parrotfish	EC
	CARANGIDAE	**TREVALLYS**	
Aseu	*Caranx sexfasciatus*	Bigeye trevally	EC
	SERRANIDAE	**GROUPERS**	
Loi	*Cephalopholis argus*	Peacock grouper	EP
Fapuku	*Epinephelus fuscoguttatus*	Brown-marbled grouper	EC
Gatalaliki	*Epinephelus merra*	Honeycomb grouper	E
Tonu	*Plectropomus laevis*	Blacksaddle coral grouper	EP
	CHAETODONTIDAE	**BUTTERFLYFISHES**	
Moipepe	*Chaetodon auriga*	Threadfin butterflyfish	I
Moipepe	*Chaetodon citrinellus*	Speckled butterflyfish	I
Moipepe	*Chaetodon ephippium*	Saddled butterflyfish	I
Moipepe	*Chaetodon lunula*	Racoon butterflyfish	I
Moipepe	*Chaetodon lunulatus*	Redfin butterflyfish	I
Moipepe	*Chaetodon ornatissimus*	Ornate butterflyfish	I
Moipepe	*Chaetodon rafflesi*	Latticed butterflyfish	I
Moipepe	*Chaetodon reticulatus*	Reticulated butterflyfish	I
Moipepe	*Chaetodon semeion*	Dotted butterflyfish	I
Moipepe	*Chaetodon trifascialis*	Chevroned butterflyfish	I
Moipepe	*Chaetodon ulietensis*	Pacific double-saddle butterflyfish	I
Moipepe	*Chaetodon vagabundus*	Vagabond butterflyfish	I
	LABRIDAE	**WRASSES**	
Tagafa	*Cheilinus undulatus*	Humphead wrasse	E
	MULLIDAE	**GOATFISHES**	
Afulu	*Parupeneus sp.*	Goatfishes	EC
Afulu	*Parupeneus barberinus*	Dash-dot goatfish	EC
Kalo	*Mulloidichthys flavolineatus*	Yellowstripe goatfish	EC
Vete	*Mulloidichthys vanicolensis*	Yellowfin goatfish	EC
	LETHRINIDAE	**EMPERORS**	
Saputu	*Lethrinus erythracanthus*	Yellowfin emperor	E
Tanutanu	*Lethrinus harak*	Thumbprint emperor	EC
Tanutanu	*Lethrinus obsoletus*	Orange-striped emperor	EC
Filoa	*Lethrinus olivaceus*	Longface emperor	EC
Muu	*Monotaxis grandoculis*	Humpnose bigeye bream	EC
	KYPHOSIDAE	**SEA CHUBS**	
Nanue	*Kyphosus sp*	Sea chubs	EC
	LUTJANIDAE	**SNAPPERS**	
Palusega	*Aphareus sp.*	Jobfishes	EC
Utu	*Aprion virescens*	Green jobfish	EC
Taiva	*Lutjanus monostigma*	Onespot snapper	EP
Fagamea	*Lutjanus bohar*	Red snapper	EP
Tagau	*Lutjanus fulvus*	Blacktail snapper	E

Funafuti name	Latin name	Common name	Justification
Taea	*Lutjanus gibbus*	Humpback snapper	EC
Savane	*Lutjanus kasmira*	Bluestripe snapper	EC
	BALISTIDAE	**TRIGGERFISHES**	
Umu	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	E
Sumu	*Rhinecanthus aculeatus*	Picasso triggerfish	E
	SIGANIDAE	**RABBITFISHES**	
Maiava	*Siganus argenteus*	Forktail rabbitfish	EC
Maiava pukupuku	*Siganus sp*	Rabbitfishes	EC
	GERREIDAE	**MOJARRAS**	
Matu	*Gerres oyena*	Blacktip silver biddy	E
	CARCHARHINIDAE	**SHARKS**	
Mago	*Triaenodon obesus*	Whitetip reef shark	E

2.4. DATA ANALYSIS

Statistical analyses, using the program Statistica, were carried out on:

- Total live coral cover
- Total algae cover
- Total target macroinvertebrates
- Edible macroinvertebrates
- Total target fish
- Edible fish

Macroinvertebrate and fish abundances were reported as density estimates (individuals per hectare). Corals and algae were quantified as percent cover for each transect. Densities and percent cover patterns were described and compared between sites and conservation status (inside or outside the CAs), using Analysis of Variance (ANOVA) and Multivariate ANOVA (MANOVA), with appropriate transformations of data that did not conform to the test assumptions of **normality** and **homoscedasticity**.

3. RESULTS

3.1. BENTHIC SURVEY

3.1.1. Hard live coral cover

Mean hard coral cover was low in all 3 atolls (respectively 15%, 11% and 6% in Funafuti, Nanumea and Nukulaelae). Higher coral cover in Funafuti is most probably a consequence of better water flow due to large passages all around the atoll and a greater diversity of habitats (e.g. channels, pinnacles, deep lagoon, coral bommies on sandy lagoonal seabed).

Nevertheless, coral cover in Funafuti was highly variable, ranging from 0.1% to 58%, with a mean cover of 15% across all sites. Coral cover appears to have declined since 2004, when average cover was estimated at between 20 and 30% (Lovell et al., 2004). Results from our survey indicate that coral cover was not significantly different between inside and outside the FCA, but tended to be higher outside the FCA, with mean values of 11% and 19% respectively inside and outside the FCA. The highest coral cover estimates were recorded on reef slopes: Tepuka (58%), Fualefeke (35%) and Fuafatu (34%).

The dominant hard coral growth form was *Acropora* staghorn branching corals (13 stations out of 18 were dominated by this form). Some stations (Fuafatu lagoon and Tefala reef slope) also had a significant proportion of plate-forming corals, whereas others (Fualopa reef flat and reef slope, Tefala reef flat and Tefala reef slope) had a significant proportion of encrusting forms. The blue coral (*Heliopora coerulea*), a rare and threatened species (listed as 'vulnerable' under the IUCN Red List), was observed at 3 stations: Teafualiku reef flat (0.1%), Tepuka lagoon (1%) and Fuafatu lagoon (1.5%).

Table 12. Live hard coral cover and dominant growth forms recorded in Funafuti.

Status	Station	Live coral cover	Dominant growth form
FCA	Fuafatu flat	7%	*Acropora* branching coral
FCA	Fuafatu slope	34%	*Acropora* branching coral
FCA	Fuafatu lagoon	15%	*Acropora* branching and plate-forming coral
FCA	Fualopa flat	0.1%	Encrusting coral
FCA	Fualopa slope	9%	Encrusting coral
FCA	Fualopa lagoon	7%	*Acropora* branching coral
FCA	Tefala flat	2%	Encrusting coral
FCA	Tefala slope	12%	*Acropora* branching and plate-forming coral, encrusting coral
FCA	Tefala lagoon	14%	*Acropora* branching coral
Outside FCA	Tepuka flat	0.1%	*Acropora* branching coral
Outside FCA	Tepuka slope	58%	*Acropora* branching coral
Outside FCA	Tepuka lagoon	5%	*Acropora* branching coral
Outside FCA	Fualefeke flat	1%	*Acropora* and non-*Acropora* branching coral
Outside FCA	Fualefeke slope	35%	*Acropora* branching coral
Outside FCA	Fualefeke lagoon	19%	*Acropora* branching coral
Outside FCA	Teafualiku flat	5%	*Acropora* branching coral
Outside FCA	Teafualiku slope	24%	*Acropora* branching coral
Outside FCA	Teafualiku lagoon	27%	*Acropora* branching coral

On the outer atolls, hard coral cover appeared to be relatively low. In Nukulaelae, coral cover ranged from 0% to 13%, with a mean cover of 6% across all sites. Coral cover was similar inside and outside the CA, with mean values of 6% and 5% respectively. The dominant growth form was *Acropora* staghorn branching coral (6 stations out of 10 were dominated by branching forms), but some stations were dominated by other growth forms, mainly bushy colonies such as Pocilloporidae species, plate-forming corals (*Acropora* species) and massive forms (usually *Porites*).

In Nanumea, coral cover ranged from 2% to 22%, with a mean cover of 11% across all sites. Coral cover was similar inside and outside the CA, with mean values of 12% and 9% respectively. Encrusting (mainly *Montipora* species), massive (mainly *Porites* species) and bushy (mainly *Pocillopora* species) growth forms were evenly represented in the coral assemblage. *Acropora* species were seldom seen in Nanumea lagoon.

Table 13. Live hard coral cover and dominant growth forms recorded in Nukulaelae and Nanumea.

Status	Station	Live coral cover	Dominant growth form	Station	Live coral cover	Dominant growth form
CA	NKLCA1	5%	Table	NNMCA1	14%	Encrusting
CA	NKLCA2	13%	Branching	NNMCA2	16%	Other
CA	NKLCA3	9%	Other	NNMCA3	9%	Other
CA	NKLCA4	4%	Branching	NNMCA4	11%	Encrusting
CA	NKLCA5	0%	-	NNMCA5	11%	Encrusting
Outside CA	NKLOCA1	7%	Branching	NNMOCA1	22%	Other and massive
Outside CA	NKLOCA2	8%	Branching	NNMOCA2	2%	Massive
Outside CA	NKLOCA3	4%	Massive	NNMOCA3	3%	Massive
Outside CA	NKLOCA4	3%	Branching	NNMOCA4	9%	Massive
Outside CA	NKLOCA5	3%	Branching			

There is little information on the past status of benthic communities available for coral reefs of Tuvalu, and almost all previous surveys focused on Funafuti atoll, more specifically on the FCA. The only existing past assessments for Nanumea include Apinelu's (1990) description of Nanumea corals as 'unhealthy', probably reflecting low coral cover and high algal cover on rocky substrate. Nanumea was also the site of a survey on long-term effects of blasted boat passages on intertidal organisms (Kaly and Jones 1994). More specifically the authors assessed the effects of explosive blasting to build the American channel during World War II on molluscs, crustaceans, algae and physical characteristics of the substratum. This study does not contain any information on coral communities.

The FCA was declared in 1996, though it has been functionally operational since June 1997 (Kaly 1999). Marine resource monitoring was conducted in 1997 (baseline survey) and subsequently in 1999, 2002, 2003 and 2006, by the Fisheries Department and FCA officers. Unfortunately no raw data resulting from these surveys could be sourced to investigate changes in coral community structure over time, due to data loss.

The FCA baseline survey revealed that total coral cover was low (between 10 and 20% at most sites), but reached around 55% in the slope habitat at control sites (outside the FCA) (Kaly 1997).
The second marine survey of the FCA revealed that total hard coral cover varied between 0 and 76% at sites within the FCA and 0 and 99% at sites outside the FCA. Hard coral cover increased between these two surveys in terrace habitats at FCA sites, and *Acropora nobilis* cover increased at reef slope stations (Kaly et al. 1999).

Figure 42. Main coral growth forms encountered in Tuvalu (based on TML investigations).

Sauni (2000) described the coral reefs of the Tuvalu archipelago as presenting a low hard coral cover with staghorn and other corals dominating reef tops. The reef slopes appeared dominated by *Acropora* including *A. nobilis* and *A. florida*, with lower cover of plating *A. hyacinthus* and several bushy forms. On the ocean side terrace habitats were described as rich in coral cover and diversity. This habitat was not investigated during the present CA survey.

In 2002, a number of threats to reef communities were identified, includingover-fishing, road and foreshore damage, land reclamation, sewage pollution and natural impacts. These threats led to changes in coral reef communities, including increased turf and blue-green algae, decreased hard coral cover and lower populations of butterflyfishes (Sulu et al. 2002). A minimal **coral bleaching event** (about 1%) was recorded during the Pacific-wide 2000 event. However, surveys in May 2002 indicated that about 30-40% of coral reefs were bleached during the 2002 bleaching event, when there was a 1°C rise in water temperatures to 31-32°C.

In 2004, live coral cover was still very variable among stations within the FCA (0-70% cover) (Lovell et al. 2004). The highest coral cover was found outside the FCA, compared with low coral cover in the Tefala Reserve and Fualopa Reserve (6.5% and 6.2%, respectively). High coral cover was found on the western side of the atoll and reef slopes possibly due to the presence of several deep channels into the lagoons. The coral cover had declined by 9% between 2002 and 2004. This may be due to strong wave action created by stormy conditions in late 2002, and compounded by destructive fishing practices. The trends in coral cover from 1997 to 2004 showed reasonable stability of 20 to 30% average coral cover with a large component of the structure at many sites made up of sand, dead coral and coral rock.

More recently, the range of coral cover in Tuvalu was again considered large with an average coral cover of 65% (range 55–98%) (Morris and Mackay 2008), unfortunately the authors did not identify the islands visited nor the habitats investigated. This result is surprising when considering that reef flats usually show coral cover of 0-10% and are mostly composed of sand and rubble.

A review of the main pressures acting on Tuvaluan coral reef health (South and Skelton 2000; Sauni 2000) showed that reefs were mostly threatened by:

- Climate change (sea level rise, increased storm surges and global warming): general major threat
- Sand mining: localised major threat
- Coastal erosion, cyclones and overfishing: average threat
- Coastal constructions (reef channel blasting, channelling and dredging activities)
- Pollution (sewage and waste disposal)
- **Ciguatera** fish poisoning

3.1.2. Algal cover

During our investigations in Funafuti, we categorised algae as '*Halimeda*' (all *Halimeda* species), 'Macroalgae' (all macroalgae except *Halimeda*) and 'Turf Algae'. 'Coralline algae' were treated separately as their ecological role and abundance on reefs differ from fleshy or turf algae, especially in terms of their contribution to reef health. Coralline algae are known to facilitate coral settlement, whereas turf and macroalgae tend to prevent it.

Our results indicate that total algal cover tends to be higher within the FCA than outside, which is consistent with findings from the first marine survey of the FCA (Kaly 1997). Overall average algal cover was 43% within the FCA (range 16-90%) and 29% outside the FCA (range 10-76%). The highest algal cover was observed on the Fualopa, Tepuka and Fuafatu reef flats. *Halimeda* was well represented in Fualopa lagoon and on the Tepuka reef slope; apart from these 2 stations, *Halimeda* cover was low (range 0-4%). Species noted were *Halimeda minima, H. taenicola* and *H. macroloba*.

Turf algal cover was higher outside the FCA (mean cover: 18%, range 5-42%) than inside the FCA (mean cover: 7%, range 0-22%). Turf algae were mainly observed on dead staghorn *Acropora* branches usually colonised by damselfishes (*Stegastes* sp., also called 'farmer fish' as they culture algae by removing live coral tissue and unfavourable algae from their territories). The highest turf algal cover was observed in Teafualiku and Tepuka reefs.

Coralline algae were seldom seen in Funafuti lagoon, and only observed at sites within the FCA (mean cover: 3%, range: 0-14%). Tefala showed particularly high crustose coralline algal cover (reef flat mean cover: 8%; reef slope mean cover: 14%), which is a good sign for potential coral development or regeneration.

Table 14. Algal cover recorded in Funafuti.

Status	Station	*Halimeda*	Macroalgae	Turf algae	Total algae	CCA
FCA	Fuafatu flat	1%	23%	22%	46%	2%
FCA	Fuafatu slope	0%	9%	22%	31%	1%
FCA	Fuafatu lagoon	1%	23%	6%	29%	0%
FCA	Fualopa flat	0%	90%	0%	90%	0%
FCA	Fualopa slope	0%	75%	0%	75%	0%
FCA	Fualopa lagoon	8%	17%	4%	30%	1%
FCA	Tefala flat	1%	42%	0%	43%	8%
FCA	Tefala slope	0%	25%	2%	28%	14%
FCA	Tefala lagoon	0%	11%	5%	16%	0%
Outside FCA	Tepuka flat	0%	68%	8%	76%	0%
Outside FCA	Tepuka slope	7%	0%	30%	37%	0%
Outside FCA	Tepuka lagoon	2%	5%	17%	25%	0%
Outside FCA	Fualefeke flat	1%	4%	5%	10%	0%
Outside FCA	Fualefeke slope	3%	2%	16%	21%	0%
Outside FCA	Fualefeke lagoon	4%	0%	5%	10%	0%
Outside FCA	Teafualiku flat	0%	8%	23%	32%	0%
Outside FCA	Teafualiku slope	1%	0%	42%	43%	0%
Outside FCA	Teafualiku lagoon	1%	0%	11%	12%	1%

On the outer atolls, we only recorded 2 categories of algae: 'Macroalgae' and 'Turf algae'. Crustose coralline algae were absent on the reefs visited and *Halimeda* was scarce and therefore included in the 'Macroalgae' category. The most abundant algal species was *Microdyction*, which is typically observed in lagoons of closed or semi-closed atolls (Payri et al. 2000).

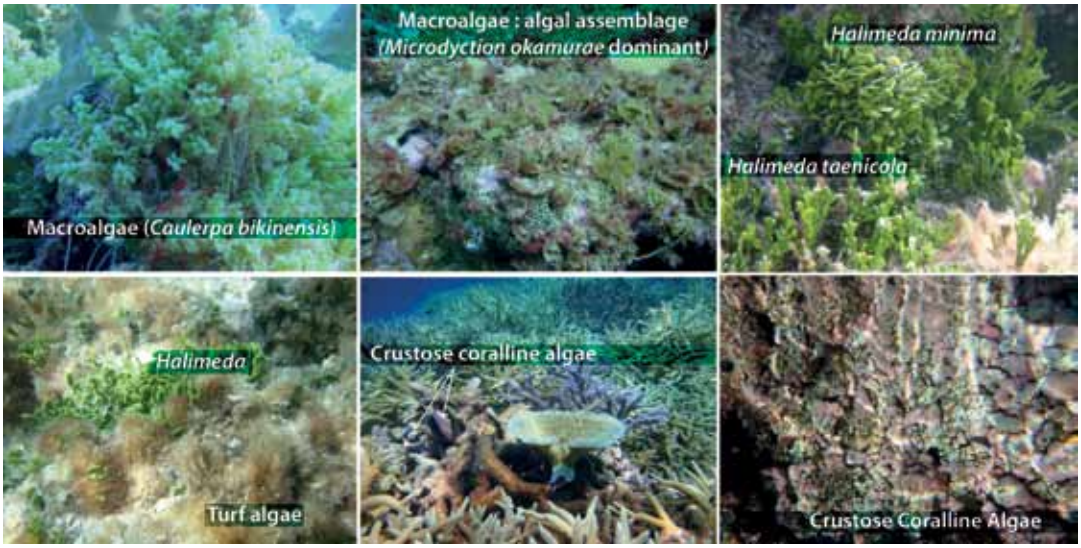
In Nukulaelae, as in Funafuti, algal cover tended to be higher within the CA than outside, with an average total algal cover of 27% within the CA (range 0-16%) and 19% outside the CA (range 1-14%). The highest algae cover was observed at the stations NKLOCA3, NKLCA2 and NKLCA3.

In Nanumea, algal cover was similar inside and outside the CA (12 and 13%, respectively) and dominated by turf algae. Turf algae were found on rocky substrates rather than dead coral branches as seen in Funafuti (branching corals are seldom observed in Nanumea).

Table 15. Algal cover recorded in Nukulaelae and Nanumea (MA: Macroalgae, TA: Turf algae).

Status	Station	MA	TA	Total algae	Station	MA	TA	Total algae
CA	NKLCA1	6%	14%	20%	NNMCA1	0%	1%	1%
CA	NKLCA2	16%	22%	38%	NNMCA2	0%	1%	1%
CA	NKLCA3	8%	29%	37%	NNMCA3	1%	17%	18%
CA	NKLCA4	1%	11%	12%	NNMCA4	1%	11%	12%
CA	NKLCA5	0%	28%	28%	NNMCA5	14%	13%	28%
Outside CA	NKLOCA1	1%	7%	7%	NNMOCA1	12%	0%	12%
Outside CA	NKLOCA2	14%	7%	21%	NNMOCA2	0%	9%	9%
Outside CA	NKLOCA3	2%	44%	47%	NNMOCA3	0%	18%	18%
Outside CA	NKLOCA4	2%	9%	11%	NNMOCA4	6%	7%	14%
Outside CA	NKLOCA5	3%	4%	8%		0%	1%	1%

Figure 43. Main algae observed in the 3 visited atolls.



As for corals, there is currently no information on algal assemblages on the outer atolls and little information is available on Funafuti marine flora through previous FCA surveys. Sparse information is available through literature reviews from ancient expeditions.

The first survey of the FCA revealed that algal cover tended to be higher in the FCA than outside and it was highest in the terrace habitat (both inside and outside the FCA). The dominant algae were *Microdictyon*, *Halimeda*, *Dictyosphaeria*, and *Peyssonelia* (Kaly 1997).

During the second survey, increases in *Dictyosphaeria* and *Microdictyon* were observed and overall, there was an increase in algal diversity and total cover on the reef slope of the FCA and a decrease in algae on the reef flats (Kaly et al. 1999).

Sauni (2000) described the Funafuti lagoon as having a high cover by *Dictyota*, *Halimeda* and other macroalgae. Crustose coralline algae were observed on patch reefs and coral heads.

In 2002, reef degradation (overfishing, costal constructions, land reclamation, sewage pollution and natural impacts) was suggested to have led to significant changes in the coral reef communities, including increased turf and blue-green algae (Lovell et al. 2004).

3.1.3. Other biotic cover

Other biotic categories included in this survey were sponges, soft corals and ascidians.

During the Funafuti survey only 2 stations had soft corals (species of the genus *Sinularia and Sarcophyton*) in very low proportions: Fuafatu lagoon and Fualopa reef slope (0.1 and 0.2% respectively). Sponges were recorded at 3 stations: Fualefeke reef flat and reef slope (respectively 0.7 and 0.3%) and Tefala lagoon (0.3%).

In Nukulaelae, no other living organisms were recorded.

In Nanumea, NNMCA4 showed a significant proportion of other biotic cover (11%), which was composed of ascidians: large mats of *Didemnum* sp. covered the rocks, and some specimens of *Polycarpa* sp. were also recorded.

Figure 44. Other living organisms recorded in the 3 visited atolls.

3.1.4. Abiotic cover

In the 2004 Status of the World's Coral Reefs report (Lovell et al. 2004), it was stated that a large component of the Funafuti seabed was made up of sand, dead coral and coral rock. Results of our survey indicate that abiotic substrate (rocks, limestone, dead coral, rubble and sand) covered almost half of the surveyed substratum (mean abiotic cover=47%), ranging from 4% (Tepuka slope) to 88% (Fualefeke flat).

Table 16. Abiotic cover recorded in Funafuti (RC: rocks, limestone and dead corals ; RB: rubbles ; SD: sand).

Status	Station	RC	RB	SD	Total abiotic
FCA	Fuafatu flat	8%	14%	23%	45%
FCA	Fuafatu slope	3%	7%	23%	33%
FCA	Fuafatu lagoon	1%	5%	49%	55%
FCA	Fualopa flat	1%	0%	8%	10%
FCA	Fualopa slope	6%	2%	8%	16%
FCA	Fualopa lagoon	2%	0%	59%	62%
FCA	Tefala flat	30%	7%	10%	48%
FCA	Tefala slope	27%	6%	13%	46%
FCA	Tefala lagoon	5%	4%	61%	70%
Outside FCA	Tepuka flat	8%	1%	15%	24%
Outside FCA	Tepuka slope	0%	2%	2%	4%
Outside FCA	Tepuka lagoon	8%	31%	31%	70%
Outside FCA	Fualefeke flat	11%	25%	52%	88%
Outside FCA	Fualefeke slope	5%	30%	6%	41%
Outside FCA	Fualefeke lagoon	0%	3%	68%	71%
Outside FCA	Teafualiku flat	33%	28%	1%	63%
Outside FCA	Teafualiku slope	32%	0%	0%	32%
Outside FCA	Teafualiku lagoon	15%	2%	43%	59%

In Nukulaelae, abiotic cover was high, with a mean value of 71% for the whole atoll, ranging from 49% (NKLOCA3 and NKLCA2) to 86% (NKLOCA4).

In Nanumea, abiotic cover was also high, with a mean value of 74% for the whole atoll, ranging from 61% (NNMCA5) to 89% (NNMOCA2).

Table 17. Abiotic cover recorded in outer islands (RC: rocks, limestone and dead corals; RB: rubble; SD: sand).

Status	Station	RC	RB	SD	Total abiotic	Station	RC	RB	SD	Total abiotic
CA	NKLCA1	52%	6%	16%	75%	NNMCA1	35%	7%	41%	82%
CA	NKLCA2	9%	7%	33%	49%	NNMCA2	41%	6%	33%	80%
CA	NKLCA3	21%	27%	6%	54%	NNMCA3	42%	11%	20%	72%
CA	NKLCA4	8%	0%	76%	85%	NNMCA4	27%	4%	34%	65%
CA	NKLCA5	7%	38%	26%	72%	NNMCA5	29%	10%	22%	61%
Outside CA	NKLOCA1	28%	28%	29%	85%	NNMOCA1	22%	20%	23%	65%
Outside CA	NKLOCA2	51%	13%	7%	71%	NNMOCA2	17%	55%	17%	89%
Outside CA	NKLOCA3	27%	6%	15%	49%	NNMOCA3	46%	27%	5%	79%
Outside CA	NKLOCA4	60%	18%	8%	86%	NNMOCA4	1%	12%	63%	76%
Outside CA	NKLOCA5	67%	5%	10%	82%		35%	7%	41%	82%

3.2. MACROINVERTEBRATE SURVEY

3.2.1. Target macroinvertebrate density

A. Total macroinvertebrate density

The overall mean density of target macroinvertebrates was higher on Nukulaelae atoll (260.4 individuals per hectare +/- 213.1 SE) than on Nanumea (137.7 individuals per hectare +/- 79.4 SE) and Funafuti (31.6 individuals per hectare +/- 15.4 SE).

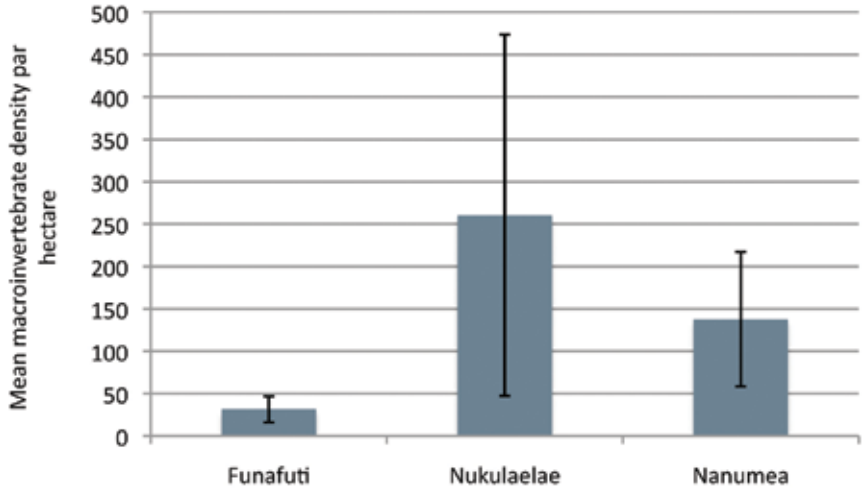


Figure 45. Mean density of total target macroinvertebrates on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

Comparing stations inside and outside CAs *(Figure 46)*, we noted that:

- In Funafuti, mean total target macroinvertebrate density was similar inside and outside the FCA (39.9 ind./ha +/- 18.8 SE versus 23.2 ind./ha +/- 10.2 SE).
- In Nukulaelae, mean total target macroinvertebrate density was slightly higher within the CA than outside (301.6 ind./ha +/- 222.8 SE versus 219.3 ind./ha +/- 207.8 SE). This difference was not significant.
- In Nanumea, mean total target macroinvertebrate density was lower within the CA than outside (40.6 ind./ha +/- 17.4 SE versus 259.2 ind./ha +/- 69.8 SE). This difference was highly significant.

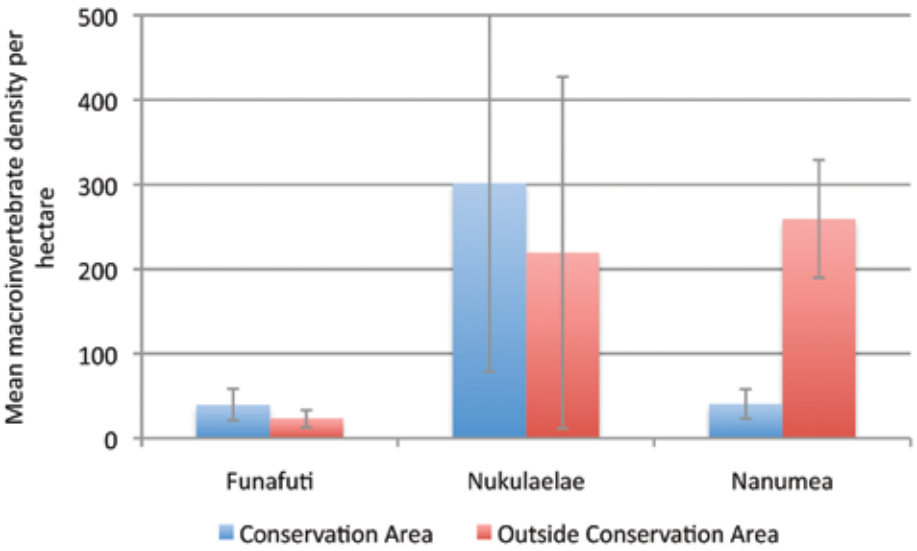


Figure 46. Mean density of total target macroinvertebrates inside and outside conservation areas, on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

In Funafuti, mean total target macroinvertebrate density ranged from 1.7 to 96.0 individuals per hectare, with the highest density recorded at Tefala reef flat, Fualopa reef slope and Tefala reef slope.

Status	Station	Mean density	SE
FCA	Fuafatu flat	34.9	5.4
FCA	Fuafatu slope	18.3	7.0
FCA	Fuafatu lagoon	9.7	2.6
FCA	Fualopa flat	28.6	5.3
FCA	Fualopa slope	93.1	11.7
FCA	Fualopa lagoon	16.6	5.0
FCA	Tefala flat	96.0	36.1
FCA	Tefala slope	60.0	20.2
FCA	Tefala lagoon	1.7	0.8
Outside FCA	Tepuka flat	33.1	7.4
Outside FCA	Tepuka slope	5.1	3.2
Outside FCA	Tepuka lagoon	45.1	12.1
Outside FCA	Fualefeke flat	34.9	17.7
Outside FCA	Fualefeke slope	18.3	7.3
Outside FCA	Fualefeke lagoon	8.0	3.9
Outside FCA	Teafualiku flat	48.0	8.0
Outside FCA	Teafualiku slope	10.9	4.6
Outside FCA	Teafualiku lagoon	5.7	2.1

Table 18. Total target macroinvertebrate densities (mean number of individuals/ha) recorded in Funafuti.

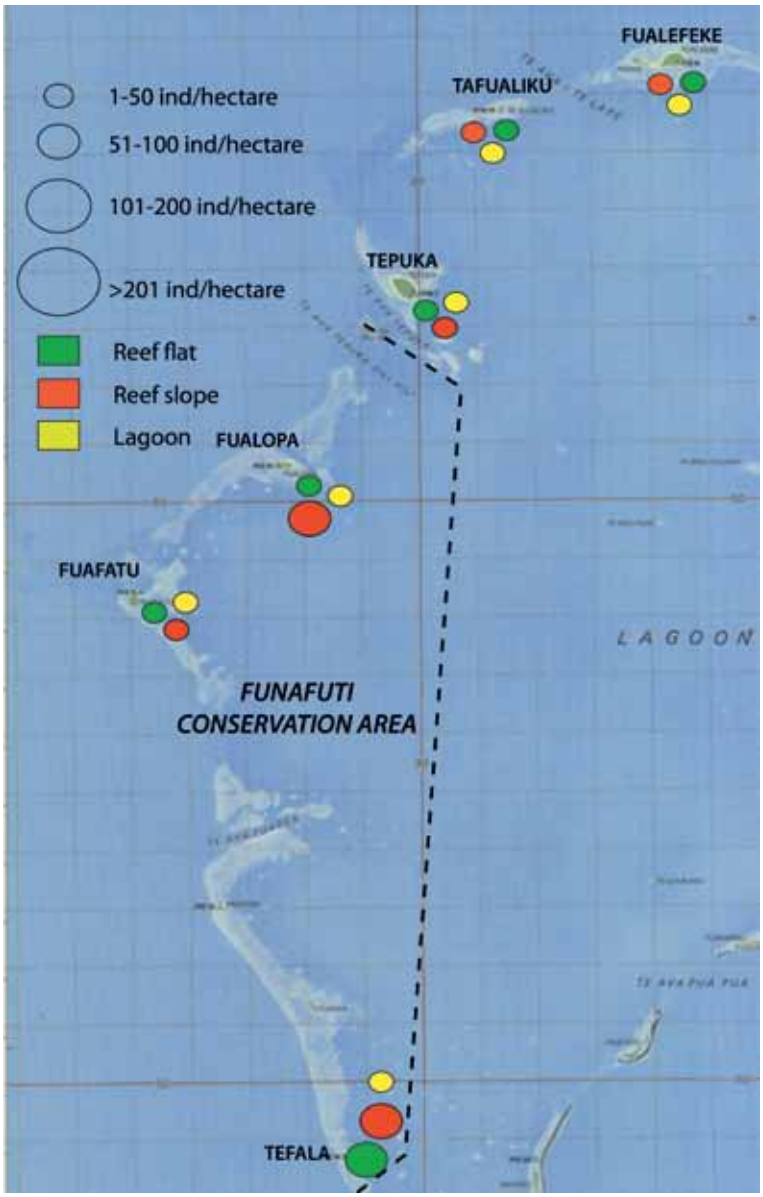


Figure 47. Mean total target macroinvertebrate density in Funafuti, calculated as the total number of individuals per hectare.

In Nukulaelae, mean total target macroinvertebrate density ranged from 42.7 to 1976.0 individuals per hectare, with the highest density recorded at CA5, OCA3 and CA4. The highest concentration of total target macroinvertebrates was recorded on the sheltered side of the atoll, both inside and directly outside the CA (OCA3).

Table 19. Total target macroinvertebrate densities (mean number of individuals/ha) recorded in Nukulaelae.

Status	Station	Mean density	SE
Conservation Area	NKLCA1	49.3	16.7
Conservation Area	NKLCA2	261.3	165.1
Conservation Area	NKLCA3	138.0	44.7
Conservation Area	NKLCA4	591.3	166.6
Conservation Area	NKLCA5	1976.0	265.8
Outside Conservation Area	NKLOCA1	46.7	16.2
Outside Conservation Area	NKLOCA2	140.0	58.3
Outside Conservation Area	NKLOCA3	1814.0	122.2
Outside Conservation Area	NKLOCA4	42.7	17.6
Outside Conservation Area	NKLOCA5	149.3	52.5

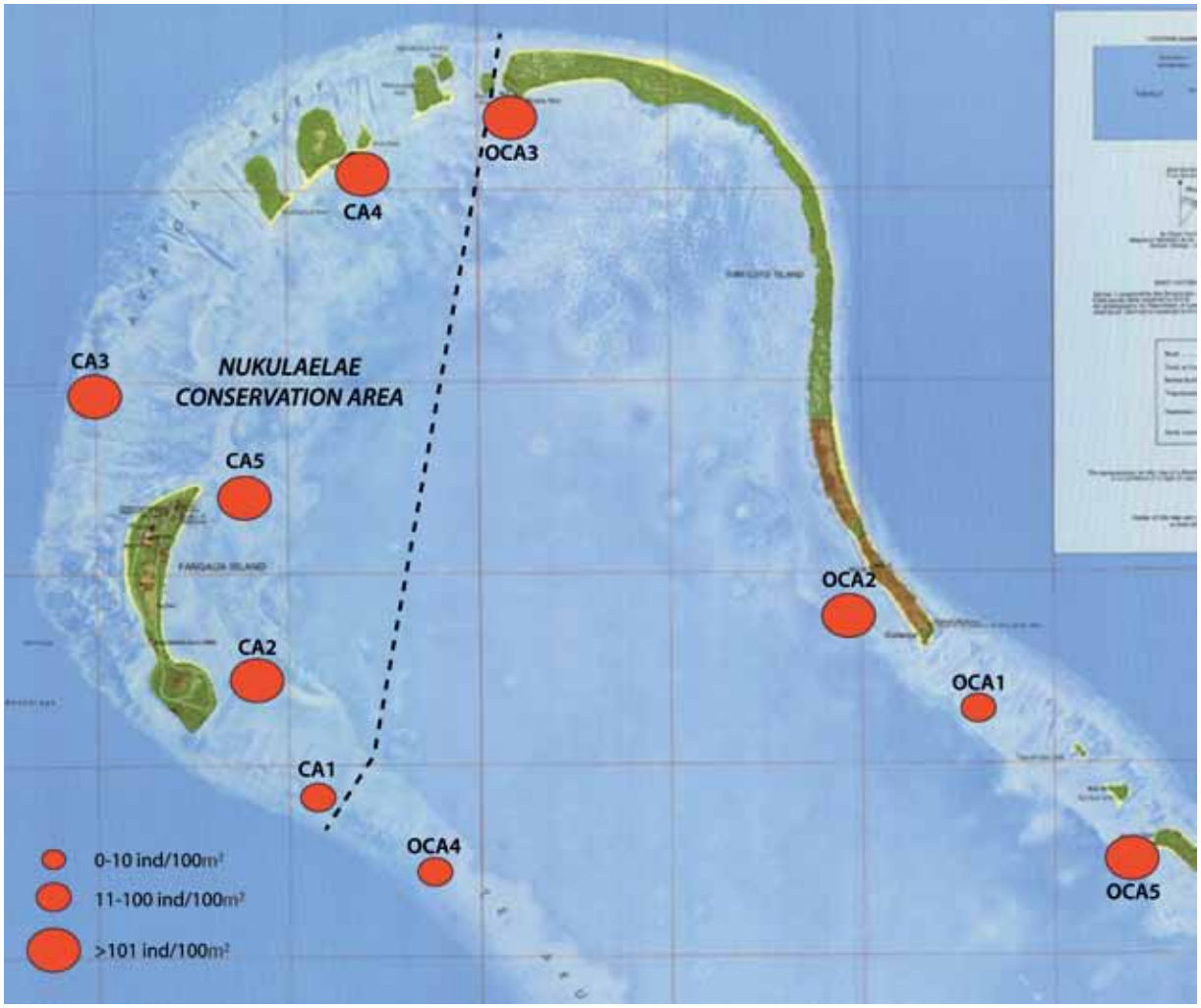


Figure 48. Mean total target macroinvertebrate density in Nukulaelae, calculated as the total number of individuals per hectare.

In Nanumea, mean total target macroinvertebrate density ranged from 48.0 to 646.0 individuals per hectare, with the highest density recorded at OCA2, OCA4 and OCA1. All sites outside the CA exhibited very high numbers of macroinvertebrates compared to sites within the CA.

Table 20. Total target macroinvertebrate densities (mean number of individuals/ha) recorded in Nanumea.

Status	Station	density	SE
Conservation Area	NNMCA1	49.3	7.2
Conservation Area	NNMCA2	155.3	61.3
Conservation Area	NNMCA3	48.0	5.8
Conservation Area	NNMCA4	100.7	7.3
Conservation Area	NNMCA5	58.0	12.9
Outside Conservation Area	NNMOCA1	464.0	172.0
Outside Conservation Area	NNMOCA2	646.0	15.0
Outside Conservation Area	NNMOCA3	430.0	174.1
Outside Conservation Area	NNMOCA4	533.3	182.6

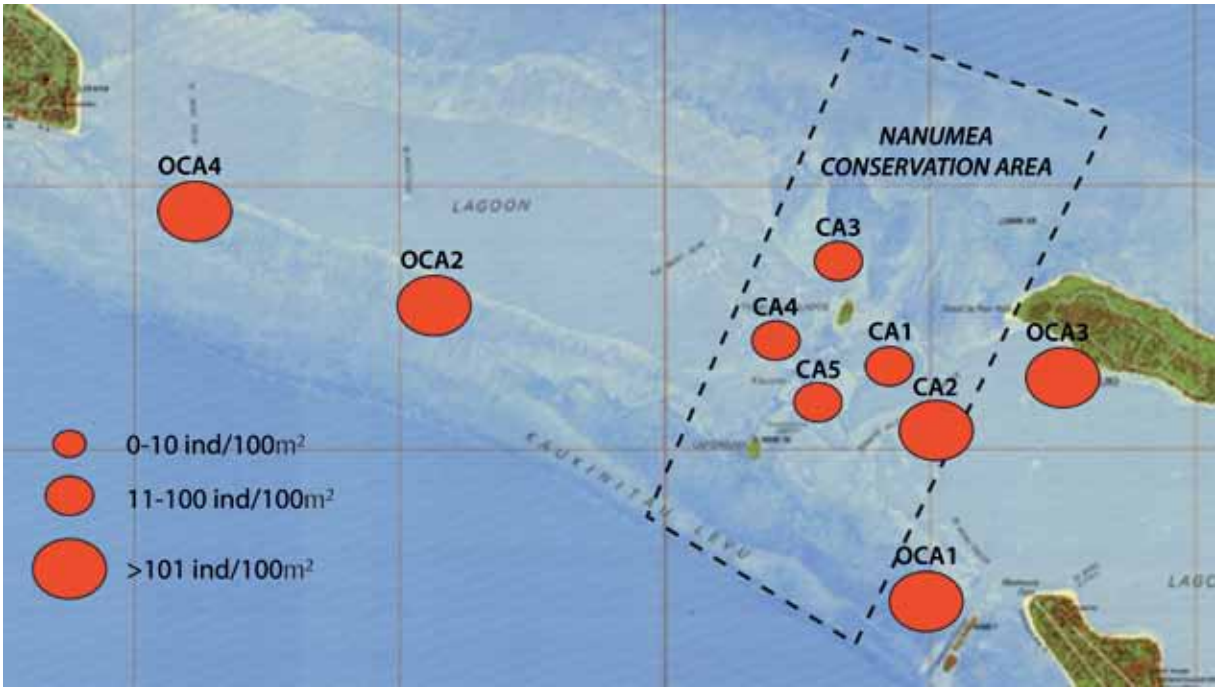


Figure 49. Mean total target macroinvertebrate density in Nanumea, calculated as the total number of individuals per hectare.

B. Edible macroinvertebrate density

Mean edible macroinvertebrate densities were low in Funafuti and Nukulaelae and moderate in Nanumea. Mean macroinvertebrate density was higher on Nanumea atoll (120.2 individuals per hectare +/- 122.6 SE) than on Nukulaelae (18.5 individuals per hectare +/- 11.6 SE) and Funafuti (9.9 individuals per hectare +/- 5.7 SE).

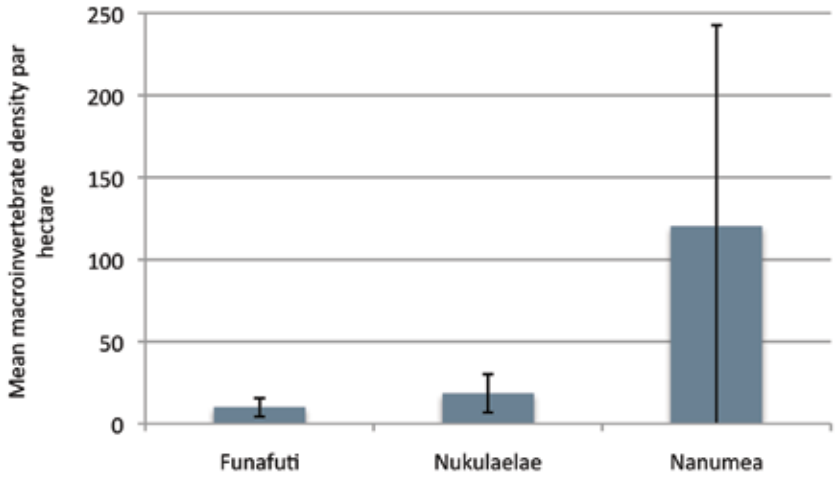


Figure 50. Mean density of edible macroinvertebrates on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

Comparing stations inside and outside the CAs *(Figure 51)*, we noted that:

- In Funafuti, mean edible macroinvertebrate density was similar inside and outside the FCA (11.2 ind./ha +/- 5.6 SE versus 8.6 ind./ha +/- 5.8 SE).

- In Nukulaelae, mean edible macroinvertebrate density was similar inside and outside the CA (16.1 ind./ha +/- 12.7 SE versus 20.9 ind./ha +/- 10.7 SE).

- In Nanumea, mean edible macroinvertebrate density was lower within the CA than outside (49.5 ind./ha +/- 37.5 SE versus 208.7 ind./ha +/- 69.1 SE). This difference was not significant.

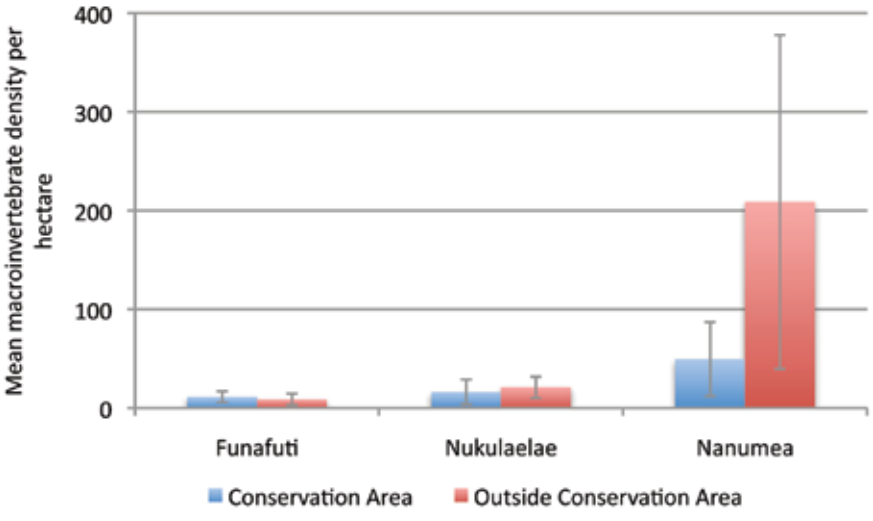


Figure 51. Mean density of edible macroinvertebrates inside and outside CAs, on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

In Funafuti, mean edible macroinvertebrate density was low at all stations, ranging from 0.6 to 48.0 individuals per hectare, with the highest density recorded at Teafualiku reef flat, Fualopa reef slope and Fualefeke reef flat.

Table 21. Edible macroinvertebrate densities (mean number of individuals/ha) recorded in Funafuti.

Status	Station	Mean density	SE	Status	Station	Mean density	SE
FCA	Fuafatu flat	12.6	6.3	Outside FCA	Tepuka flat	33.1	5.9
FCA	Fuafatu slope	14.9	6.4	Outside FCA	Tepuka slope	3.4	2.2
FCA	Fuafatu lagoon	5.7	1.9	Outside FCA	Tepuka lagoon	29.7	10.8
FCA	Fualopa flat	1.1	0.7	Outside FCA	Fualefeke flat	34.9	1.4
FCA	Fualopa slope	40.0	5.8	Outside FCA	Fualefeke slope	18.3	1.1
FCA	Fualopa lagoon	10.3	3.1	Outside FCA	Fualefeke lagoon	8.0	2.3
FCA	Tefala flat	19.4	1.7	Outside FCA	Teafualiku flat	48.0	5.8
FCA	Tefala slope	9.1	1.9	Outside FCA	Teafualiku slope	10.9	0.6
FCA	Tefala lagoon	0.6	0.6	Outside FCA	Teafualiku lagoon	5.7	1.5

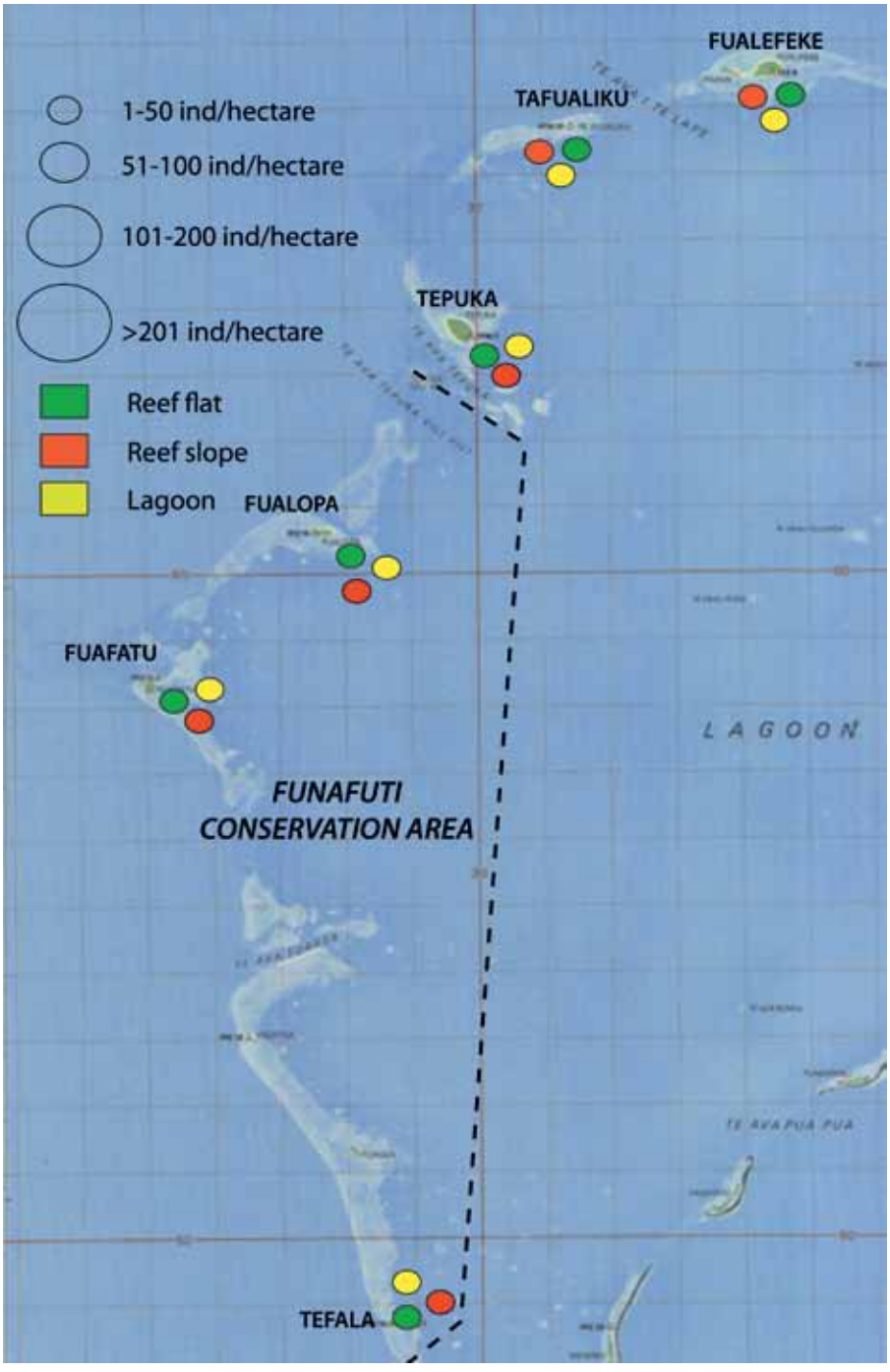


Figure 52. Mean edible macroinvertebrate density in Funafuti, calculated as the total number of individuals per hectare.

In Nukulaelae, mean edible macroinvertebrate density was low at all stations, ranging from 2.0 to 55.3 individuals per hectare, with the highest density recorded at CA5 and OCA5.

Table 22. Edible macroinvertebrate densities (mean number of individuals/ha) recorded in Nukulaelae.

Status	Station	Mean density	SE
Conservation Area	NKLCA1	10.0	2.0
Conservation Area	NKLCA2	2.0	0.0
Conservation Area	NKLCA3	7.3	1.8
Conservation Area	NKLCA4	6.0	3.1
Conservation Area	NKLCA5	55.3	11.8
Outside Conservation Area	NKLOCA1	21.3	19.3
Outside Conservation Area	NKLOCA2	14.7	7.7
Outside Conservation Area	NKLOCA3	12.0	4.2
Outside Conservation Area	NKLOCA4	18.0	8.3
Outside Conservation Area	NKLOCA5	38.7	7.4

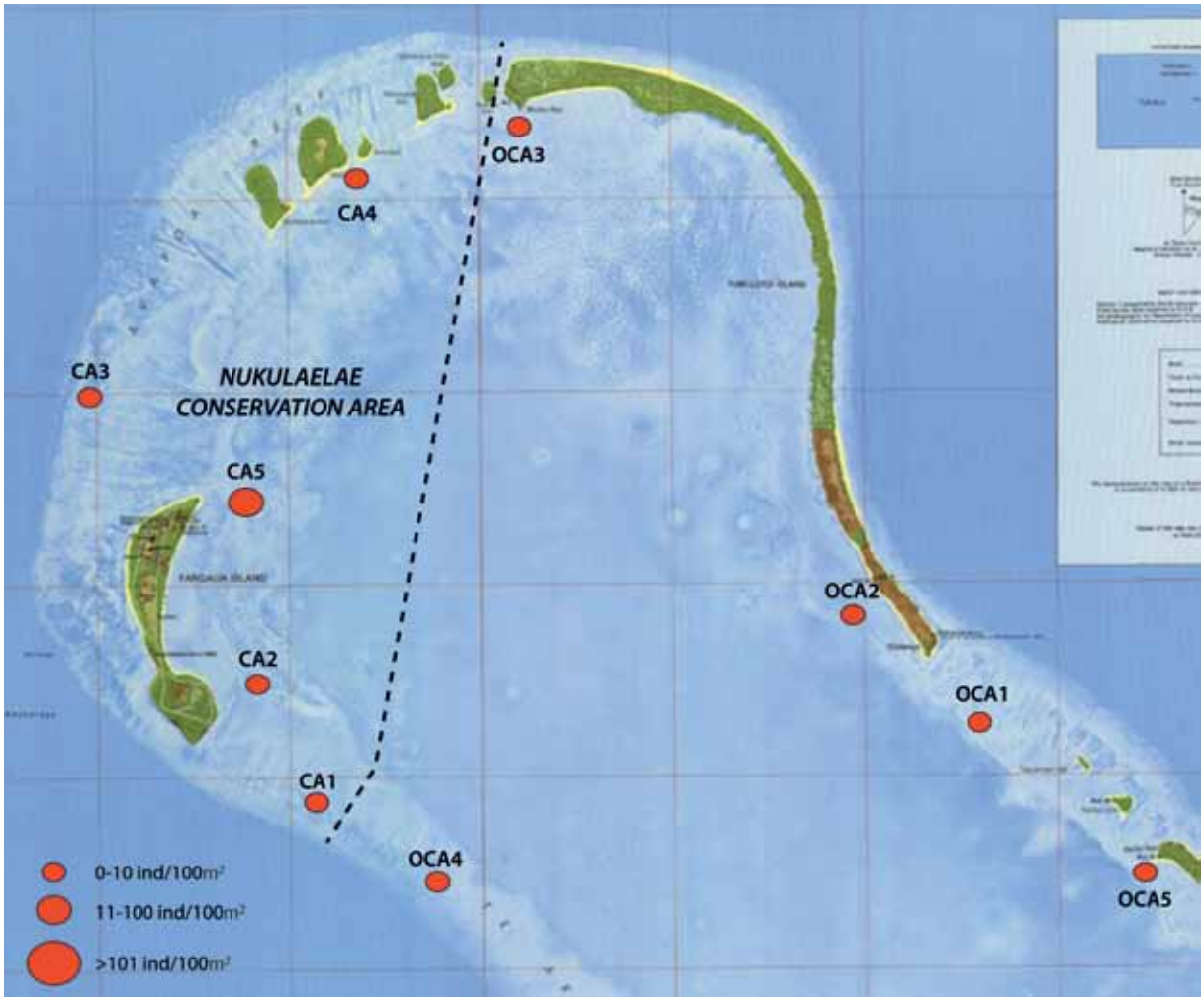


Figure 53. Mean edible macroinvertebrate density in Nukulaelae, calculated as the total number of individuals per hectare.

In Nanumea, mean edible macroinvertebrate density ranged from 1.3 to 513.3 individuals per hectare, with the highest density recorded on OCA4, OCA1 and CA2.

Table 23. Edible macroinvertebrate densities (mean number of individuals/ha) recorded in Nanumea.

Status	Station	density	SE
Conservation Area	NNMCA1	30.0	2.0
Conservation Area	NNMCA2	145.3	63.3
Conservation Area	NNMCA3	29.3	1.8
Conservation Area	NNMCA4	19.3	6.6
Conservation Area	NNMCA5	23.3	3.3
Outside Conservation Area	NNMOCA1	316.7	154.5
Outside Conservation Area	NNMOCA2	1.3	1.3
Outside Conservation Area	NNMOCA3	3.3	1.3
Outside Conservation Area	NNMOCA4	513.3	196.5

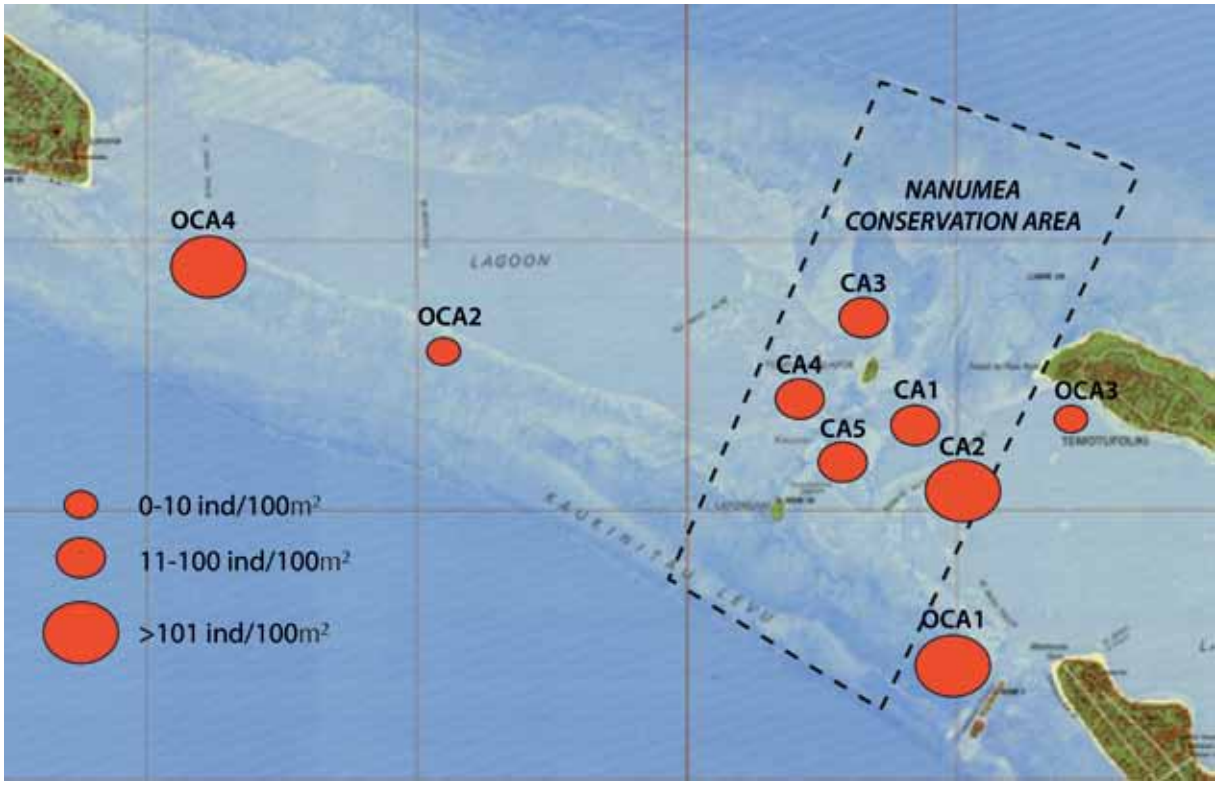


Figure 54. Mean edible macroinvertebrate density in Nanumea, calculated as the total number of individuals per hectare.

3.2.2. Sea cucumbers

Sea cucumbers play a vital role in the oceanic food web and are referred to as the earthworms of the sea. They literally clean the ocean floor. They have been used as food and medicine in Asia over many centuries. Currently, most of the species are exported from Tuvalu for food and a few species for the live aquarium trade. There is also an emerging market for the use of sea cucumbers in the pharmaceutical, nutriceutical and cosmetic industries. Sea cucumbers have been overexploited in Asia to supply the market and more recently this activity has expanded to more distant fishing grounds. Currently, harvesting occurs across most of the resource range, including remote parts of the Pacific (Kinch et al. 2008).

Due to this high demand from Asian countries, holothurian fisheries have rapidly evolved from traditional activities to more industrial fisheries throughout the Indo-Pacific (Friedman et al. 2008), involving the use of larger boats, diving equipment and bottom dredges. Sea cucumber collection is now made easier, even in remote places and deep-water locations.

Sea cucumbers are prone to over-fishing because of their biology: many species grow slowly and natural recruitment is highly variable between years. Historically, sea cucumbers were collected irregularly, and collection bouts were often separated by long periods of time, allowing time for the stock to recover. Moreover, there were areas that remained unfished. Today the situation is different, and many of the coastal villages in the Pacific have an agent for businesses that buys sea cucumbers. Fishers now harvest more frequently over wide areas and all year round. Stocks have little chance to recover.

A large variety of sea cucumber species are exploited worldwide, with new species being brought to market as some species become scarcer and more difficult to find. About thirty species are exploited in the Pacific, amongst which some have more value than others. *Table 24* lists the most valuable species harvested in Papua New Guinea, where the beche-de-mer fishery has been well documented (Lovatelli et al. 2004). Unfortunately no information could be accessed on Tuvalu's beche-de-mer fishery.

Table 24. High grade species of beche-de-mer (from Lovatelli et al., 2004).

Trade name	Scientific name
Sandfish	*Holothuria scabra,* and *H. scabra versicolor*
Black teatfish	*Holothuria whitmaei*
White teatfish	*Holothuria fuscogilva*
Greenfish	*Stichopus chloronotus*
Prickly redfish	*Thelenota ananas*
Surf redfish	*Actinopyga mauritiana*
Blackfish	*Actinopyga miliaris* and *Actinopyga spp.*
Stonefish	*Actinopyga lecanora*
Leopardfish	*Bohadschia argus*
Brown sandfish	*Bohadschia vitiensis*

In Tuvalu, sea cucumbers are locally known as funafuna, with almost no distinction between species except for the lolly fish (*Holothuria atra*) called loli and the black and white teatfish (*Holothuria whitmaei* and *Holothuria fuscogilva*) called funafuna faiu.

Under the *Fisheries Act 1978*, the Minister for Natural Resources of Tuvalu has full authority to promote the development of fishing and fisheries to ensure that fisheries resources are exploited for the benefit of Tuvalu. In 1978, the Fisheries Department received funding from the UNDP to assist the development of the sea cucumber industry, and resource surveys were conducted in all islands that have lagoons. Only Funafuti and Nukufetau were identified as having stocks of commercially valuable sea cucumbers. The Fisheries Department trained the local fishermen in sea cucumber harvesting to promote this industry. In 1979 and 1980 products were sold to overseas markets but local fishermen did not show much interest, and production and exportation stopped. From 1993 to 1995 local fishermen started again to exploit and export sea cucumbers to Singapore, Hong Kong and Fiji (Belhadjali 1997). The main species targeted for export were the white teatfish (*Holothuria fuscogilva*) and the black teatfish (*H. whitmaei*). Other species were harvested but in lower proportions: the prickly redfish (*Thelenota ananas*), the elephant trunkfish (*H. fuscopunctata*), the blackfish (*Actinopyga miliaris*), the surf redfish (*A. mauritiana*), the brown sandfish (*Bohadschia marmorata*) and the leopardfish (*B. argus*). *Table 25* shows the Tuvalu beche-de-mer production and composition between 1993 and 1995 (from Belhadjali 1997).

Table 25. Tuvalu beche-de-mer production and composition between 1993 and 1995.

Year	Total (kg)	Value (US$)	Species composition (%) by weight				
			White teatfish	Black teatfish	Prickly redfish	Elephant trunkfish	Other
1993	871	12,461	52.1	10.6	19.0	13.6	4.6
1994	3,678	40,004	67.4	0.6	14.1	5.1	12.8
1995	3,228	45,737	71.7	0.0	19.5	5.9	2.8

In terms of management, in 1997 it was stated that there were no regulations to manage the sea cucumber industry in Tuvalu (Belhadjali 1997). Additionally, in 1997, the Fisheries Department advocated a ban on the use of SCUBA and hookah to harvest sea cucumbers. At the end of the 2000s, a partnership in between an Asian company and a local enterprise started sea cucumber harvesting. The project ended in 2011.

During our investigations, whose primary goal was not to specifically assess sea cucumbers stocks but that included a count of these species and measurements of high-value commercial species when encountered, the following observations were made:

• The only high value sea cucumber species encountered was the curryfish, only seen once inside the Nukulaelae CA.

• Funafuti lagoon exhibits very low sea cucumber densities. The only species recorded was *Holothuria atra* (lollyfish or loli), which was observed in Fuafatu (within the FCA, 29 ind./ha) and Fualefeke (686 ind./ha) reef flats, at low densities.

• Nanumea and Nukulaelae lagoons exhibit moderate to high densities of sea cucumbers *(Figures 56 and 57)*, almost exclusively lollyfish. Some sites had very high densities: NNMOCA2 and NNMOCA3 for Nanumea and NKLCA2, NKLCA4, NKLCA5 and NKLOCA3 for Nukulaelae. Individuals of all sizes were recorded.

• The highest lollyfish densities were found in Nukulaelae lagoon, in similar abundance inside and outside the Nukulaelae CA.

• Apart from lollyfish, only few specimens of leopardfish (*Bohadschia argus*), amberfish (*Thelenota anax*, not recorded in the following tables because observed outside the transects) and curryfish (*Stichopus herrmanni*) were observed, at very low densities, in Nanumea and Nukulaelae only.

Figure 55. Sea cucumbers species recorded in the 3 atolls.

Table 26. Sea cucumber densities (number of individuals/hectare) recorded in Nanumea.

Status	Station	Lollyfish	Teatfish	Other species	
Conservation Area	NNMCA1	200	0	0	*Bohadschia argus*
Conservation Area	NNMCA2	0	0	0	
Conservation Area	NNMCA3	34	0	34	*Bohadschia argus*
Conservation Area	NNMCA4	1200	0	0	
Conservation Area	NNMCA5	50	0	0	
Outside CA	NNMOCA1	767	0	0	
Outside CA	NNMOCA2	14500	0	0	
Outside CA	NNMOCA3	9634	0	0	
Outside CA	NNMOCA4	34	0	0	

Table 27. Sea cucumber densities (number of individuals/hectare) recorded in Nukulaelae.

Status	Station	Lollyfish	Teatfish	Other species	
Conservation Area	NKLCA1	100	0	0	
Conservation Area	NKLCA2	6317	0	150	*Stichopus herrmanni* and *Bohadschia argus*
Conservation Area	NKLCA3	3067	0	34	*Bohadschia argus*
Conservation Area	NKLCA4	14500	0	0	
Conservation Area	NKLCA5	47750	0	0	
Outside CA	NKLOCA1	534	0	0	
Outside CA	NKLOCA2	3050	0	0	
Outside CA	NKLOCA3	44534	0	0	
Outside CA	NKLOCA4	34	0	0	
Outside CA	NKLOCA5	2734	0	0	

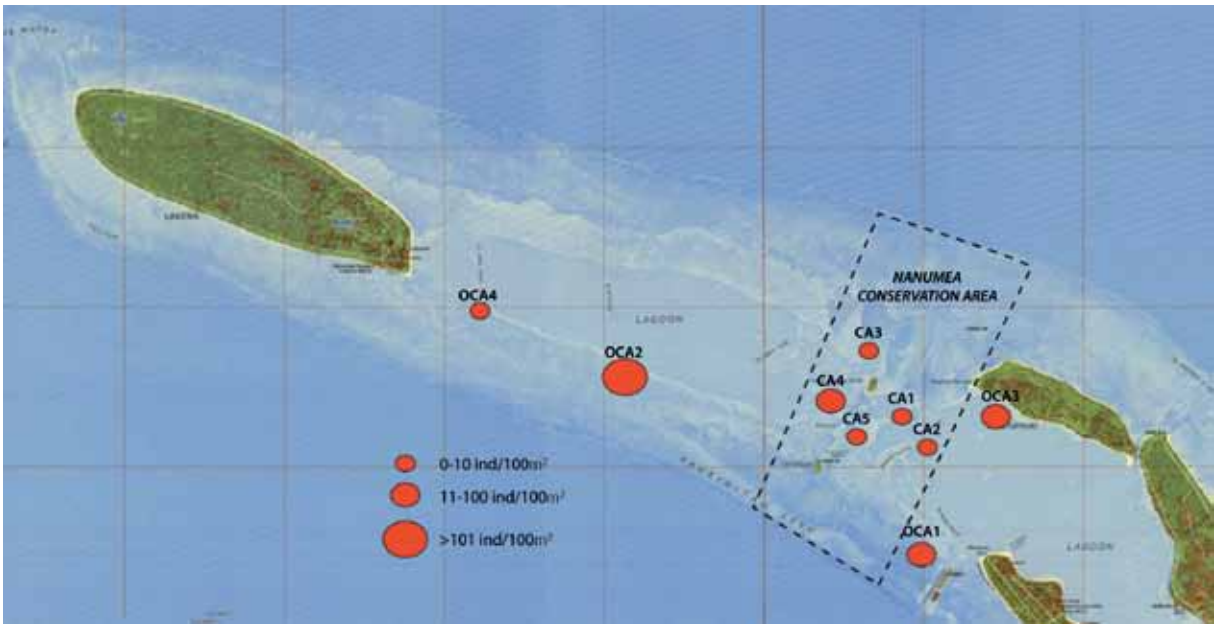


Figure 56. Sea cucumber population abundance and distribution in Nanumea lagoon.

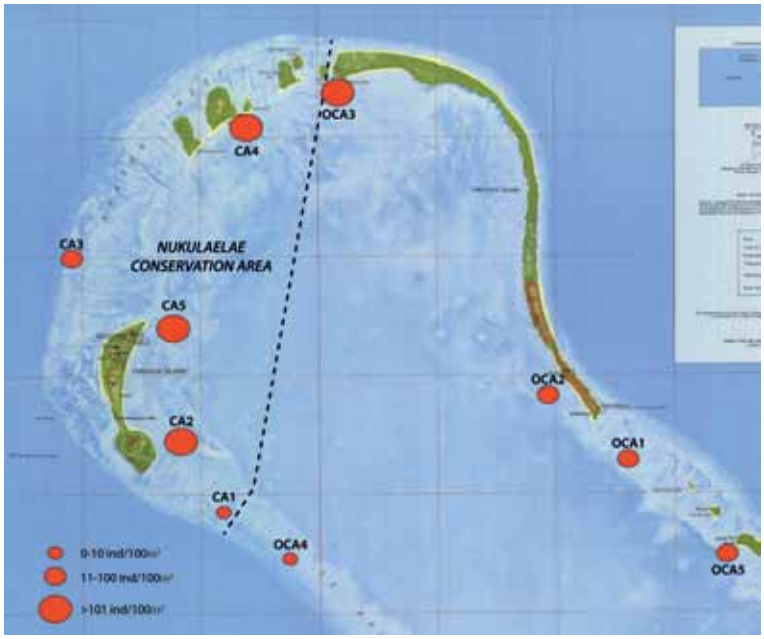


Figure 57. Sea cucumber population abundance and distribution in Nukulaelae lagoon.

It has to be stressed that investigations were conducted in shallow waters (<-5m) using free diving, and inside the lagoon exclusively.

To determine if a sea cucumber fishery is healthy, SPC and the WorldFish Center (Friedman et al. 2008) recommended the use of indicators, among which some may be useful to assess the health of the Tuvaluan sea cucumber stock without necessarily assessing the fishery as a whole.

Indicator 1: Presence of breeding groups: breeding groups of lollyfish exist in Nanumea and Nukulaelae, as we observed large and dense groups of lollyfish of all sizes (adults and juveniles). None was observed in Funafuti or for other species on the 3 atolls.

Indicator 2: Sea cucumber abundance: is it stable through time? From discussions with local fishermen and Fisheries officers it seems that funafuna and funafuna faiu abundances have sharply declined and have not recovered through time, on all 3 atolls. Lollyfish abundance appears stable through time (it is not exploited yet).

Indicator 3: Ratio of species abundance: are high-value and medium-value species still abundant and well represented in catches? Apparently not, owing that the only species recorded in high densities was the low-value lollyfish (*Holothuria atra*). High value species are now only found in deep and remote sites (from discussions with local divers working for the fishery).

In conclusion, our results support the fact that high value sea cucumber species are overexploited in Funafuti, Nanumea and Nukulaelae and there is a clear need for management and perhaps resource restocking.

Few words about the lollyfish…

The lollyfish, Holothuria atra*, has an important role in nutrient cycling as a sediment-feeder in coral reef ecosystems. This cycling of nutrients contributes to the high productivity in coral reefs.*

3.2.3. Giant clams

Giant clams (Fasua in Tuvaluan) are a significant component of Pacific islanders' diets. The clams are exploited for subsistence, for meat exports, for shells and for live exports for the marine aquarium trade (Teitelbaum and Friedman 2008). As with sea cucumbers, their stocks have severely declined through the combined effects of increasing human populations, pollution, habitat destruction and poaching. Furthermore, their biology is susceptible to overexploitation due their low growth rate. Due to these pressuresand slow recovery from overfishing, clams have been listed in Appendix II of CITES (1983) and are considered vulnerable under the IUCN Red List of Threatened Species (1996).

In order to assess clam stocks and the potential for clam **mariculture** in Tuvalu, field assessments were carried out in 1988 and 1990 in Nukufetau, Nukulaelae, Funafuti, Nanumea and Nui (Braley 1988; Langi 1990; Taconi and Tisdell, 1991). The species reported to be present at that time were *Tridacna maxima* and *T. squamosa* in Funafuti and Nukulaelae, the former being the dominant specie on both atolls. *T. squamosa* was recorded as either very rare or locally extinct in 1990 in Nukulaelae. Shells of *T. gigas* were found, but no live animals were recorded. In Nanumea only *T. maxima* was observed. *T. crocea* does not naturally occur in Tuvalu (Tacconi and Tisdell 1990). Stock estimates were considered "quite modest" in Funafuti (101 clams per hectare) and "very low" in Nukulaelae (3.1 clams per hectare). In Nanumea, clam densities were even lower than in Nukulaelae, with 0.6 clams per hectare. The authors suggested that these low densities indicated a certain degree of depletion, and that this depletion could possibly be attributed to human activities. This was confirmed by villagers interviewed during Langi's survey (Langi 1990), who suggested that clam numbers have decreased over time, resulting in an increase in the importance of fish over clams in their diet.

In October 1988, one thousand *Tridacna derasa* (a non-autochthonous species) were introduced to Tuvalu from Palau for restocking purposes. In 1990, 146 individuals of this stock were still alive, 64 in 2000 and only 8 individuals were left in 2011. The main reason of this decrease is human exploitation (T. Poulasi, pers. comm.).

More recently, Sauni (2000) pointed out that giant clam stocks were very low on all Tuvaluan islands and that people were rarely eating them. Giant clams in Tuvalu are especially susceptible to recruitment failure if the stock levels fall below sustainable limits (Belhadjali 1998).

During our surveys, clam abundance and size were recorded (location, mean sizes and abundance are given in the descriptive sheets for each station) along belt transects during the macroinvertebrate survey. No live clams were observed on the outer atolls (Nanumea and Nukulaelae).
In Nanumea, we observed thousands of dead shells, still attached to rocks or broken and piled onto the seabed, especially at stations inside the CA. Langi, Apinelu and Naseli also observed this phenomenon in 1990: dead shells of *Tridacna maxima* were very numerous. No living giant clams were found in the lagoon (Apinelu 1990). Through discussion with local people, it appears that clam mortality occurred a long time ago ("when old people were still young") and that the clams were not eaten.
Some people said that mortality occurred at the time of the American Passage blasting in 1943. The hypothesis of an extinction caused by a disease is unlikely, as there is no record on Tridacna maxima extinction in the Pacific due to "natural" causes. Lastly, old people from the atoll believe that the clams were killed by an act of God. Even though it is impossible to determine the exact cause of this die-off, our observations support the hypothesis of historical human exploitation of clams.

During our surveys, clams were only observed in Funafuti lagoon, mainly within the FCA. Three species were identified: *Tridacna maxima* (the most abundant), *T. squamosa* and *T. derasa*. The highest density was recorded on the Fualopa reef slope. Fuafatu reef also had high clams densities in all habitats (*Table 28*).

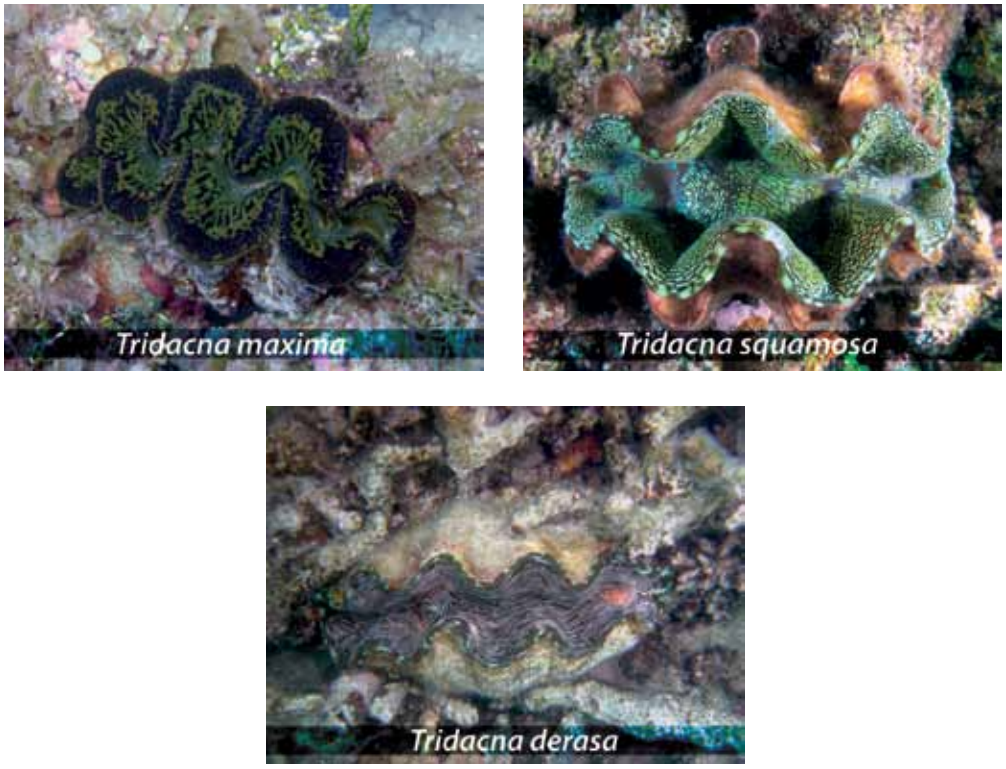


Figure 58. The 3 species of clams observed in Funafuti.

Table 28. Clam densities (number of individual/hectare) recorded in Funafuti.

Status	Station	Density	Status	Station	Density
FCA	Fuafatu flat	214	Outside FCA	Tepuka flat	14
FCA	Fuafatu slope	200	Outside FCA	Tepuka slope	29
FCA	Fuafatu lagoon	171	Outside FCA	Tepuka lagoon	57
FCA	Fualopa flat	0	Outside FCA	Fualefeke flat	0
FCA	Fualopa slope	714	Outside FCA	Fualefeke slope	14
FCA	Fualopa lagoon	57	Outside FCA	Fualefeke lagoon	0
FCA	Tefala flat	14	Outside FCA	Teafualiku flat	43
FCA	Tefala slope	86	Outside FCA	Teafualiku slope	0
FCA	Tefala lagoon	0	Outside FCA	Teafualiku lagoon	14

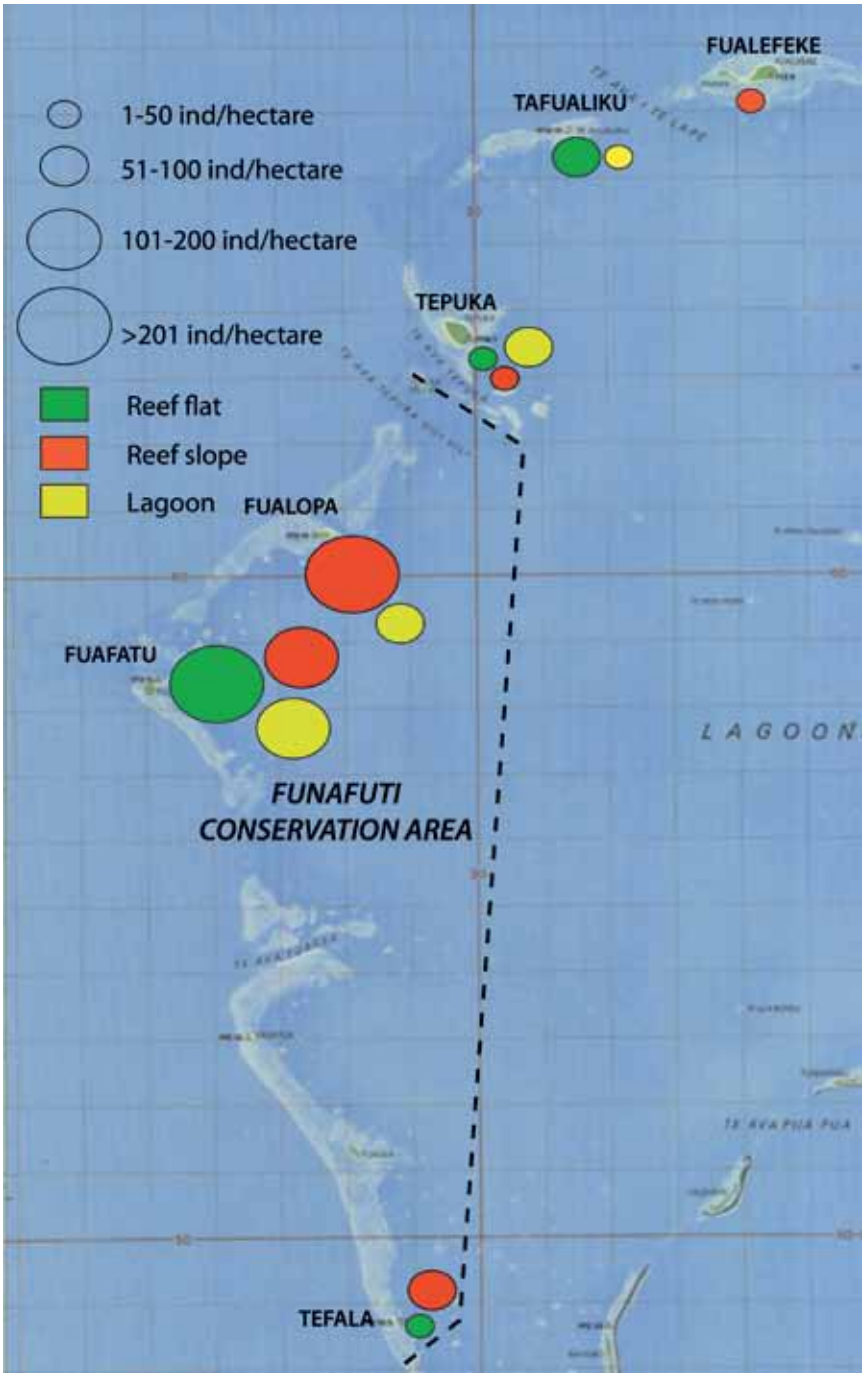


Figure 59. Clam population abundance and distribution in Funafuti lagoon.

3.2.4. *Trochus*

Trochus, also known as topshells (Munikau in Tuvaluan), are fished for their shells to be used as buttons, ornaments (as exports), and their meat is traditionally consumed.

Fisheries Department officers conducted an assessment on *Trochus* population in Nanumea in 1990. They were found to be abundant in the surf zone of the outer reef, but no individuals were recorded inside the lagoon. Only one specimen was observed during the first survey of the FCA (Kaly, 1997). Unfortunately, data from the second survey (1999) and subsequent years could not be consulted, preventing any further comparison through time.

There have been several attempts to reintroduce *Trochus* to Tuvalu *(Table 29)* for restocking purposes. It seems that they have poorly established in Tuvaluan waters: the Fisheries Department recently conducted several surveys to assess the transplanted *Trochus s*tock and they only found few specimens left (less than 20 animals), in front of Amatuku islet (T. Poulasi, pers. comm.).

Table 29. Trochus introductions to Tuvalu (from Gillett, 1993).

Date	Areas	Details	Source
1985	Fiji (Viti Levu) to Funafuti	181 shells transferred in 3 air shipments. Successful. Larger transfer planned	Parkinson 1984
1987	Fiji to Funafuti	200 trochus transported on commercial aircraft, 20 died in transit.	Petaia, pers. comm.
1988	Aitutaki (Cook Islands) to Tuvalu	1336, 2672, and 844 shells transferred to Nukulaelae, Funafuti, and Nukufetau respectively using military aircraft and parachutes.	Gillett 1988
1989	Aitutaki (Cook Islands) to Tuvalu	1000 and 600 shells transferred to Nui and Nanumea, using military aircraft and parachutes.	Gillett 1989

During our survey of the outer atolls, no *Trochus* were found in Nanumea and few specimens were recorded in Nukulaelae, exclusively on the inner barrier reef flat where surge and tidal currents are strong. *Trochus* were observed in similar densities inside and outside the CA, the highest densities being recorded on the west-facing side of the atoll, which was described as the exposed side.

In Funafuti, *Trochus* were found in very low densities on almost all reef flats (except Fualefeke reef flat) and in low densities in Tefala and Fualopa reef slopes (both included in the FCA) and Teafualiku and Tepuka lagoonal sites (outside the FCA). These values have to be interpreted with caution as there may be a risk of identification error between *Trochus niloticus* and other trochids, such as *Tectus pyramis* or *Trochus maculatus*, which are non-commercial species usually occurring together with *Trochus niloticus*, and occupying the same ecological niche.

Figure 60. Trochid species commonly found in Pacific coral reefs.

Table 30. Trochus niloticus densities (number of individual/hectare) recorded in Nukulaelae and Funafuti.

Status	Station	Density	Status	Station	Density
Conservation Area	NKLCA1	134	FCA	Fuafatu flat	14
Conservation Area	NKLCA2	0	FCA	Fuafatu slope	0
Conservation Area	NKLCA3	17	FCA	Fuafatu lagoon	0
Conservation Area	NKLCA4	0	FCA	Fualopa flat	14
Conservation Area	NKLCA5	0	FCA	Fualopa slope	71
Outside CA	NKLOCA1	17	FCA	Fualopa lagoon	0
Outside CA	NKLOCA2	0	FCA	Tefala flat	14
Outside CA	NKLOCA3	0	FCA	Tefala slope	29
Outside CA	NKLOCA4	150	FCA	Tefala lagoon	0
Outside CA	NKLOCA5	0	Outside FCA	Tepuka flat	14
			Outside FCA	Tepuka slope	0
			Outside FCA	Tepuka lagoon	14
			Outside FCA	Fualefeke flat	0
			Outside FCA	Fualefeke slope	0
			Outside FCA	Fualefeke lagoon	0
			Outside FCA	Teafualiku flat	43
			Outside FCA	Teafualiku slope	0
			Outside FCA	Teafualiku lagoon	14

3.2.5. Other targeted species used as food sources

A. *Turbo* sp.

The main species of turban shells (Alili in Tuvaluan) harvested in the South Pacific are the green snail (*Turbo marmoratus*), the rough turban (*T. setosus*) and the silver-mouth turban (*T. argyrostomus*). *T. setosus* and *T. argyrostomus* are mainly targeted for food in the South Pacific region and their shells are discarded whereas the green snail has a nacreous shell which is highly prized for inlay material for lacquerware, furniture and jewellery. Green snails have been commercially exploited throughout tehir Indo-Pacific range for at least a century. Due to tehir slow rate of regeneration after fishing, green snails population are now in decline in many Pacific countries (Yamaguchi, 1993).

Two species of turban shells were observed throughout the survey: *Turbo petholathus* and *T. setosus*. They were rare, as only two specimens were recorded during the outer atoll surveys. Both were seen inside the Nukulaelae CA at station NKLCA1 (inner barrier reef flat on the exposed side of the atoll) and none was found in Nanumea lagoon. In Funafuti, turban shells were also very scarce. They were observed at 4 stations: Fuafatu reef flat, Tefala reef slope and Fualefeke lagoon (29 specimens per hectare at each station) and Teafualiku reef flat (highest density recorded: 129 specimens per hectare). However, the preferred habitats for turban shells were not investigated (reef crests).

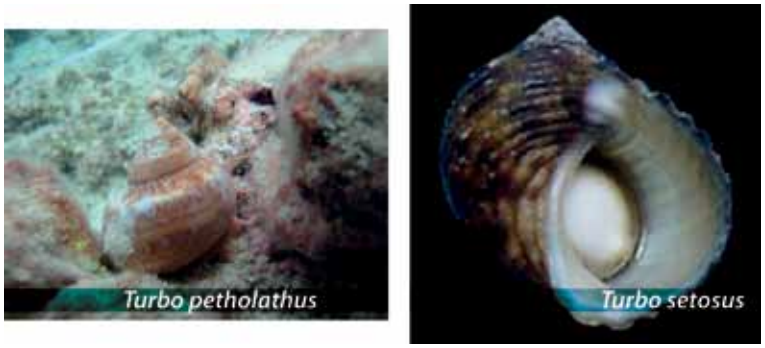


Figure 61. Species of turban shells recorded in Tuvalu.

B. *Strombus luhuanus*

The strawberry conch (*Strombus luhanus*, Panea in Tuvaluan) was found at almost all sites visited, it is a common species in Tuvaluan lagoons. In Nanumea, densities were low, ranging from 0 to 43 individuals per hectare. Densities were similar inside and outside the CA. In Nukulaelae, they were more numerous outside the CA, except NKLCA5 (reef flat in front of Fangaua islet), which supported the highest density (1383 individuals per hectare). In Funafuti, strawberry conchs were found at all stations, with the highest densities recorded in Tepuka lagoon (643 individuals per hectare) and reef flat (457 individuals per hectare).

Table 31. Strawberry conch densities (number of individuals/ha) recorded in Funafuti, Nukulaelae and Nanumea.

Status	Station	Density	Station	Density	Station
FCA	Fuafatu flat	57	NKLCA1	67	NNMCA1
FCA	Fuafatu slope	186	NKLCA2	0	NNMCA2
FCA	Fuafatu lagoon	29	NKLCA3	67	NNMCA3
FCA	Fualopa flat	14	NKLCA4	67	NNMCA4
FCA	Fualopa slope	186	NKLCA5	1383	NNMCA5
FCA	Fualopa lagoon	171	NKLOCA1	400	NNMOCA1
FCA	Tefala flat	86	NKLOCA2	100	NNMOCA2
FCA	Tefala slope	29	NKLOCA3	200	NNMOCA3
FCA	Tefala lagoon	0	NKLOCA4	267	NNMOCA4
Outside FCA	Tepuka flat	457	NKLOCA5	167	
Outside FCA	Tepuka slope	57			
Outside FCA	Tepuka lagoon	643			
Outside FCA	Fualefeke flat	57			
Outside FCA	Fualefeke slope	14			
Outside FCA	Fualefeke lagoon	29			
Outside FCA	Teafualiku flat	171			
Outside FCA	Teafualiku slope	14			
Outside FCA	Teafualiku lagoon	29			

C. Spondyles

There is very little information on Spondyles (Hopu nifo and Hopu teka in Nanumea; Sopuu in Nukulaelae and Funafuti) from the literature, apart from a survey dedicated to valuable macroinvertebrates in Nui and Nanumea conducted in 1990 (Apinelu, 1990). At that time they were reported to be very numerous in Nanumea lagoon but no density estimates were given. Kaly (1997) also reported the presence of *Spondylus* within the FCA, at very low densities: only 2 individuals were found throughout the whole FCA baseline survey.

Our survey indicates that high densities of Spondyles are found in Nanumea and Nukulaelae lagoons (up to 800 individuals per hectare; *Table 32*). In Nanumea, higher densities were recorded inside the CA, with an average density of 150 individuals/hectare within the CA versus 34 individuals/hectare outside the CA. Station NNMCA2 had the highest density with 436 individuals/hectare. In contrast, in Nukulaelae, Spondyle densities were higher outside the CA, with an average density of 260 individuals/hectare outside the CA versus 27 individuals/hectare inside the CA. Station NKLOCA5 had the highest density with 800 individuals/hectare.

Spondyles are found in Funafuti lagoon, but at very low densities: 14 individuals per hectare at each station (i.e. 1 individual per station). They are most often observed at lagoonal stations (Fuafatu, Tefala, Tepuka).

Figure 62. Spondyle species observed in Tuvalu.

Table 32. Spondyle densities (number of individuals/ha) recorded in Funafuti, Nukulaelae and Nanumea.

Status	Station	Density	Station	Density	Site	Density
FCA	Fuafatu flat	0	NKLCA1	17	NNMCA1	43
FCA	Fuafatu slope	0	NKLCA2	50	NNMCA2	436
FCA	Fuafatu lagoon	14	NKLCA3	0	NNMCA3	54
FCA	Fualopa flat	0	NKLCA4	67	NNMCA4	95
FCA	Fualopa slope	0	NKLCA5	0	NNMCA5	124
FCA	Fualopa lagoon	0	NKLOCA1	117	NNMOCA1	109
FCA	Tefala flat	0	NKLOCA2	267	NNMOCA2	0
FCA	Tefala slope	14	NKLOCA3	100	NNMOCA3	0
FCA	Tefala lagoon	14	NKLOCA4	17	NNMOCA4	29
Outside FCA	Tepuka flat	0	NKLOCA5	800		
Outside FCA	Tepuka slope	0				
Outside FCA	Tepuka lagoon	14				
Outside FCA	Fualefeke flat	0				
Outside FCA	Fualefeke slope	0				
Outside FCA	Fualefeke lagoon	0				
Outside FCA	Teafualiku flat	0				
Outside FCA	Teafualiku slope	0				
Outside FCA	Teafualiku lagoon	0				

D. Other bivalves*: Chama spp.* and arks

Chama species (Hopu papa in Tuvaluan) and arks (*Arca ventricosa* and *Barbatia* sp., Kohi in Tuvaluan) were only assessed in Nanumea, as from discussion with local people it seems that only Nanumean people consume them. These species were observed at all stations except NNMCA1 and NNMOCA2. Very high densities were recorded outside the CA, in NNMOCA1 (3700 Hopu papa and 4067 Kohi per hectare) and in NNMOCA4 (5150 Hopu papa and 7633 Kohi per hectare).

Figure 63. Other bivalves recorded in Nanumea.

Table 33. Chama sp. and ark densities (number of individuals/hectare) recorded in Nanumea.

Status	Station	*Chama* sp.	Arks
Conservation Area	NNMCA1	0	0
Conservation Area	NNMCA2	100	2567
Conservation Area	NNMCA3	50	67
Conservation Area	NNMCA4	33	133
Conservation Area	NNMCA5	133	50
Outside CA	NNMOCA1	3700	4067
Outside CA	NNMOCA2	0	0
Outside CA	NNMOCA3	17	33
Outside CA	NNMOCA4	5150	7633

E. Octopus and lobsters

One octopus (Feke in Tuvaluan) and one lobster (Tapa tapa in Tuvaluan) were recorded during the survey, both in Nanumea lagoon, on NNMCA5 and NNMCA1 respectively (both inside the CA). Locations visited throughout our survey were not necessarily the ideal habitat for these animals, especially for lobsters that are usually seen in crevices of the reef crest at low tide and at night. Octopuses hide under rocks and in crevices, which make them difficult to see when conducting free-diving visual census.

3.2.6. Species used for handicraft

Shell handicrafts have a strong traditional significance for the people of the islands of Tuvalu. For instance, shell jewellery used to be prized on Vaitupu. On special occasions the men of Niutao would wear a headband woven from women's hair decorated with six or seven cowrie shells. Excavations of ancient graves on Vaitupu and Nukufetau yielded necklaces and pendants made from mother-of-pearl and cowrie shells, among other things (Tiraa-Passfield, 1996). Today, shell handicrafts are given to relatives or friends departing Tuvalu. They are also given to guests at special functions, visiting high-ranking officials, and are worn by men and women when performing the fatele (a local dance).

Five main species of shells are used in handicraft production: 2 species of white cowrie (Pule Kena in Tuvaluan), *Cypraea annulus*, the gold-ring cowrie, and *C. moneta*, the money cowrie, and one species of black cowrie (Pule Uli in Tuvaluan): *C. caputserpentis*, the snakehead cowrie. The money cowrie is the most abundant and the most widely used for handicraft. Two species of land gastropods are also used: *Melambus luteus* and *M. fasciatus*, both referred as misa (Tiraa-Passfield, 1996). Other species used for handicraft in Tuvalu include cones (Uga, Fakamili), spider conchs (Kalea, Mataga) and pearl oysters (Tifa).

Cowries are collected by women and children, with bare hands, at low tide. They are mainly found under coral rocks in intertidal pools on the lagoon reef flat. It is said that pule kena is easier to catch when it is rainy or at night, as they make their way to the surface of the rocks.

A. Cowries

In the present study we did not investigate land gastropods, therefore we will only present our results on cowrie abundance and distribution. Additionally our values are certainly under-estimates, as we did not overturn rocks to look for animals.

- The dominant species of cowrie encountered was *Cypraea moneta*. Other species observed were *Cypraea annulus, C. helvola, C. erosa* and *C. tigris.*
- Cowries were found at all 3 atolls visited, at low densities except at 2 stations in Nanumea where they were abundant (1350-1933 ind./ha).
- Cowries were more abundant in Nanumea than in Nukulaelae or Funafuti.

Status	Station		Station		Station	
FCA	Fuafatu flat	0	NKLCA1	33	NNMCA1	67
FCA	Fuafatu slope	43	NKLCA2	17	NNMCA2	217
FCA	Fuafatu lagoon	29	NKLCA3	17	NNMCA3	83
FCA	Fualopa flat	200	NKLCA4	00	NNMCA4	667
FCA	Fualopa slope	43	NKLCA5	83	NNMCA5	617
FCA	Fualopa lagoon	0	NKLOCA1	67	NNMOCA1	1933
FCA	Tefala flat	100	NKLOCA2	0	NNMOCA2	1350
FCA	Tefala slope	14	NKLOCA3	133	NNMOCA3	367
FCA	Tefala lagoon	14	NKLOCA4	33	NNMOCA4	467
Outside FCA	Tepuka flat	171	NKLOCA5	17		
Outside FCA	Tepuka slope	0				
Outside FCA	Tepuka lagoon	57				
Outside FCA	Fualefeke flat	114				
Outside FCA	Fualefeke slope	0				
Outside FCA	Fualefeke lagoon	0				
Outside FCA	Teafualiku flat	143				
Outside FCA	Teafualiku lagoon	71				
Outside FCA	Teafualiku slope	14				

Table 34. Cowrie densities (number of individuals/ha) recorded in Funafuti, Nukulaelae and Nanumea.

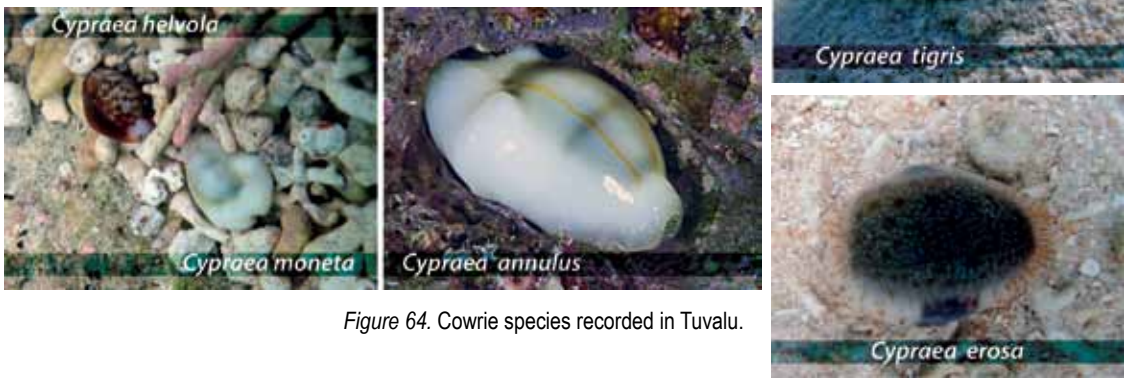


Figure 64. Cowrie species recorded in Tuvalu.

B. Cones

Several species of cones (Uga, Fakamili) were observed: *Conus capitaneus*, *C. cf. frigidus*, *C. chaldeus*, *C. ebraeus*, *C. leopardus, C. litteratus, C. lividus, C. miles, C. planorbis, C. pulicarius* and *C. rattus*. No species was dominant. Cones were seen at almost all stations except Funafuti lagoonal sites. They were mainly found on shallow reef flats, on rubble or partially buried in sand. Their abundances ranged from 2 to 670 individuals per hectare. Some sites showed higher densities of cones, including:

- For Funafuti: Fualopa reef flat (530 ind./ha) and Teafualiku and Fuafatu reef flats (both 200 ind./ha).
- For Nukulaelae: NKLCA1 (250 ind./ha).
- For Nanumea: NNMOCA3 (670 ind./ha), NNMCA3 (320 ind./ha), NNMOCA2 (270 ind./ha), NNMOCA1 (230 ind./ha) and NNMCA5 (200 ind./ha).

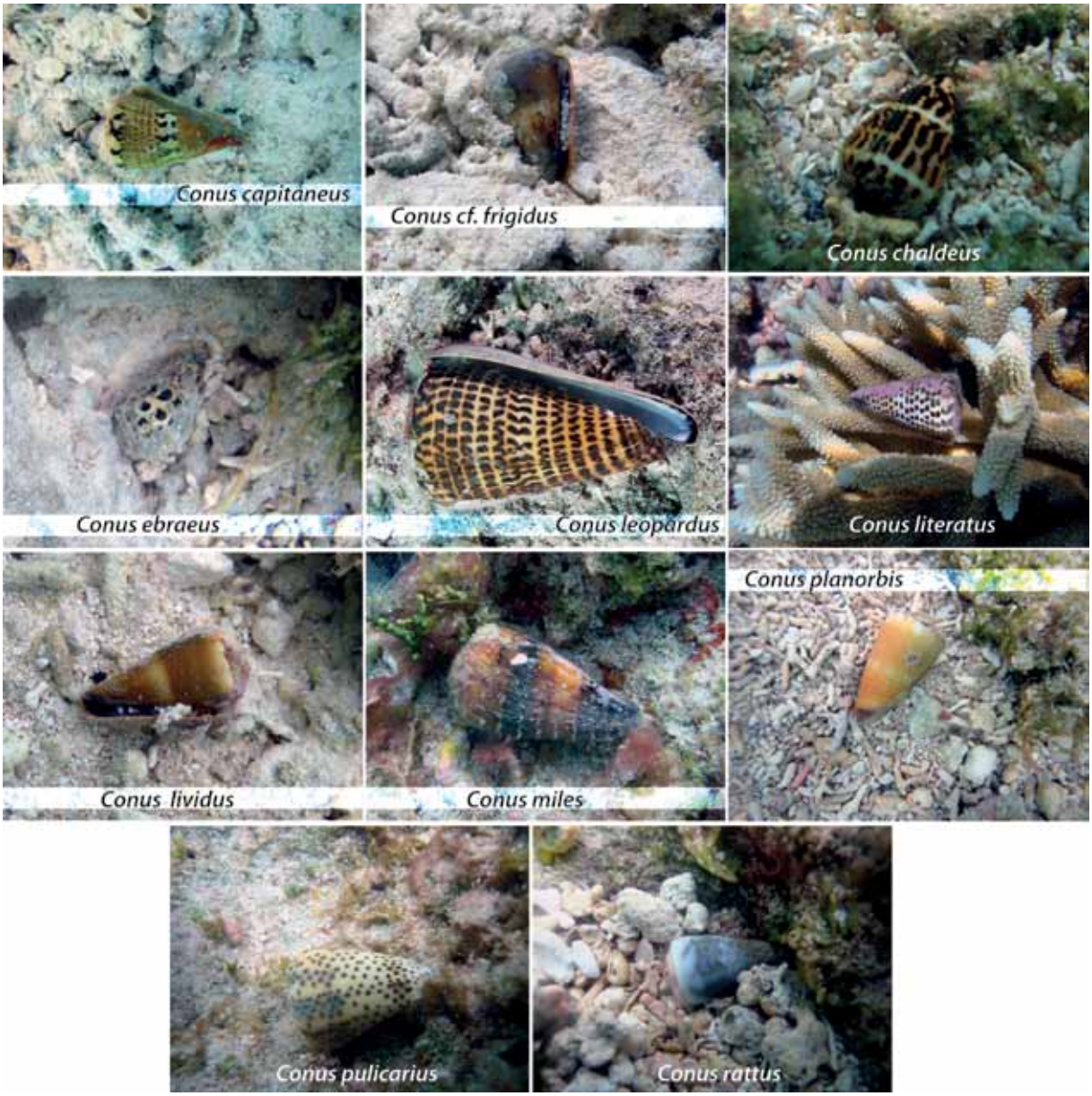


Figure 65. Cone species recorded in Tuvalu.

C. Spider conchs

Spider conchs (Kalea, Mataga) are used for handicraft and as food items.

Two species of spider conch were observed during our surveys: *Lambis chiragra* and *L. truncata* (the giant spider conch). The common spider conch (*Lambis lambis)* was not recorded. This absence was also noted in 1984 by Parkinson who did an extensive survey on shell resources in Funafuti (Parkinson, 1984). He stated that the common spider shell seemed to have been replaced by the giant spider shell (*Lambis truncata*).

Figure 66. Spider conch species recorded in Tuvalu.

Spider shells were mainly found in Funafuti lagoon, whereas none was observed in Nanumea and only 2 individuals were counted in Nukulaelae (at stations NKLCA4 and NKLOCA4).

In Funafuti, spider conchs were more abundant within the FCA than outside the FCA: Tefala reef flat and reef slope exhibited the highest densities (43 ind./ha at both stations), Fualopa reef slope and lagoon (29 ind./ha at both stations) and Fuafatu reef slope (10 ind./ha). Some individuals were also seen outside the FCA: Fualefeke reef flat and Tepuka lagoon (respectively 29 and 14 ind./ha). From previous reports (Parkinson, 1984) it seems that this resource has declined as it was considered a common food item 20 years ago.

D. Pearl oysters

The two main commercially significant species of pearl oyster (Tifa in Tuvaluan) in the South Pacific are the black-lip pearl oyster *Pinctada margaritifera* and the gold-lip or silver-lip pearl oyster *P. maxima*. Pearl oysters have been traditionally used in the production of fishing lures in the South Pacific. Globally they are in demand for their shell and cultured pearls (Preston et al., 1990).

In 1990, residents of Nukulaelae stated that the pearl oyster was common and easy to find in Nukulaelae relative to other Tuvaluan islands. Despite that, after intensive searching using SCUBA at 19 lagoonal sites, only 4 live specimens were found, which was considered low. Additionally, the Fisheries Department conducted a survey on the status of clams, pearl oysters and bêche-de-mer in Nanumea in 1990 and none were recorded after extensive SCUBA search (Apinelu, 1990).

There is currently a pilot project, initiated in 2008 by the Fisheries Department in Funafuti lagoon, to investigate the potential for developing the pearl industry. So far, it seems that the natural resource is too low to support this industry. The Fisheries department is conducting a spat collection program to improve natural stock (T. Poulasi, pers. comm.).

During our survey, only one pearl oyster was recorded, in Funafuti atoll, more specifically at the Tepuka lagoonal station.

3.2.7. Other targeted species

A. *Cerithium nodulosum*

The nodulose coral creeper (Sipo in Tuvaluan) is a species of sea snail, a marine gastropod (mollusc) of the family Cerithiidae. It has a very wide distribution encompassing the Pacific, the Indian Ocean, the Red Sea, the Mediterranean Sea and other European waters (source: WoRMS[3]). It is generally considered an abundant species in shallow sandy area close to coral reefs, especially in the Indo-Pacific. Sipo shells can be sold as curios but must often they are used locally as bait, especially in Nukulaelae and Funafuti.

They may be also used in Nanumea but at the time of the survey Nanumean residents had not divulged this information. Therefore sipo were not assessed in Nanumea.

Sipo were not very abundant in Funafuti despite the presence of favourable habitats (sandy seabed), which might reflect their exploitation by local fishermen. In Nukulaelae they were numerous both inside and outside the CA, with the highest density recorded in NKLCA1 (517 ind./ha), NKLOCA3 (383 ind./ha) and NKLOCA4 (317 ind./ha).

Table 35. Cerithium nodulosum densities (number of individuals/ha) recorded in Funafuti and Nukulaelae.

Status	Station		Station	
FCA	Fuafatu flat	0	NKLCA1	517
FCA	Fuafatu slope	0	NKLCA2	0
FCA	Fuafatu lagoon	0	NKLCA3	100
FCA	Fualopa flat	0	NKLCA4	67
FCA	Fualopa slope	0	NKLCA5	33
FCA	Fualopa lagoon	0	NKLOCA1	17
FCA	Tefala flat	0	NKLOCA2	83
FCA	Tefala slope	0	NKLOCA3	383
FCA	Tefala lagoon	0	NKLOCA4	317
Outside FCA	Tepuka flat	0	NKLOCA5	17
Outside FCA	Tepuka slope	0		
Outside FCA	Tepuka lagoon	71		
Outside FCA	Fualefeke flat	14		
Outside FCA	Fualefeke slope	0		
Outside FCA	Fualefeke lagoon	0		
Outside FCA	Teafualiku flat	100		
Outside FCA	Teafualiku slope	0		
Outside FCA	Teafualiku lagoon	14		

B. Coral predators: *Acanthaster planci* and *Drupella* snails

The crown-of-thorns starfish (COTs) *Acanthaster planci* (Kalauna in Tuvaluan) is a major predator of corals, and although a normal member of coral communities, widespread population outbreaks have caused dramatic reductions in coral cover on Indo-Pacific coral reefs (Endean, 1982). High densities of *A. planci* tend to modify the coral communities in terms of diversity and abundance, with flow-on effects on reef-associated plants and animals (Carpenter 1997). The causes of such explosions are still not well understood (Pratchett 2005), however it was believed in the past that the depletion of its 2 main predators (the triton snail (*Charonia tritonis*), and the humphead wrasse (*Cheilinus undulatus*)) might place a role in the frequency and severity of recent outbreaks. Heavy terrestrial runoff is also believed to be involved in recent outbreaks as subsequent algal bloom may provide food for *Acanthaster* larvae. Another possible cause would be the natural fluctuation of COTs populations. COTs feeding scars are very distinctive, leaving extensive white areas devoid of live tissue as it progresses. Coral colonies are usually only partially consumed.

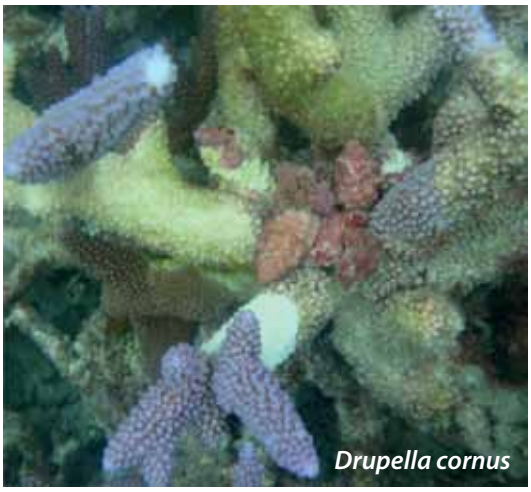
[3] World Register of Marine Species. www.marinespecies.org

Like most other sea stars, the COTs extrudes its gastric folds to digest its prey externally. This feeding method allows these sea stars to affect very large areas of coral over relatively short time spans.

Sauni (2000) pointed out that signs of COTs outbreaks were frequently found in the lagoon and on the ocean terrace of Funafuti, ranging from 0 to 119 COTs per hectare (Anon, 1995; Kaly, 1997). COTs were also observed at 37% of the sites surveyed on Funafuti in an earlier survey (Belhadjali, 1998). Anecdotal evidence suggests that *A. planci* densities are also high (>100 individuals/ha) on some of the bommies in Funafuti lagoon. COTs had been observed in Nanumea lagoon, feeding on table coral at 15m depth (Belhadjali, 1998).

During our survey we did not observe any COT on the outer atolls within the monitoring transects. However, 2 individuals were seen outside transects in Nukulaelae (both in NKLCA1) and many white feeding scars were noted on corals of this station.

In Funafuti, we counted 7 COTs (22% of the sites surveyed in Funafuti, though we did not visit ocean terraces), mainly at lagoonal stations. Their densities ranged from 0 to 43 individuals per hectare. This is far from being considered an outbreak, but their densities should continue to be monitored carefully. Having said that, there is little we can do to avoid *Acanthaster* outbreaks apart from maintaining good water quality.


Drupella cornus

Drupella snails are also coral feeders that can cause extensive damage on coral reefs. The species is relatively common throughout the Indo-Pacific. *Drupella* uses specialised mouthparts to feed on living coral tissue, leaving white scars on affected corals, similar to a small to medium COT feeding scars. The snails are not always easy to see while snorkelling on the reef as they are hiding within the colony. The most conspicuous signs are the white feeding scars generally at the base of coral branches (usually *Acropora* staghorn and plate growth forms). As with *Acanthaster,* the causes of their fluctuations on reefs are not understood and the influence of human impacts is not clear yet. *Drupella* snails are most frequently found in low densities (<100 per ha), however outbreaks have been reported in several countries (in McClanahan, 1994). At high densities they can cause extensive damage on reefs. Known predators of *Drupella* are balistids and some species of labrids.

During our survey of the outer atolls we did not encounter any *Drupella* nor white feeding scars in Nukulaelae, whereas in Nanumea the coral-eating snail was found in high density at only one station (NNMOCA1, north-west of the American Passage).This station had 717 snails per hectare, feeding on *Pocillopora verrucosa* colonies. Previous studies suggested that high population densities are most common on reefs with abundant coral, which is the case in Nanumea as NNMOCA1 showed the highest coral cover of all stations visited (22% live coral cover). Additionally, preferred corals are reported to be those of the genus *Acropora* and the family Pocilloporidae (in McClanahan, 1994), which was also the case in Nanumea.

In Funafuti lagoon, *Drupella* densities were low (range: 14-271 ind./ha). They were more frequent and more abundant outside the FCA than inside. This result supports the findings of McClanahan (1994), from his study on Kenyan lagoons that found that *Drupella* population densities were higher on unprotected reefs than in protected areas.

As with *Acanthaster,* there are no clear guidelines about how to avoid *Drupella* outbreaks, apart from maintaining good water quality and avoiding the overexploitation of its predators.

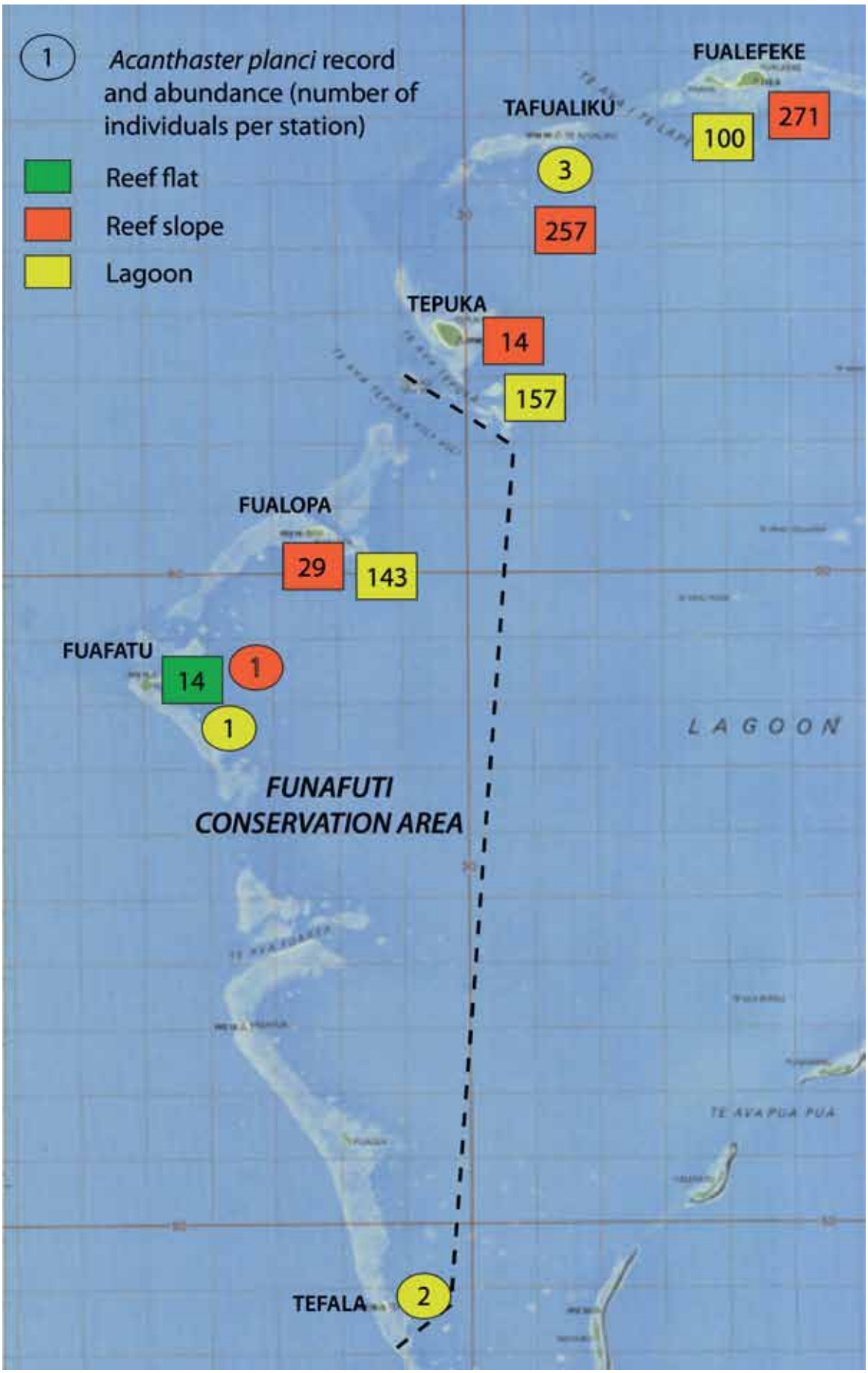
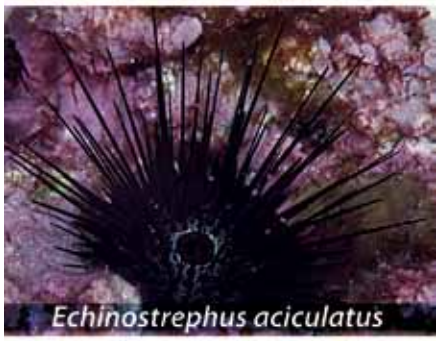


Figure 67. Acanthaster planci and *Drupella* snail abundance and distribution in Funafuti lagoon.

C. Sea urchins



Sea urchins (Vana in Tuvaluan) are important coral reef herbivores, and through their grazing activity they control algal biomass and species composition, allowing space for coral larvae to settle. This key herbivorous group plays an important role in determining the structure of shallow benthic communities in many coral reef systems. The well-known example of Jamaican reefs reflects this relationship, as an unusual mass mortality of Diadema sea urchins in 1983 rapidly led to a dramatic increase in benthic turf algal cover (from 30% before the die-off to 70% 4 months after the event) and a consistent decrease in coral cover (from 50% in late 1970's to 5% in 1993). However, recent studies highlighted the need for caution when using sea urchins and macroalgal abundances for evaluating reef ecosystem condition (Johansson et al., 2010) as both were found at high abundances in a relatively intact and preserved coral reef (Ningaloo Reef, Western Australia).

In Nanumea and Nukulaelae only one species of sea urchin was recorded: the rock-boring urchin (*Echinometra mathaei*). In Funafuti we also observed the needle spine urchin (*Echinostrephus aciculatus*) and the longspine black urchin (*Echinothrix diadema*), however Echinometra mathaei was the dominant species. Surprisingly, no longspine sea urchin (*Diadema savignyi*) were found, whereas they were the most abundant macroinvertebrate recorded during the first FCA survey (Kaly, 1997). This is most probably because large numbers of sea urchins were found in the terrace habitat, which was not visited during our survey.

In Nanumea sea urchins were very rare as we only observed few individuals at one station, in NNMOCA1, north-west of the American Passage: 33 sea urchins per hectare.

In Nukulaelae, sea urchins were found at 3 stations, in low densities: NKLOCA4 (133 sea urchins per hectare), NKLCA1 (83 sea urchins per hectare) and NKLCA4 (17 sea urchins per hectare).
In Funafuti, sea urchins were more diverse and abundant than on the outer islands (Table 36). Almost all stations had sea urchin populations in low densities (14-171 sea urchins per hectare). One station had a moderate sea urchin population (Teafualiku reef flat: 400 sea urchins per hectare) and 3 stations had high population densities: Tefala reef flat (1914 sea urchins per hectare), Tefala reef slope (1086 sea urchins per hectare) and Fualopa reef slope (1214 sea urchins per hectare), all located within the FCA.

Table 36. Sea urchin species composition and population densities (number of individuals/ha) recorded in Funafuti.

Status	Station	Density	Species
FCA	Fuafatu flat	171	*Echinometra mathaei* and *Echinostrephus aciculatus*
FCA	Fuafatu slope	0	
FCA	Fuafatu lagoon	29	*Echinometra mathaei*
FCA	Fualopa flat	57	*Echinostrephus aciculatus*
FCA	Fualopa slope	1214	*Echinometra mathaei, Echinostrephus aciculatus* and *Echinothrix diadema*
FCA	Fualopa lagoon	0	
FCA	Tefala flat	1914	*Echinometra mathaei, Echinostrephus aciculatus* and *Echinothrix diadema*
FCA	Tefala slope	1086	*Echinometra mathaei, Echinostrephus aciculatus* and *Echinothrix diadema*
FCA	Tefala lagoon	0	
Outside FCA	Tepuka flat	100	*Echinometra mathaei*
Outside FCA	Tepuka slope	29	*Echinometra mathaei*
Outside FCA	Tepuka lagoon	57	*Echinometra mathaei*
Outside FCA	Fualefeke flat	0	
Outside FCA	Fualefeke slope	14	*Echinometra mathaei*
Outside FCA	Fualefeke lagoon	0	
Outside FCA	Teafualiku flat	400	*Echinometra mathaei* and *Echinostrephus aciculatus*
Outside FCA	Teafualiku slope	0	
Outside FCA	Teafualiku lagoon	0	

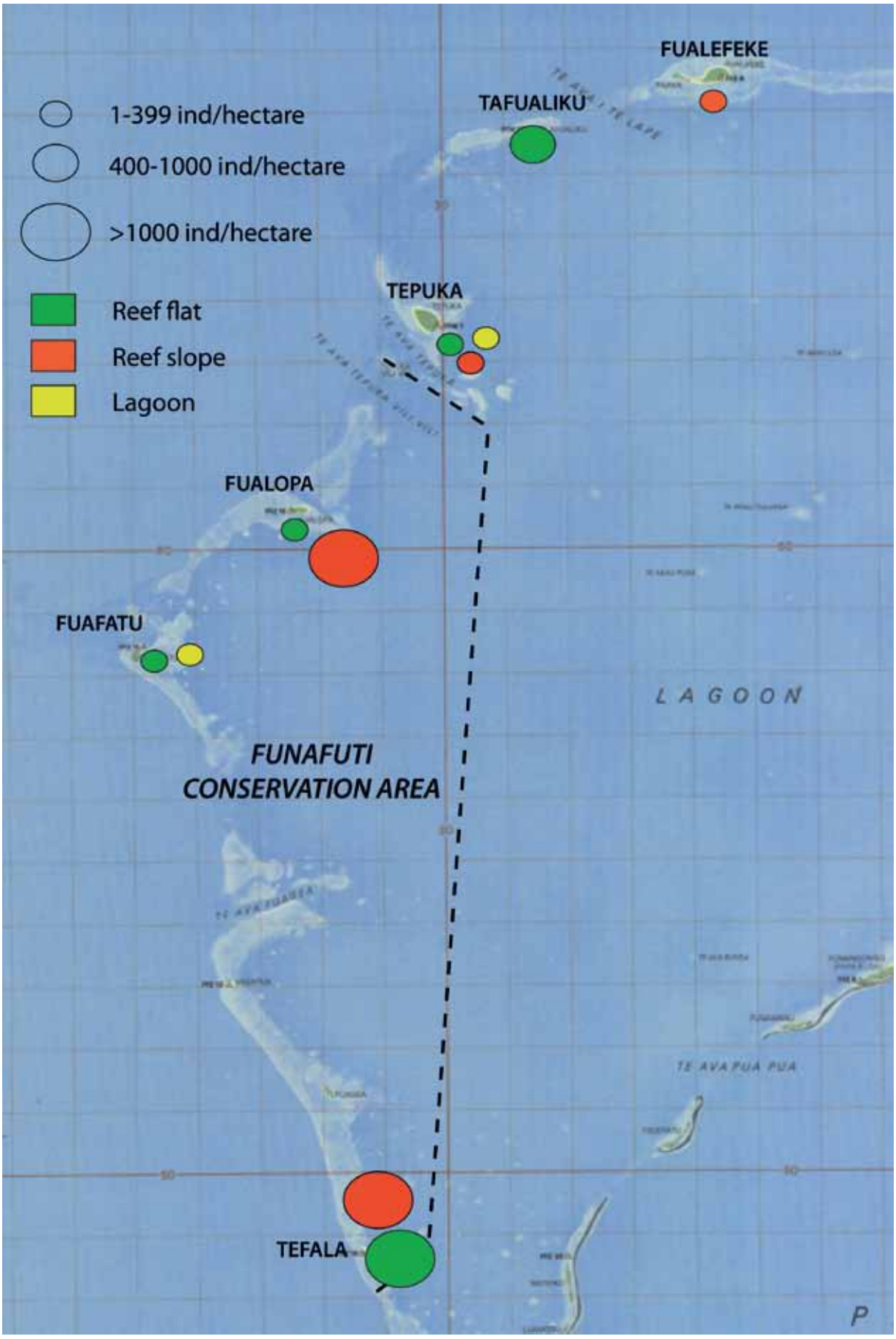


Figure 68. Sea urchin abundance and distribution in Funafuti lagoon.

3.3. REEF FISH SURVEY

3.3.1. Target fish density

A. Total fish density

The overall mean target fish density was higher on Funafuti atoll (127.7 fish per hectare +/- 52.1 SE) than on Nukulaelae (99.6 fish per hectare +/- 54.2 SE) and Nanumea (78.7 fish per hectare +/- 21.8 SE).

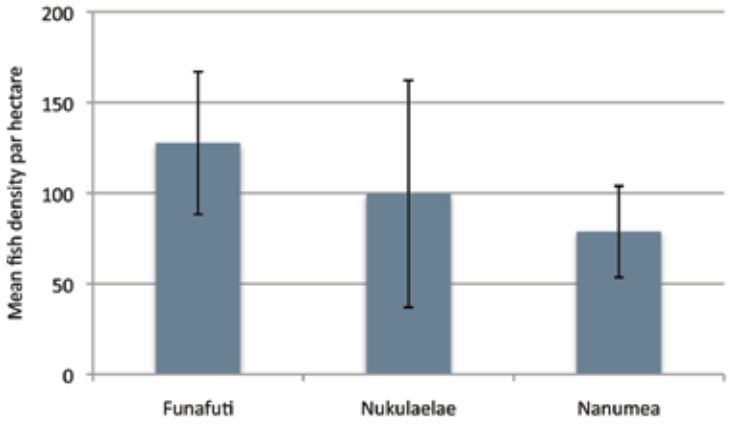


Figure 69. Mean density of total target reef fish on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

Comparing stations inside and outside the CAs, we note that:

- In Funafuti, mean total target fish density was slightly higher inside the FCA than outside (144.4 fish/ha +/- 49.9 SE versus 110.8 fish/ha +/- 53.6 SE). This difference was not significant.
- In Nukulaelae, mean total target fish density was slightly lower inside the CA than outside (90.7 fish/ha +/- 36.5 SE versus 108.5 fish/ha +/- 68.2 SE). This difference was not significant.
- In Nanumea, mean total target fish density was similar inside and outside the CA (77.2 fish/ha +/- 17.4 SE versus 80.7 fish/ha +/- 27.2 SE).

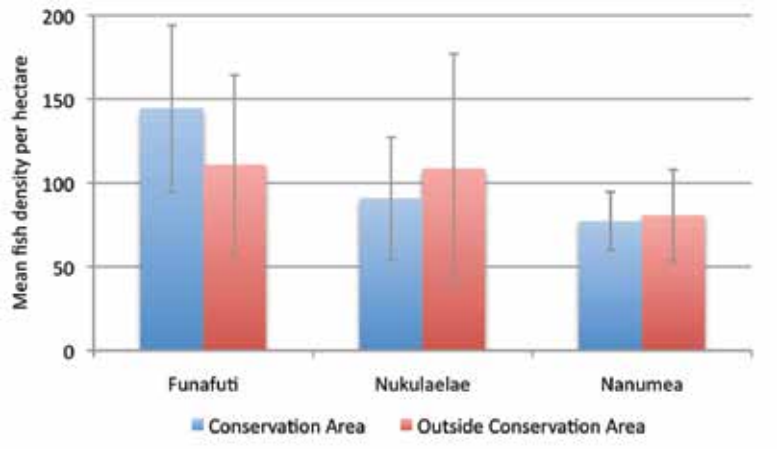


Figure 70. Mean density of total target reef fish inside and outside conservation areas, on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

In Funafuti, mean total target fish density ranged from 342.9 to 15.4 fish per hectare, with the highest density recorded on the Fualefeke reef slope, the Fuafatu reef slope and Fuafatu lagoon. The highest concentration of target fish was recorded in Fuafatu (within the FCA).

Table 37. Total target fish densities (mean number of individuals/ha) recorded in Funafuti.

Status	Station	Mean density	SE	Status	Station	Mean density	SE
FCA	Fuafatu flat	157.1	32.6	Outside FCA	Tepuka flat	88.6	22.1
FCA	Fuafatu slope	296.0	51.8	Outside FCA	Tepuka slope	15.4	5.0
FCA	Fuafatu lagoon	216.6	31.4	Outside FCA	Tepuka lagoon	95.4	11.7
FCA	Fualopa flat	84.0	26.5	Outside FCA	Fualefeke flat	115.4	41.9
FCA	Fualopa slope	109.1	14.9	Outside FCA	Fualefeke slope	342.9	39.3
FCA	Fualopa lagoon	86.9	19.8	Outside FCA	Fualefeke lagoon	77.7	24.0
FCA	Tefala flat	73.1	12.0	Outside FCA	Teafualiku flat	124.0	14.6
FCA	Tefala slope	129.7	26.0	Outside FCA	Teafualiku slope	82.3	23.0
FCA	Tefala lagoon	147.4	26.4	Outside FCA	Teafualiku lagoon	56.0	14.7

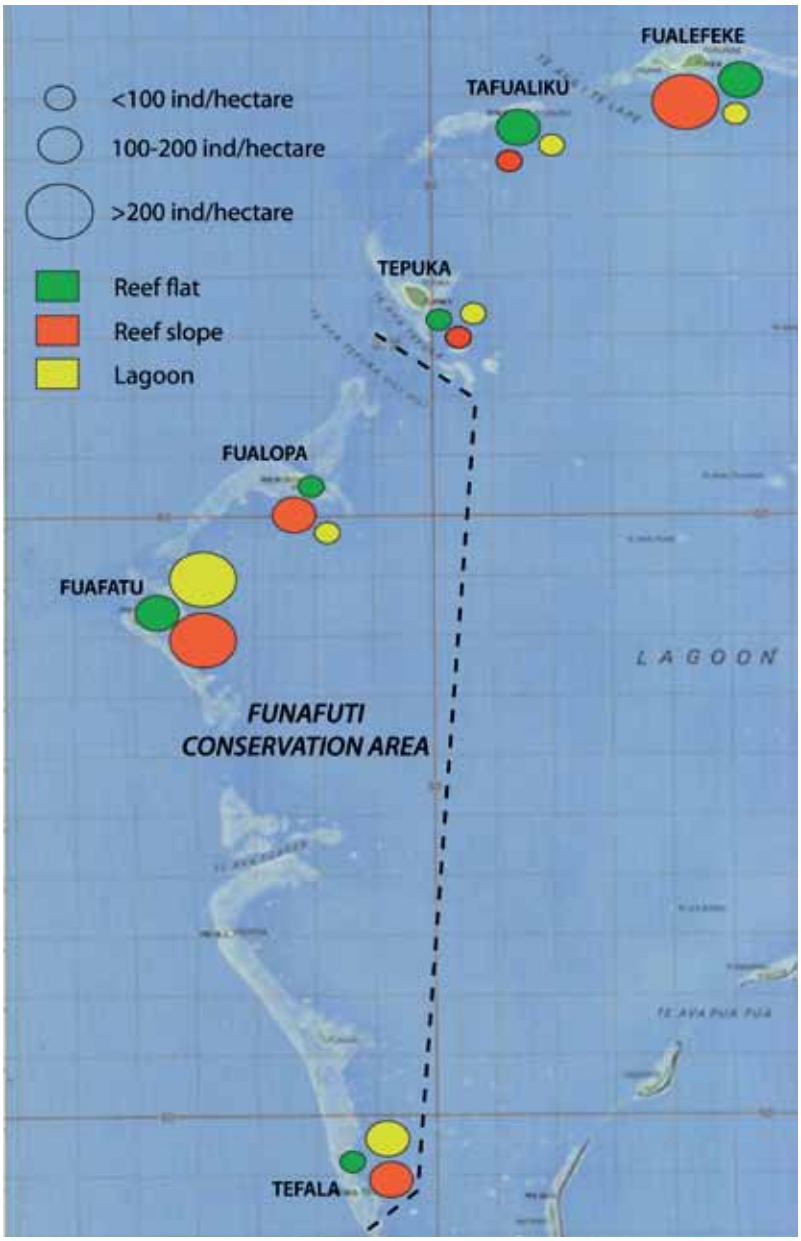


Figure 71. Mean target fish density in Funafuti, calculated as the total number of individuals per hectare.

In Nukulaelae, mean target fish density ranged from 203.3 to 9.3 fish per hectare, with the highest density recorded at OCA5, CA2 and OCA3. The highest concentration of total target fish was recorded on the sheltered side of the atoll, outside the CA.

Table 38. Total target fish densities (mean number of individuals/ha) recorded in Nukulaelae.

Status	Station	Mean density	SE
Conservation Area	NKLCA1	116.7	14.3
Conservation Area	NKLCA2	196.0	30.6
Conservation Area	NKLCA3	85.3	31.2
Conservation Area	NKLCA4	46.0	8.1
Conservation Area	NKLCA5	9.3	4.8
Outside Conservation Area	NKLOCA1	72.0	43.3
Outside Conservation Area	NKLOCA2	106.0	73.5
Outside Conservation Area	NKLOCA3	132.0	47.6
Outside Conservation Area	NKLOCA4	29.3	4.8
Outside Conservation Area	NKLOCA5	203.3	160.6

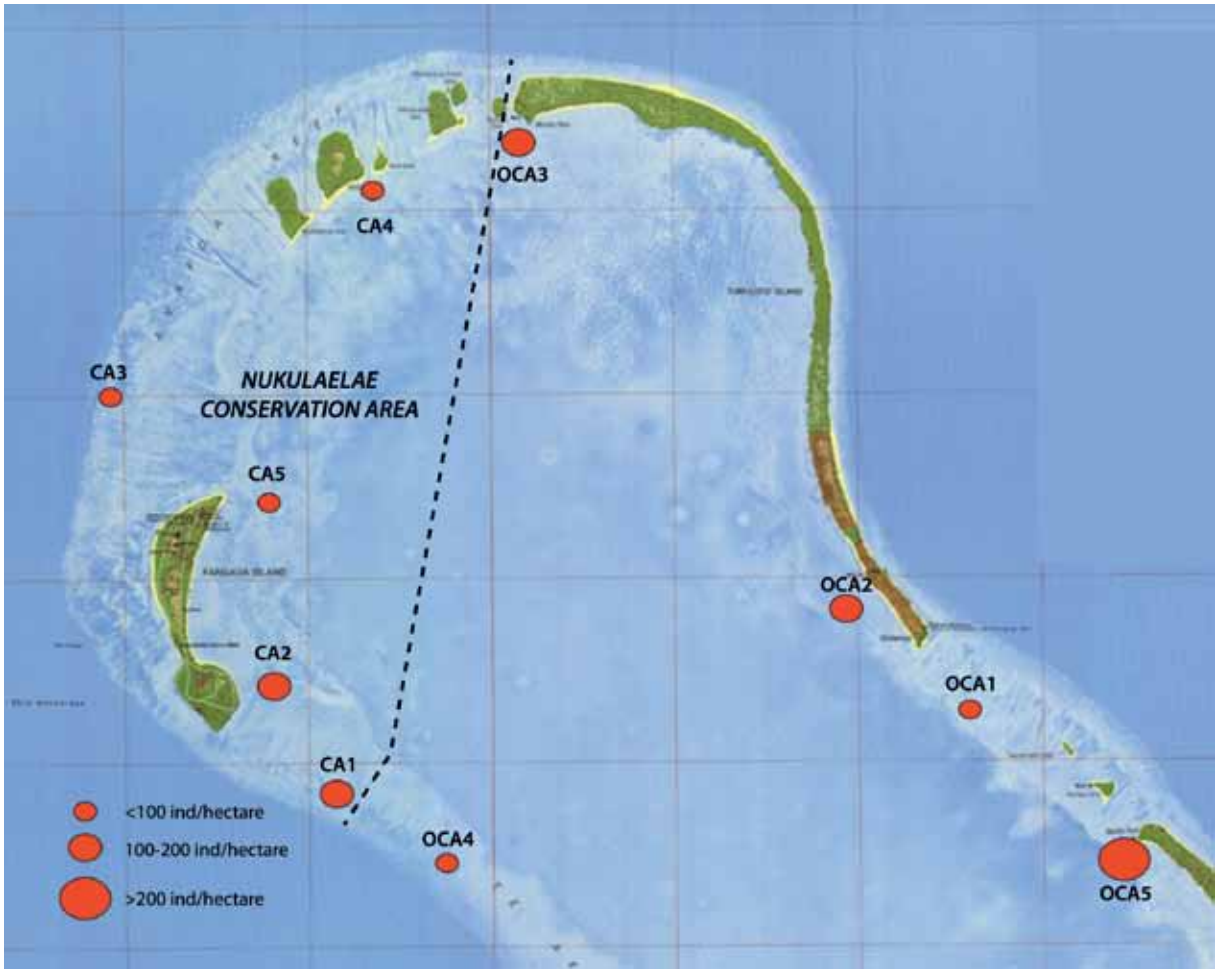


Figure 72. Mean target fish density in Nukulaelae, calculated as the total number of individuals per hectare.

In Nanumea, mean target fish density ranged from 139.3 to 45.3 fish per hectare, with the highest density recorded at OCA1, CA3 and CA5 *(Table 39)*. The abundance of total targeted fish was similar at all sites, both inside and outside the CA, except at the station close to the channel, which showed a slightly higher density of reef fish.

Table 39. Total target fish densities (mean number of individuals/ha) recorded in Nanumea.

Status	Station	Mean density	SE
Conservation Area	NNMCA1	81.3	21.3
Conservation Area	NNMCA2	58.7	5.8
Conservation Area	NNMCA3	90.7	37.0
Conservation Area	NNMCA4	70.7	24.7
Conservation Area	NNMCA5	84.7	7.3
Outside Conservation Area	NNMOCA1	139.3	35.6
Outside Conservation Area	NNMOCA2	45.3	26.0
Outside Conservation Area	NNMOCA3	72.7	3.3
Outside Conservation Area	NNMOCA4	65.3	31.2

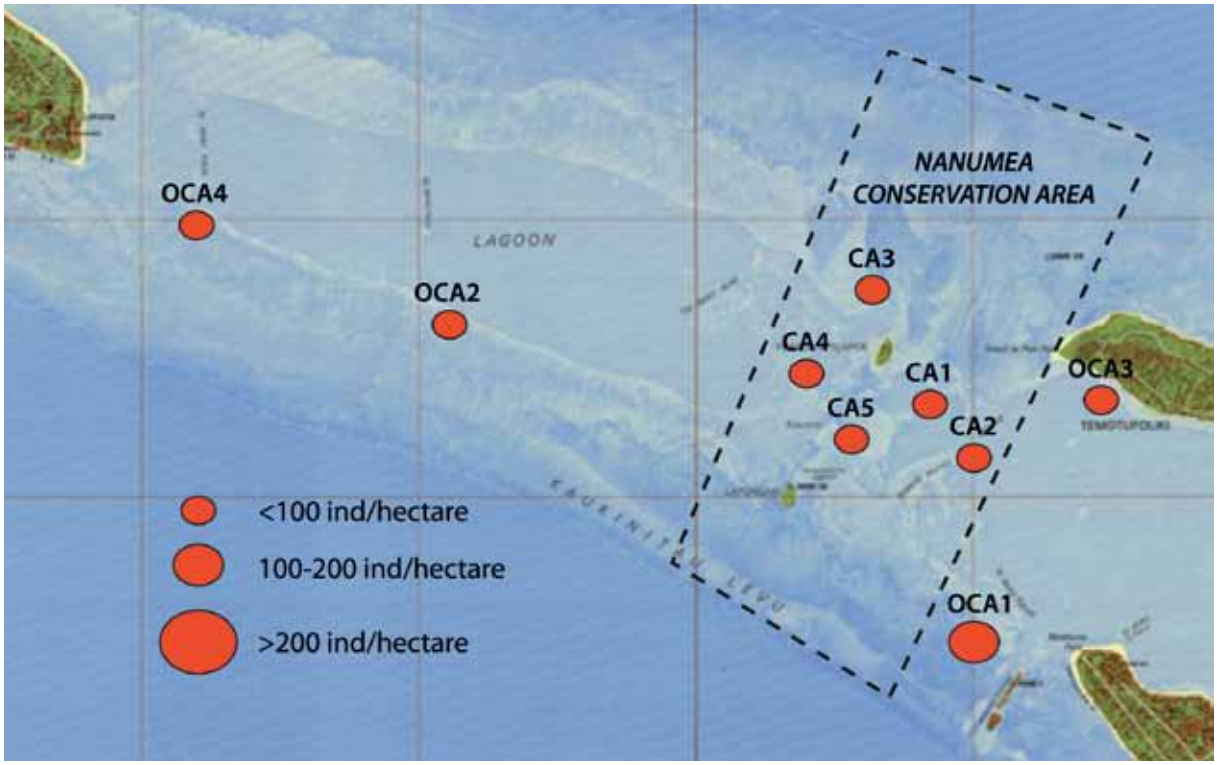


Figure 73. Mean target fish density in Nanumea, calculated as the total number of individuals per hectare.

B. Edible fish density

Mean edible fish densities were higher on Funafuti atoll (90.3 fish per hectare +/- 29.4 SE) and Nukulaelae (87.7 fish per hectare +/- 57.5 SE), and lower on Nanumea atoll (54.3 fish per hectare +/- 18.6 SE).

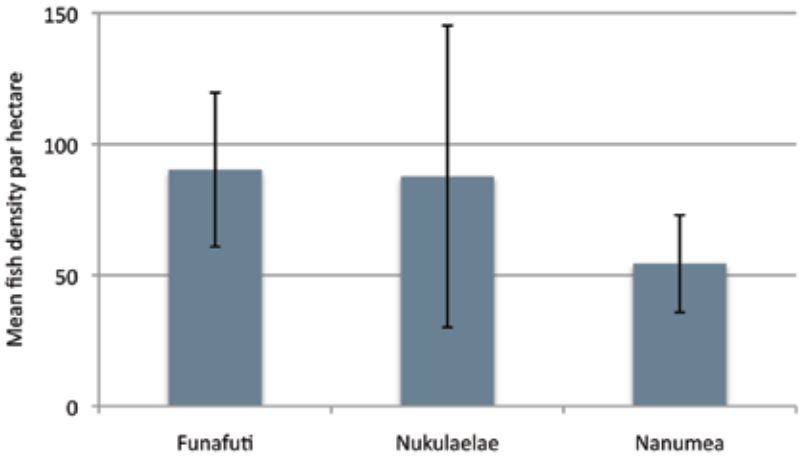


Figure 74. Mean density of edible reef fish on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

Comparing stations inside and outside the CAs, we note that:

- In Funafuti, mean edible fish density was slightly higher inside the FCA than outside (105.7 fish/ha +/- 30.0 SE versus 74.9 fish/ha +/- 28.0 SE). This difference was not significant.
- In Nukulaelae, mean edible fish density was slightly lower inside the CA than outside (79.5 fish/ha +/- 42.4 SE versus 95.9 fish/ha +/- 70.8 SE). This difference was not significant.
- In Nanumea, mean edible fish density was similar inside and outside the CA (56.8 fish/ha +/- 17.4 SE versus 51.2 fish/ha +/- 20.6 SE).

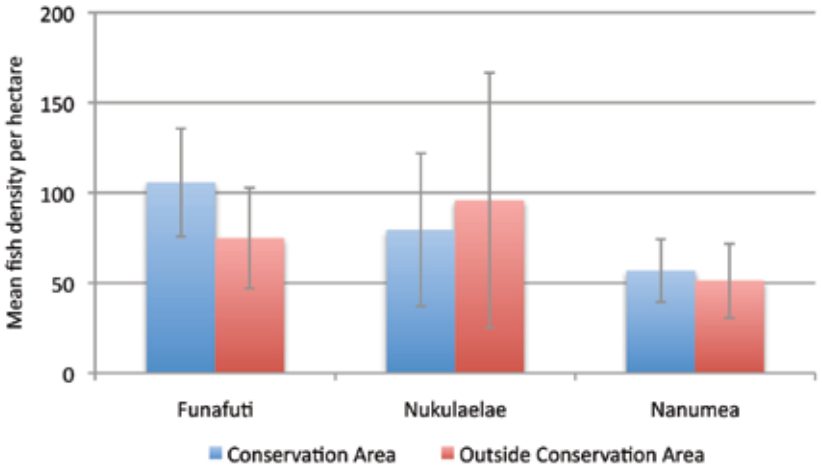


Figure 75. Mean density of edible reef fish inside and outside conservation areas, on the three atolls surveyed in Tuvalu, calculated as the total number of individuals per hectare. Error bars represent 1 S.E.

In Funafuti, mean edible fish density ranged from 242.3 to 15.4 fish per hectare, with the highest density recorded on the Fuafatu reef slope, the Fualefeke reef slope and Fuafatu lagoon. The highest concentration of edible fish was recorded in Fuafatu (within the FCA).

Table 40. Edible fish densities (mean number of individuals/ha) recorded in Funafuti.

Status	Station	Mean density	SE	Status	Station	Mean density	SE
FCA	Fuafatu flat	116.6	24.9	Outside FCA	Tepuka flat	58.8	17.5
FCA	Fuafatu slope	242.3	45.5	Outside FCA	Tepuka slope	15.4	5.0
FCA	Fuafatu lagoon	133.2	19.8	Outside FCA	Tepuka lagoon	77.2	11.0
FCA	Fualopa flat	60.0	18.9	Outside FCA	Fualefeke flat	98.3	40.9
FCA	Fualopa slope	89.2	16.8	Outside FCA	Fualefeke slope	181.2	44.2
FCA	Fualopa lagoon	56.6	13.2	Outside FCA	Fualefeke lagoon	56.0	17.0
FCA	Tefala flat	60.6	10.1	Outside FCA	Teafualiku flat	96.6	12.8
FCA	Tefala slope	82.8	21.3	Outside FCA	Teafualiku slope	59.4	19.5
FCA	Tefala lagoon	109.7	18.3	Outside FCA	Teafualiku lagoon	34.8	11.8

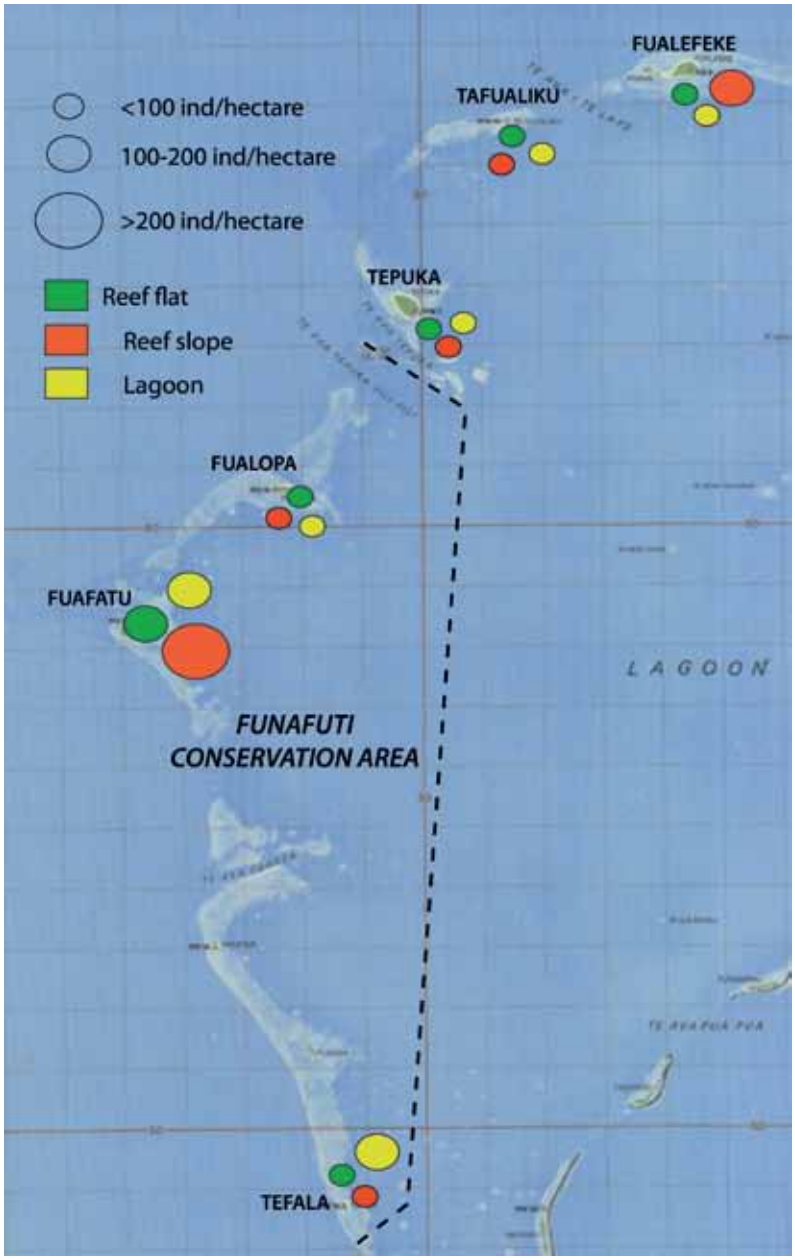


Figure 76. Mean edible fish density in Funafuti, calculated as the total number of individuals per hectare.

In Nukulaelae, mean edible fish density ranged from 192.0 to 9.3 fish per hectare, with the highest density recorded at CA2, OCA5 and OCA3. The abundance of edible fish was similar at all sites, both inside and outside the CA.

Table 41. Edible fish densities (mean number of individuals/ha) recorded in Nukulaelae.

Status	Station	Mean density	SE
Conservation Area	NKLCA1	101.4	12.8
Conservation Area	NKLCA2	192.0	33.0
Conservation Area	NKLCA3	59.4	32.4
Conservation Area	NKLCA4	35.4	7.0
Conservation Area	NKLCA5	9.4	4.8
Outside Conservation Area	NKLOCA1	72.0	43.4
Outside Conservation Area	NKLOCA2	88.6	68.8
Outside Conservation Area	NKLOCA3	124.6	44.0
Outside Conservation Area	NKLOCA4	24.0	3.0
Outside Conservation Area	NKLOCA5	170.0	143.0

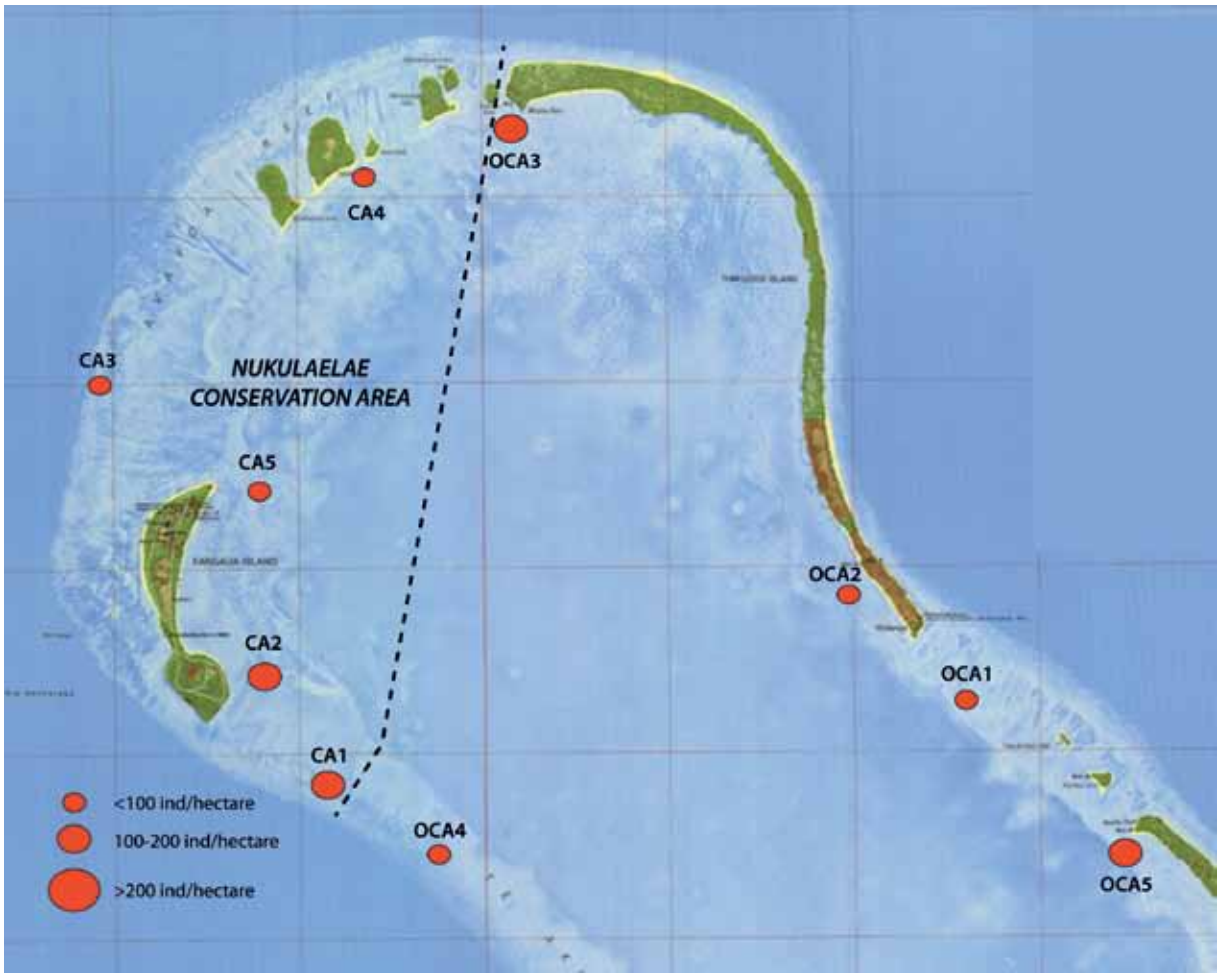


Figure 77. Mean edible fish density in Nukulaelae, calculated as the number of edible individuals per hectare.

In Nanumea, mean edible fish density ranged from 88.0 to 25.4 fish per hectare, with the highest density recorded at OCA1, CA5 and OCA3. The abundance of edible fish was similar at all sites, both inside and outside the CA.

Table 42. Edible fish densities (mean number of individuals/ha) recorded in Nanumea.

Status	Station	Mean density	SE
Conservation Area	NNMCA1	61.4	7.8
Conservation Area	NNMCA2	31.4	3.8
Conservation Area	NNMCA3	56.0	33.0
Conservation Area	NNMCA4	56.0	18.4
Conservation Area	NNMCA5	79.4	4.6
Outside Conservation Area	NNMOCA1	88.0	22.6
Outside Conservation Area	NNMOCA2	25.4	17.2
Outside Conservation Area	NNMOCA3	62.6	8.4
Outside Conservation Area	NNMOCA4	28.6	11.0

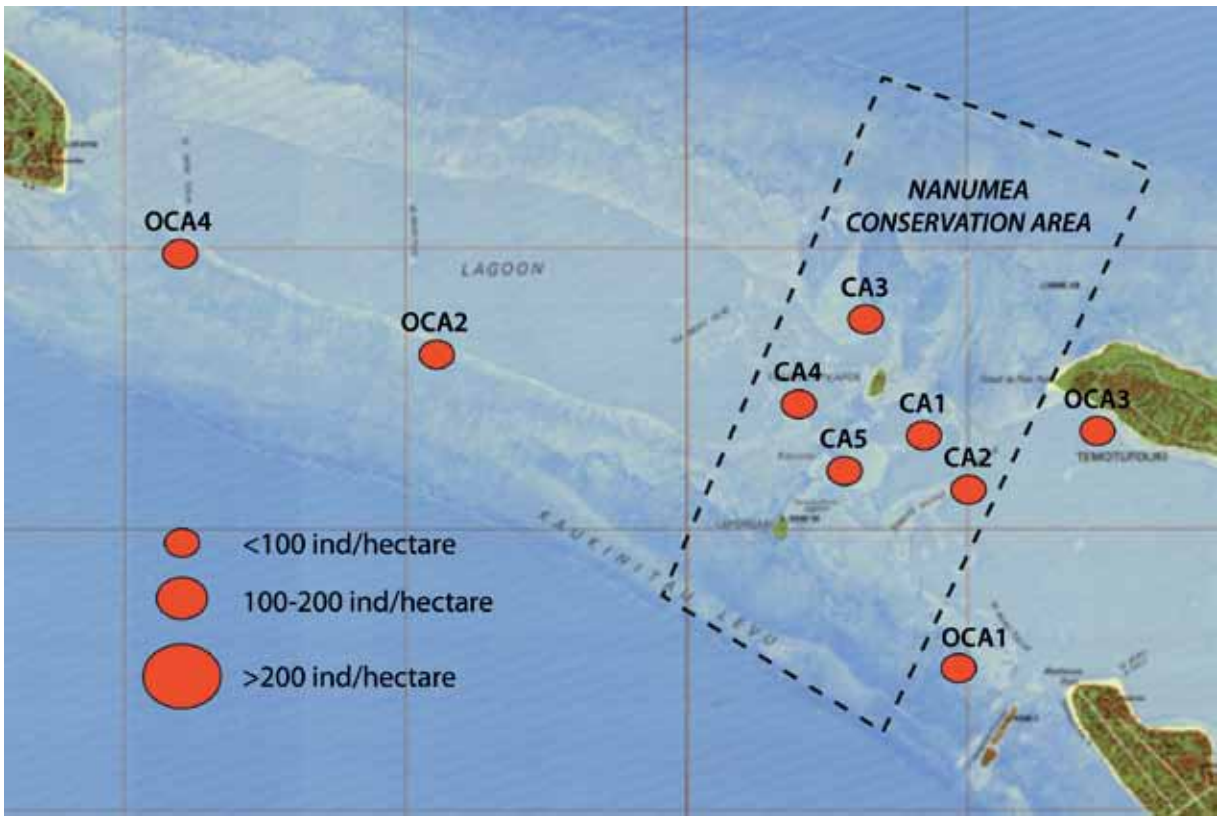
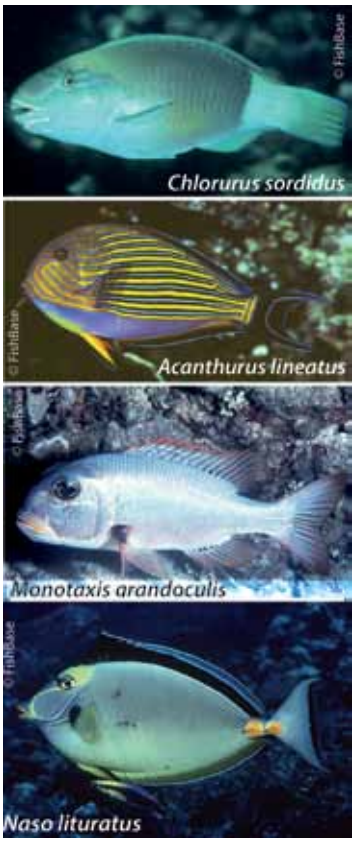


Figure 78. Mean edible fish density in Nanumea, calculated as the number of edible individuals per hectare.

3.3.2. Target fish species composition and distribution

In Funafuti, the most abundant fish species encountered was *Ctenochaetus striatus* (Pone uli in Tuvaluan), considered a poisonous fish, which represented 18% of the total number of fish counted. The highest number of *C. striatus* was found in Fualefeke reef slope.



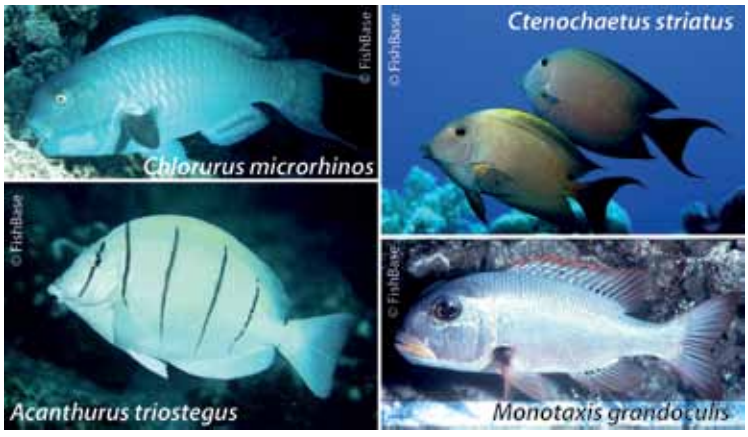
Other abundant fish species include:

- *Chlorurus spp*. (Laea) (16% of the total fish abundance), mostly found on Fuafatu (reef flat, reef slope and lagoon), Teafualiku reef slope and Tepuka lagoon.
- *Acanthurus lineatus* (Ponelolo) (10% of the total abundance), mostly found on Fualefeke, Fuafatu and Fualopa reef slopes and Teafualiku reef flat.
- *Acanthurus triostegus* (Manini) (9% of the total abundance): mostly found on Fualefeke reef flat and slope, Tepuka lagoon, Fualopa and Tefala reef flats and Fuafatu slope.
- *Monotaxis grandoculis* (Muu) (6% of the total abundance): mostly found on Fuafatu (reef flat, reef slope and lagoon), Tefala lagoon and Fualefeke reef slope and lagoon.
- *Naso lituratus* (Manini lakau) (6% of the total abundance): mostly found on Fuafatu (reef flat, reef slope and lagoon), Tefala lagoon, Fualopa and Teafualiku reef slopes.

In Funafuti, despite the lack of difference in the density of target and edible fish, there was a significant difference in the species composition of target fish inside and outside the FCA. The herbivore *Acanthurus nigricans* and the facultative corallivore *Chaetodon ephippium* occurred only outside the FCA. These species generally feed in coral-rich areas on the outer reef, and the FCA may not have provided appropriate habitat. In contrast, the benthic carnivore *Pseudobalistes flavimarginatus*, the predator *Cephalopholis argus* and the herbivores *Naso lituratus* and *Scarus ghobban* were more abundant inside the FCA. These species are all targeted by fishers in Funafuti (except *Cephalopolis argus* which is a poisonous species), and the FCA may be effective for their protection.

In Nukulaelae, the most abundant fish species encountered were all edible species:

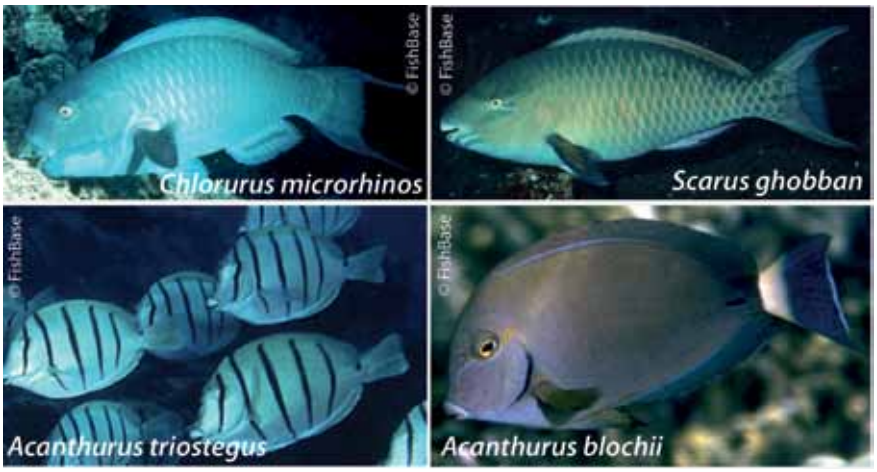
- *Chlorurus microrhinos* (Homo) (18% of the total abundance): mostly found at CA1 and CA2.
- *Ctenochaetus striatus* (Pone uli, which is not considered as poisonous in Nukulaelae) (15% of the total abundance): mostly found at CA1 and CA2.
- *Acanthurus triostegus* (Manini) (13% of the total abundance): mostly found at OCA5, CA2 and CA3.
- *Monotaxis grandoculis* (Muu) (8% of the total abundance): mostly found at OCA5 and OCA2.



The composition of the target fish community in Nukulaelae was similar between sites inside and outside the CA except for 2 species: the predator Cephalopholis argus was more abundant inside the CA, and the obligate corallivore *Chaetodon reticulatus* was more abundant outside the CA.

In Nanumea, the most abundant fish species encountered was the poisonous fish *Ctenochaetus striatus* (Pone uli), which represented 22% of the total abundance. Most of them were counted at OCA1, OCA4 and CA3.

Other abundant species were:



- *Acanthurus triostegus* (Manini) (13% of the total abundance): mostly found at OCA1 and OCA3.
- *Chlorurus microrhinos* (Homo) (13% of the total abundance): mostly found at CA4, OCA1 and CA3.
- *Scarus ghobban* (Ulafi) (7% of the total abundance): mostly found at CA1.
- *Acanthurus blochii* (Maa) (7% of the total abundance): mostly found at CA1, CA3 and CA5.

The composition of the target fish community in Nanumea was similar between sites inside and outside the CA, except for a few species. The herbivores *Acanthurus triostegus* and *Scarus ghobban* were more abundant outside the CA. In contrast, the herbivore *A. blochii*, the benthic carnivore *Pseudobalistes flavimarginatus* and the predators *Epinephelus hexagonatus* and *Monotaxis grandoculis* were more abundant inside the CA. These species are all targeted by fishers in Nukulaelae (edible and/or commercial species), and the CA may be effective for their protection.

4. DISCUSSION

Our findings support some interesting trends towards an improvement of macroinvertebrate and fish communities inside CAs, especially in Funafuti and Nukulaelae. However, none of the observed trends were statistically significant, suggesting that it may still be too early to identify definite effects of protection, especially on the outer atolls. Poaching may also hamper the recovery of exploited species inside the CAs.

The following trends were identified:

In Funafuti lagoon:

- Clam populations were higher within the FCA (especially at the Fuafatu and Fualopa sites) than outside. This is probably a positive effect of the protection of the area from collecting or fishing, despite known poaching incidents.
- Despite their rarity, *Trochus* appeared more abundant within the FCA, particularly at the Fualopa lagoon site. It must be noted that preferred *Trochus* habitats on the ocean terrace were not investigated in this study.
- The FCA hosted the highest edible fish density (in Fuafatu, and to a lesser extent in Fualopa). Parrotfishes (Laea), *Monotaxis grandoculis* (Muu) and *Naso lituratus* (Manini lakau) were particularly abundant in Fuafatu, whereas *Acanthurus triostegus* (Manini) and *Naso lituratus* (Manini lakau) were particularly abundant in Fualopa.
- Three fish species targeted by fishermen appeared to be more abundant within the FCA than outside: *Naso lituratus* (Manini lakau), *Pseudobalistes flavimarginatus* (Umu) and *Scarus ghobban* (Ulafi).
- The Fuafatu inner reef slope exhibited dense and healthy coral communities.
- The Tefala reef flat and reef slope showed significant crustose coralline algal cover, associated with an abundant sea urchin population, both favourable characteristics for maintaining a healthy coral reef community.

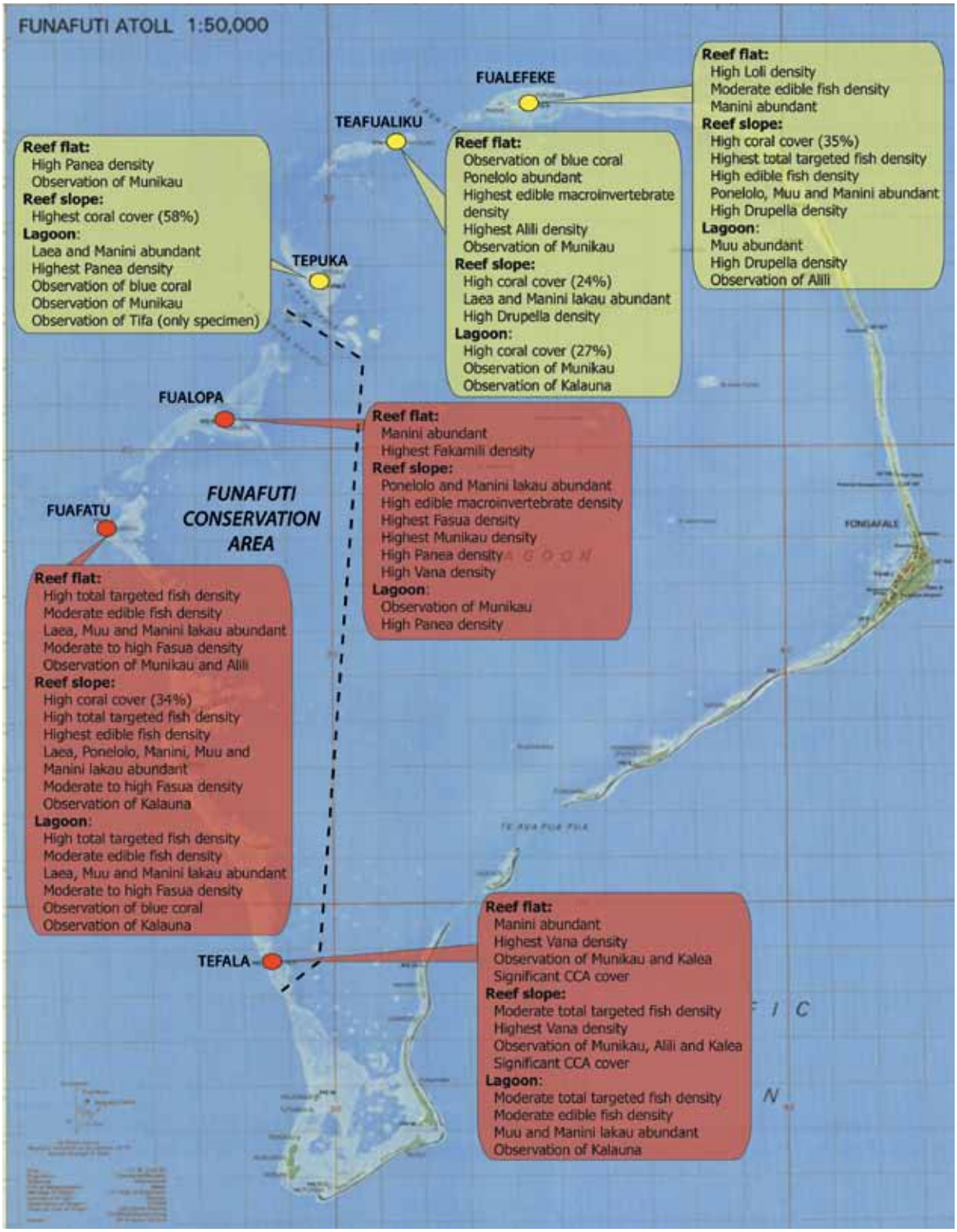


Figure 79. Synthesis map showing the points of interest at all stations investigated in Funafuti atoll.

In the Nukulaelae lagoon, stations located within the CA showed:

- The highest coral cover (station CA2)
- The highest edible fish density (CA2), with particularly high abundances of *Chlorurus microrhinos* (Homo), *Acanthurus triostegus* (Manini) and *Ctenochaetus striatus* (Pone uli) (at CA1, CA2 and CA3).
- The highest densities of *Cerithium nodulosum* (Sipo, at CA1) and *Strombus luhanus* (Panea, at CA5).
- The highest edible macroinvertebrate density (on CA5).
- The observation of the few rare commercially important sea cucumber species: leopardfish (at CA2 and CA3) and curryfish (at CA2)

The proximity of the CA to the village where most of the people from Nukulaelae live is certainly beneficial for compliance with customary regulations within the CA.

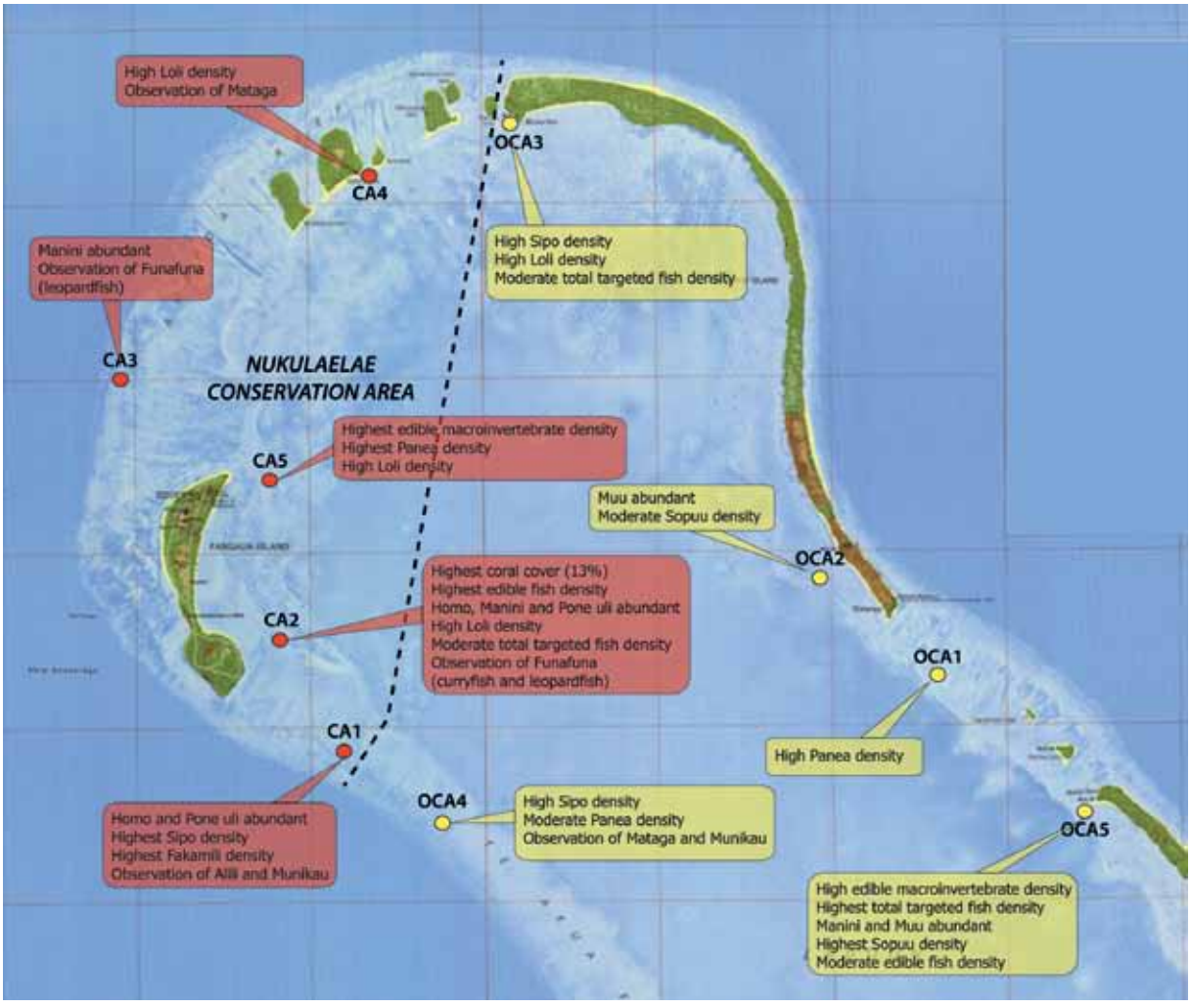


Figure 80. Synthesis map showing the points of interest at all stations investigated in Nukulaelae atoll.

In the Nanumea lagoon, stations located within the CA showed:

- A moderate coral cover (on CA1 and CA2)
- Abundant edible fish species *Chlorurus microrhinos* (Homo, at CA3 and CA4), *Acanthurus blochii* (Maa, at CA3 and CA5) and *Scarus ghobban* (Ulafi, at CA1).
- Four fish species targeted by fishermen appeared to be more abundant within the CA than outside: *Acanthurus blochii* (Kapalagi), *Pseudobalistes flavimarginatus* (Umu), *Epinephelus fuscoguttatus* (Fapuku) and *Monotaxis grandoculis* (Muu).
- The highest *Spondylus* densities (Hopu nifo and Hopu teka) (at CA2).

Station OCA1, located close to the American channel, appeared to be the richest station on the Nanumea lagoon, with:

- The highest and richest coral community
- The highest total and edible fish densities
- A high edible macroinvertebrate density, more specifically archs (Kohi) and *Chama* sp. (Hopu papa).
- The highest cowrie density.

This station is located in the immediate proximity of the only channel of the atoll (exchange zone between the lagoon and the ocean), and is therefore expected to host a richer and more diverse community, given the high water movement, the exchange of nutrients and the mixing of oceanic and lagoonal species. It is probably a place of passage for many fish species into and out of the lagoon.

A discussion could be conducted in consultation with local fishermen and the Tuvalu Fisheries Department to include this station in the CA, as closing it to fishing (even partially or seasonally) may be beneficial in maintaining an abundant and sufficient fish population as food source for the Nanumean people.

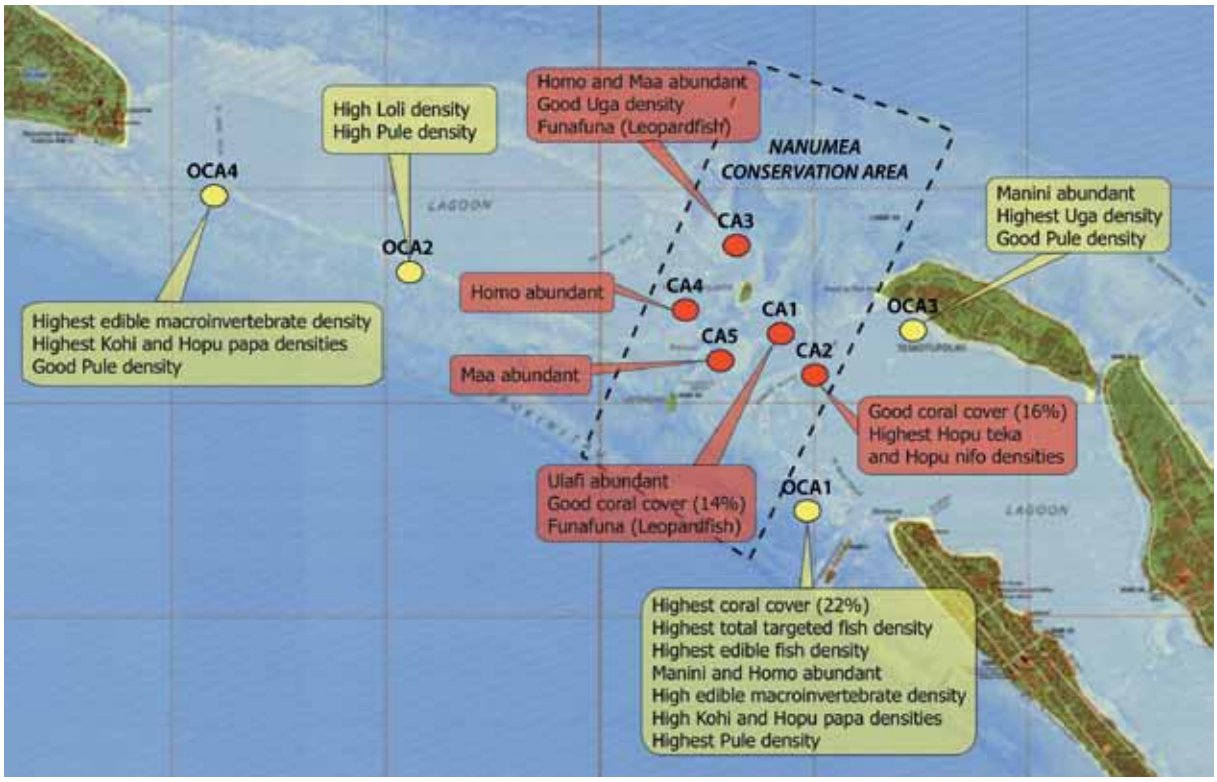


Figure 81. Synthesis map showing the points of interest at all stations investigated in Nanumea atoll.

GENERAL CONCLUSIONS AND GUIDANCE

The TML project has allowed the addition of a substantial number of fish species to the existing list: a total of 317 reef fish species were recorded during this study, including 66 species that had not been listed previously for the archipelago. These 'new species' are all common coral reef species with a broad distribution. No endemic species were found, and a number of IUCN-listed threatened species were observed. The total number of reef fish species for Tuvalu is currently 607, and with a greater sampling effort we may expect a total of 711 species for Tuvalu (equivalent to around two-thirds of the maximum known biodiversity, in the Coral Triangle). The roughly one hundred species not yet recorded could therefore be cryptic, nocturnal or deep-dwelling species (>20m). Substantial additions of species are likely to require alternative sampling techniques, including destructive methods such as collecting, trawling and line-fishing.

The three atolls surveyed support high reef fish biodiversity, and each atoll hosts a unique lagoonal fish assemblage. Reef fish communities on the two outer atolls, Nanumea and Nukulaelae, are defined by high densities of small fishes (especially within the lagoons, where there are often large schools of juvenile parrotfish and damselfish). On the other hand, Funafuti atoll is host to smaller densities and larger fish. These patterns may be the result of differential fishing pressure on the three atolls, combined with environmental parameters. Unlike the two remote atolls, Funafuti lagoon is opened to the ocean, and offers a greater variety of habitats.

Density and biomass data reflect a relatively low fishing pressure in most surveyed areas, even though signs of overexploitation can be found around inhabited areas. Previous reports have raised concerns about signs of overfishing in Funafuti, such as lower abundances and smaller individuals that occupy lower trophic levels.

Very few sharks were observed around the three atolls surveyed. These top predators are important for maintaining ecosystem health and equilibrium, but are disappearing globally.

Benthic communities are indicative of healthy coral reefs, but are nevertheless subject to multiple human and natural disturbances. Some exposed sites showed signs of past storm damage, and in Funafuti, parts of the lagoon closest to densely inhabited areas showed evidence of higher concentrations of nutrients and pollutants, with turbid water and a high cover of macro-algae.

The structure of benthic communities appears to be a good indicator for the composition of the fish assemblage, with the best predictors being live coral, sand and coralline algae. Each of these benthic categories serves as a useful proxy for the broader habitat. High live coral cover was generally found in relatively sheltered environments, the cover of sand could well serve as a proxy for lagoonal areas, and coralline algae tended to occur in higher cover in areas more exposed to wave action. Each of these habitats tended to support a distinct group of fish species.

The CA Survey provided a first assessment of marine resources on the outer atolls, as requested by local people. Gaining knowledge of their fish and invertebrates stocks was a key goal in the effort to manage their resources more sustainably. On Funafuti reefs, the FCA had already been monitored several times since its implementation. Previous surveys were conducted at the same sites; unfortunately these data were not available for comparison. Therefore, we are not able to provide an estimate of how stocks have changed over time since the establishment of the FCA.

Coral cover is relatively low on the surveyed atolls, and tends to increase with the degree of lagoon openness: on Nanumea, which has a small opening to the ocean, coral cover is very low (6% on average) while in Funafuti, where the lagoon joins the ocean through several large channels, coral cover is more than double (15% on average). There is a general dominance of branching corals of the genus *Acropora*. The density of edible macroinvertebrates is low in most places, except for three locations in Nanumea's lagoon where locally harvested bivalve densities ("Kohi" and "Hopu papa") were high. It was noted that clams were absent from the outer islands and very scarce in Funafuti lagoon. Most clams found in Funafuti were recorded from within the FCA. Almost no commercial species of sea cucumber were found during the survey. Edible fish densities were low at all surveyed sites, except at two inner reef slope stations of Funafuti, in front of Fuafatu and Fualefeke. Despite the low densities, there appear to be sufficient fish for local consumption.

CAs were found to be similar to adjacent unprotected habitats. Nevertheless, as Tuvalu faces a changing climate and declining resources, no-take Conservation Areas provides the best solution to safeguarding Tuvaluan fish biodiversity and stocks of valuable food fish: lagoons may play a major role as nurseries, host a number of juveniles of locally targeted fish species and a unique fauna that should be preserved.

It may be too early after the establishment of CAs in Nanumea and Nukulaelae to detect a statistically significant effect. We conclude with a number of suggestions about marine resource management, based on our field investigations. It is important to note that this study does not aim to advocate for particular management actions. The following recommendations aim to take into account financial and capacity limitations and attempt to remain appropriate to the local context.

Strengthen/ Enforce regulations for Conservation Areas: enforcement is more important than monitoring, as the lack of compliance with no-take areas will severely hinder any benefits of the CA. This process will limit poaching, especially around Funafuti. Poaching within the FCA has been noticed by the FCA officers, and signs of it were observed during our investigations; fishing lines were observed around Fuafatu and Tefala islets. Furthermore, dead clam shells were found on Fuafatu fringing reef.

Monitoring of Conservation Areas maintaining previous methodologies and in collaboration with the local team already involved with this project. The worksheets for each station contain all the information required to identify the sampling sites on each atoll. To assist this process, a random sampling design was chosen, leading to a high number of replicates within the same area and avoiding lengthy searching. **It is recommended that the monitoring be conducted annually by the same team**, based on the species list established during this study. It is recommended that observers attend a one-day training session as a "refresher", especially to revise counting methods and target species. Ideally, monitoring and training is to be conducted in collaboration with the Fisheries Department. A number of items to be used in future field surveys were left with the Fisheries Department of Funafuti. The monitoring of target species should allow refining the CAs boundaries, to include reefs that support high diversity and/or density of target marine species. The list of target species can be extended to include new species of interest or threatened species.

Setting up and strengthening the customary management committee on each atoll. This management committee would ideally involve community representatives (elders, women, youth, local fishermen, commercial fishermen including people involved in the sea cucumber industry). It would look after the marine resource monitoring, and then would set up management plans according to changes in stocks. It would also be responsible for disseminating information about the state of marine resources within the local community. This committee may also be able to raise funds to cover the costs of resource management (fieldwork, communication, etc.), as has already been done in Nukulaelae (GEF fund under the World Bank for marine resource management).

Commercial sea cucumber stock assessment on each atoll where commercial collection of sea cucumbers has been intense (such as Funafuti and Nukulaelae). We observed very low stocks of high grade sea cucumber species in the 3 lagoons studied. This could be the consequence of a commercial project that took place for a couple of years. According to the Tuvalu Fisheries officers, sea cucumber collection was taking place mainly on the outer reef slope and moving deeper with time, leading to higher risk for local divers. Therefore, plans for the management of sea cucumber stocks and the improvement of diver safety protocols are highly recommended.

Clam stock assessment around Funafuti. Along with sea cucumbers, clam stocks are very low, especially outside the FCA. As mentioned previously, poaching activities have been recorded outside and within the FCA. One of the first management measures must be the enforcement of existing regulations. Because clams are only caught for local consumption, it might be appropriate to raise community awareness regarding the consequences of overexploitation of clams.

***Trochus* and turbo stock assessment** within each atoll surveyed. This study demonstrated a low number of these two resources. However, it is important to note that the specific habitat for these gastropods has not been surveyed. We recommend a stock assessment within these organisms' habitats.

Explore options for shark conservation. According to our field observations and discussions with local fishermen, reef shark stocks are currently very low around Tuvalu. The cause of this is unknown, but it is highly probable that a combination of mortality sources exist, both through fisheries targeting sharks and through by-catch. Awareness about the need to protect top predators for a healthy ecosystem appeared largely lacking. Education programs could cover the importance and vulnerability of sharks, targeting a range of social groups (e.g. schoolchildren, fishermen, elders, etc.). The imposition of catch limits and banning the finning of sharks is a first effective step towards shark conservation, but it may be necessary to extend shark management programs to include foreign fisheries operating within Tuvaluan waters.

GLOSSARY

Abiotic: Physical rather than biological; not derived from living organisms.

Anthropisation: The conversion of open spaces, landscapes, and natural environments by human actions.

Benthic: Of or relating to or happening on the bottom under a body of water.

Biomass: Weigth of biological material form living organism.

Ciguatera: Poisoning by neurotoxins as a result of eating the flesh of a tropical marine fish that carries a toxic dinoflagellate.

Climate change: The change in global climate patterns apparent from the mid to late 20th century onwards, attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Cnidarian: An aquatic invertebrate animal of the phylum Cnidaria, which includes jellyfish, corals and anemones.

Coral bleaching event: An environmentally stressful period in which the symbiotic relationship between the coral and the microscopic algae in its tissues (zooxanthellae) breaks down. When stressed, the zooxanthellae become toxic and the coral must expel them, thus losing their colour and becoming white or 'bleached'. A bleached coral no longer receives the photosynthetic product of the zooxanthellae and may die if exposed to the stressful conditions for too long. A bleaching event is one in which entire coral reefs are affected by this condition.

Coralline algae: Coralline algae are red algae in the Family Corallinaceae of the order Corallinales. They are characterized by a thallus that is hard because of calcareous deposits contained within the cell.

Density: Mass per unit volume.

Ecological niche: A position or role taken by a kind of organism within its community. Such a position may be occupied by different organisms in different localities, e.g., antelopes in Africa and kangaroos in Australia.

Endemic: Native or restricted to a certain country or area.

Eutrophication: The response of an aquatic ecosystem to the addition of excessive nutrients.

Falekaupule: the Council of Elders that functions as a local government council in Tuvalu.

Homoscedasticity (data analysis): The random distribution of variances around the mean.

Inner reef slope: On a coral atoll, the internal slope or wall of the reef, facing the lagoon.

Lagoon: A stretch of salt water separated from the sea by a low sandbank or coral reef.

Macroalgae: Also known as seaweed, macroscopic, multicellular, benthic marine algae. The term includes some members of the red, brown and green algae.

Macroinvertebrate: An invertebrate (an animal without a backbone) that is large enough to be seen without the use of a microscope.

Mariculture: The cultivation of fish or other marine life for food.

Monospecific: Relating to or consisting of only one species.

Normality (data analysis): Conforming to a normal distribution, or along a regular 'bell' curve.

Overfishing: Unsustainable fishing, whereby fish are harvested faster than they can replenish their population, leaving to population collapse and wide-reaching ecosystem changes.

Pinnacles: Steep-sided seamounts, or mountains rising from the seabed to just beneath the ocean's surface.

Reef flat: The top of a reef, usually the shallowest area.

Salinisation: The deposition of salts at the surface of a soil in areas where evapotranspiration exceeds precipitation so drawing water up through the soil and with it salts that had been dissolved in it.

Staghorn (coral): Coral colonies shaped like long, tapering branches.

Terrace (reef): A level or flat area on a reef slope.

Transects: Lengths of measuring tape laid along the substrate.

Turf algae: An assemblage of small filamentous algae, sometimes including juvenile forms of larger species, forming a compact turf-like covering over the substratum, usually no more than 1-2cm in height.

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Tuvalu Marine Life

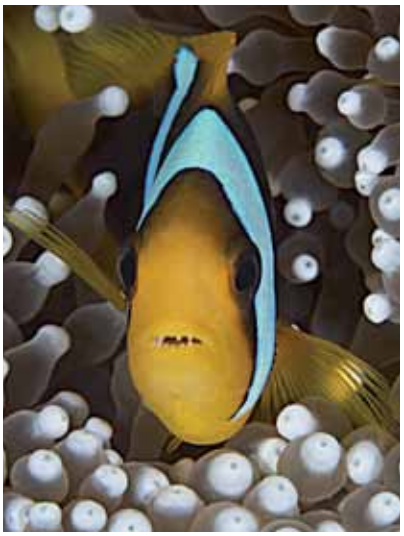
an Alofa Tuvalu Project

with the Tuvalu Fisheries Department and Funafuti, Nanumea, Nukulaelae Kaupules

Scientific Report - PART III

Documented Tuvalu Marine Life Inventory

-New recorded fish and macroinvertebrates
-Tuvalu Marine species list (update 2012)

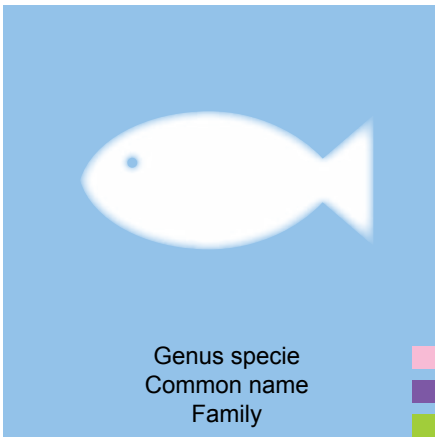




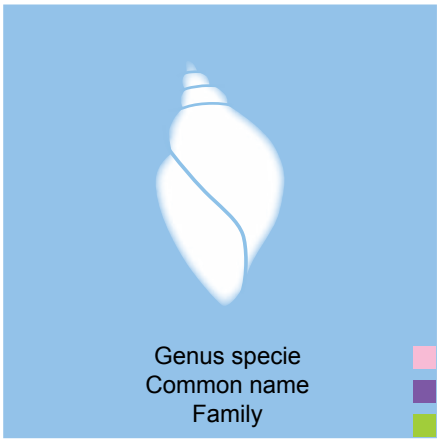



Tuvalu Fisheries Department
FONDATION D'ENTREPRISE TOTAL
ALOFA TUVALU
CRISP
SUE DEVITT

new fish



new macroinvertebrate



where? Nanumea Nukulaelae Funafuti

New recorded fish

Acanthurus auranticavus
Orange-socket surgeonfish
Acanthuridae

Ctenochaetus cyanocheilus
Bluelipped bristletooth
Acanthuridae

Zebrasoma flavescens
Yellow tang
Acanthuridae

Archamia bleekeri
Gon's cardinalfish
Apogonidae

Apogon fragilis
Fragile cardinalfish
Apogonidae

Apogon fraenatus
Spurcheek cardinalfish
Apogonidae

Apogon luteus
Yellow cardinalfish
Apogonidae

Apogon monospilus
Yelloweyed cardinalfish
Apogonidae

Apogon nigrofasciatus
Blackstripe cardinalfish
Apogonidae

Cheilodipterus artus
Wolf cardinalfish
Apogonidae

Cheilodipterus macrodon
Tiger cardinalfish
Apogonidae

Cirripectes chelomatus
Lady Musgrave blenny
Blenniidae

Ecsenius opisthofrontalis
Comical blenny
Blenniidae

Ecsenius bicolor
Bicolor blenny
Blenniidae

Plagiotremus rhinorhynchus
Bluestriped fangblenny
Blenniidae

Plagiotremus tapeinosoma
Piano fangblenny
Blenniidae

Caracanthus maculatus
Spotted croucher
Carachanthidae

Amblygobius nocturnus
Nocturn goby
Gobiidae

Asterropteryx striatus
Striped goby
Gobiidae

Enneapterygius sp.
Triplefin
Gobiidae

Eviota latifasciata
Brown-banded pygmygoby
Gobiidae

Eviota prasites
Red & white-spotted pygmygoby
Gobiidae

Eviota sigillata
Sigillata pygmygoby
Gobiidae

Eviota zebrina
Zebra goby
Gobiidae

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Eviota sp.

Gobiidae

Paragobiodon echinocephalus
Redhead coralgoby
Gobiidae

Gobiodon sp.

Gobiidae

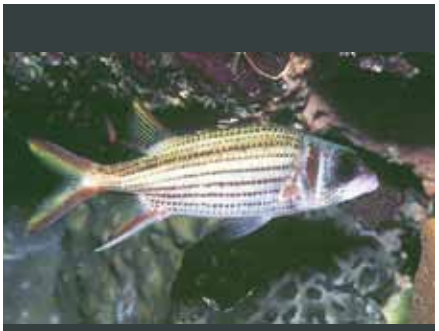
Pleurosicya mossambica
Common ghostgoby
Gobiidae

Trimma halonevum
Skinspot dwarfgoby
Gobiidae

Trimma sp.

Gobiidae

Valenciennea puellaris
Orange diamond goby
Gobiidae



Neoniphon argenteus
Clearfin squirrelfish
Holocentridae

Cheilinus oxycephalus
Snooty wrasse
Labridae

Halichoeres nebulosus
Nebulous wrasse
Labridae

Labropsis australis
Southern tubelip
Labridae

Oxycheilinus orientalis
Slender wrasse
Labridae

Oxycheilinus rhodocrous
Oriental wrasse
Labridae

Oxycheilinus unifasciatus
Ringtail wrasse
Labridae

Pteragogus cryptus
Cryptic wrasse
Labridae

Stethojulis interrupta
Cutribbon wrasse
Labridae

Stethojulis trilineata
Fourline wrasse
Labridae

Wetmorella albofasciata
Whitebanded pygmy wrasse
Labridae

Gymnocranius microdon
Blue-spotted large-eye bream
Lethrinidae

Lethrinus lentjan
Pinkear emperor
Lethrinidae

Parupeneus ciliatus
Cardinal goatfish
Mullidae

Centropyge bispinosus
Two-spined angelfish
Pomacanthidae

Centropyge heraldi
Yellow bannerfin angelfish
Pomacanthidae

Amblyglyphidodon leucogaster
White-belly damsel
Pomacentridae

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Chromis amboinensis
Ambon chromis
Pomacentridae

Chromis atripes
Darkfin chromis
Pomacentridae

Chromis vanderbilti
Vanderbilt's chromis
Pomacentridae

Chromis weberi
Weber's chromis
Pomacentridae

Chromis xanthura
Pale-tail chromis
Pomacentridae

Chrysiptera unimaculata
Onespot demoiselle
Pomacentridae

Plectroglyphidodon lacrymatus
Jewel damsel
Pomacentridae

Pomacentrus brachialis
Charcoal damsel
Pomacentridae

Pomacentrus coelestis
Neon damsel
Pomacentridae

Bluespot damsel
Pomacentridae

Pomachromis richardsoni
Richardson's reef- damsel
Pomacentridae

Sarda orientalis
Bonito
Scombridae

Sebastapistes cyanostigma
Yellow-spotted scorpionfish
Scorpaenidae

Balenoperca chabanaudi
Arrowhead soapfish
Serranidae

Pseudanthias dispar
Redfin anthias
Serranidae

Pseudanthias evansi
Yellowback anthias
Serranidae

Siganus canaliculatus
White-spotted rabbitfish
Siganidae

Saurida gracilis
slender lizardfish
Synodontidae

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New macroinvertebrates

Hyotissa hyotis
Honeycomb oyster
Gryphaeidae

Actinopyga varians
Surf redfish
Holothuriidae

Holothuria hilla
Tiger tail sea cucumber
Holothuriidae

Stichopus hermanni
Curryfish
Holothuriidae

Coralliophila violacea
Muricidae

Drupella cornus

Muricidae

Celerina heffernani
Heffernani's sea star
Ophidiasteridae

Lopha cristagalli
Cock's comb oyster
Ostreidae

Isognomon sp.
Purse oyster
Pteriidae

Spirobranchus giganteus
Christmas tree worm
Serpulidae

Dendropoma maxima
Great worm shell
Vermetidae

Tuvalu marine species list (update 2012)

1: SPECIES LISTS

1A: REEF FISHES
1B: MARINE MACROINVERTEBRATES
1C: CNIDARIANS
1D: MARINE ALGAE
1E: SEA BIRDS
1F: MARINE MAMMALS
1G: MARINE TURTLES
1H: SPONGES
1I: MANGROVE SPECIES

2: DOCUMENTS CONSULTED FOR THE SURVEY

3: MARINE SPECIES LISTED UNDER THE CITES CONVENTION FOR TUVALU

4: IUCN RED LIST OF THREATENED SPECIES FOR TUVALU MARINE SPECIES

1A: Reef fishes

New recorded reef fish species

Common name (family)	Family	Genus Specie	Common name (specie)	Tuvaluan name
SURGEONFISHES	ACANTHURIDAE	*Acanthurus achilles*	Achilles tang	Maito/Maninilakau
SURGEONFISHES	ACANTHURIDAE	*Acanthurus albipectoralis*	Whitefin surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus auranticavus*	Orange-socket surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus blochii*	Ringtail surgeonfish	Maa (NNM)/Kapalagi (NKL)
SURGEONFISHES	ACANTHURIDAE	*Acanthurus dussumieri*	Eyestripe surgeonfish	Kapalagi
SURGEONFISHES	ACANTHURIDAE	*Acanthurus guttatus*	Whitespotted surgeonfish	Api/Maono
SURGEONFISHES	ACANTHURIDAE	*Acanthurus leucocheilus*	Palelipped surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus leucopareius*	Whitebar surgeonfish	Maono
SURGEONFISHES	ACANTHURIDAE	*Acanthurus lineatus*	Lined surgeonfish	Ponelolo
SURGEONFISHES	ACANTHURIDAE	*Acanthurus maculiceps*	Spottedface surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus mata*	Elongate surgeonfish/Black surgeonfish	Homo/Kapalagi
SURGEONFISHES	ACANTHURIDAE	*Acanthurus nigricans*	Goldrim surgeonfish	Pone, pone sina
SURGEONFISHES	ACANTHURIDAE	*Acanthurus nigricauda*	Blackstreak surgeonfish	Kapalagi
SURGEONFISHES	ACANTHURIDAE	*Acanthurus nigrofuscus*	Brown surgeonfish	Pone
SURGEONFISHES	ACANTHURIDAE	*Acanthurus nigroris*	Bluelined surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus olivaceus*	Orangeband surgeonfish	Pone/Pone kaokao kula/Kapalagi (NKL)
SURGEONFISHES	ACANTHURIDAE	*Acanthurus pyroferus*	Mimic surgeonfish	Alogo, pone?
SURGEONFISHES	ACANTHURIDAE	*Acanthurus thompsoni*	Thompson's surgeonfish	
SURGEONFISHES	ACANTHURIDAE	*Acanthurus triostegus*	Convict surgeonfish	Manini
SURGEONFISHES	ACANTHURIDAE	*Acanthurus xanthopterus*	Yellowfin surgeonfish	Kapalagi
SURGEONFISHES	ACANTHURIDAE	*Ctenochaetus binotatus*	Twospot bristletooth	Pone uli
SURGEONFISHES	ACANTHURIDAE	*Ctenochaetus cyanocheilus*	Bluelipped bristletooth	
SURGEONFISHES	ACANTHURIDAE	*Ctenochaetus hawaiiensis*	Hawaiian bristletooth	Pone uli

Common name (family)	Family	Genus Specie	Common name (specie)	Tuvaluan name
CARDINALFISHES	APOGONIDAE	*Apogon luteus*	Yellow cardinalfish	
CARDINALFISHES	APOGONIDAE	*Apogon monospilus*	Yelloweyed cardinalfish	
CARDINALFISHES	APOGONIDAE	*Apogon nigrofasciatus*	Blackstripe cardinalfish	
CARDINALFISHES	APOGONIDAE	*Archamia fucata*	Orangelined cardinalfish	Matapa
CARDINALFISHES	APOGONIDAE	*Archamia lineolata*	Bronze-streaked cardinalfish	Matapa
CARDINALFISHES	APOGONIDAE	*Cheilodipterus artus*	Wolf cardinalfish	
CARDINALFISHES	APOGONIDAE	*Chelodipterus macrodon*	Tiger cardinalfish	
CARDINALFISHES	APOGONIDAE	*Cheilodipterus quinquelineatus*	Five-lined cardinalfish	Kalisi
CARDINALFISHES	APOGONIDAE	*Pseudamia polystigma*	Cardinalfish	
SILVERSIDES	ATHERINIDAE	*Atherinomorus lacunosus*	Broad-banded hardyhead	Salii
SILVERSIDES	ATHERINIDAE	*Hypoatherina barnesi*	Barnes hardyhead	Salii
SILVERSIDES	ATHERINIDAE	*Stenatherina panatela*	Panatela riverside	
TRUMPETFISHES	AULOSTOMIDAE	*Aulostomus chinensis*	Trumpetfish	Taotaoama
TRIGGERFISHES	BALISTIDAE	*Balistapus undulatus*	Orange-lined triggerfish	Mumu fatu
TRIGGERFISHES	BALISTIDAE	*Balistoides conspicillum*	Clown triggerfish	Umu fatu pulepule
TRIGGERFISHES	BALISTIDAE	*Balistoides viridescens*	Titan triggerfish	Umu fatu
TRIGGERFISHES	BALISTIDAE	*Melichthys niger*	Black durgon	Sumu lega
TRIGGERFISHES	BALISTIDAE	*Melichthys vidua*	Pinktailed durgon	Sumu papa
TRIGGERFISHES	BALISTIDAE	*Odonus niger*	Redtooth triggerfish	
TRIGGERFISHES	BALISTIDAE	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	Umu fatu/Umu (NNM/NKL/FNF)
TRIGGERFISHES	BALISTIDAE	*Pseudobalistes fuscus*	Yellow-spotted triggerfish	
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus aculeatus*	Picasso triggerfish	Sumu uta/Sumu (NNM/NKL/FNF)
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus rectangulus*	Wedge picassofish	Umu
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus verrucosus*	Blackpatch triggerfish	Sumu
TRIGGERFISHES	BALISTIDAE	*Sufflamen bursa*	Scimitar triggerfish	
TRIGGERFISHES	BALISTIDAE	*Sufflamen chrysopterum*	Halfmoon triggerfish	
TRIGGERFISHES	BALISTIDAE	*Sufflamen fraenatum*	Bridled triggerfish	
TRIGGERFISHES	BALISTIDAE	*Xanthichthys auromarginatus*	Gilded triggerfish	
TRIGGERFISHES	BALISTIDAE	*Xanthichthys caeruleolineatus*	Blueline triggerfish	

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CARDINALFISHES	APOGONIDAE	*Apogon luteus*	Yellow cardinalfish	
CARDINALFISHES	APOGONIDAE	*Apogon monospilus*	Yelloweyed cardinalfish	
CARDINALFISHES	APOGONIDAE	*Apogon nigrofasciatus*	Blackstripe cardinalfish	
CARDINALFISHES	APOGONIDAE	*Archamia fucata*	Orangelined cardinalfish	Matapa
CARDINALFISHES	APOGONIDAE	*Archamia lineolata*	Bronze-streaked cardinalfish	Matapa
CARDINALFISHES	APOGONIDAE	*Cheilodipterus artus*	Wolf cardinalfish	
CARDINALFISHES	APOGONIDAE	*Chelodipterus macrodon*	Tiger cardinalfish	
CARDINALFISHES	APOGONIDAE	*Cheilodipterus quinquelineatus*	Five-lined cardinalfish	Kalisi
CARDINALFISHES	APOGONIDAE	*Pseudamia polystigma*	Cardinalfish	
SILVERSIDES	ATHERINIDAE	*Atherinomorus lacunosus*	Broad-banded hardyhead	Salii
SILVERSIDES	ATHERINIDAE	*Hypoatherina barnesi*	Barnes hardyhead	Salii
SILVERSIDES	ATHERINIDAE	*Stenatherina panatela*	Panatela riverside	
TRUMPETFISHES	AULOSTOMIDAE	*Aulostomus chinensis*	Trumpetfish	Taotaoama
TRIGGERFISHES	BALISTIDAE	*Balistapus undulatus*	Orange-lined triggerfish	Mumu fatu
TRIGGERFISHES	BALISTIDAE	*Balistoides conspicillum*	Clown triggerfish	Umu fatu pulepule
TRIGGERFISHES	BALISTIDAE	*Balistoides viridescens*	Titan triggerfish	Umu fatu
TRIGGERFISHES	BALISTIDAE	*Melichthys niger*	Black durgon	Sumu lega
TRIGGERFISHES	BALISTIDAE	*Melichthys vidua*	Pinktailed durgon	Sumu papa
TRIGGERFISHES	BALISTIDAE	*Odonus niger*	Redtooth triggerfish	
TRIGGERFISHES	BALISTIDAE	*Pseudobalistes flavimarginatus*	Yellowmargin triggerfish	Umu fatu/Umu (NNM/NKL/FNF)
TRIGGERFISHES	BALISTIDAE	*Pseudobalistes fuscus*	Yellow-spotted triggerfish	
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus aculeatus*	Picasso triggerfish	Sumu uta/Sumu (NNM/NKL/FNF)
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus rectangulus*	Wedge picassofish	Umu
TRIGGERFISHES	BALISTIDAE	*Rhinecanthus verrucosus*	Blackpatch triggerfish	Sumu
TRIGGERFISHES	BALISTIDAE	*Sufflamen bursa*	Scimitar triggerfish	
TRIGGERFISHES	BALISTIDAE	*Sufflamen chrysopterum*	Halfmoon triggerfish	
TRIGGERFISHES	BALISTIDAE	*Sufflamen fraenatum*	Bridled triggerfish	
TRIGGERFISHES	BALISTIDAE	*Xanthichthys auromarginatus*	Gilded triggerfish	
TRIGGERFISHES	BALISTIDAE	*Xanthichthys caeruleolineatus*	Blueline triggerfish	

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NEEDLEFISHES	BELONIDAE	*Platybelone argalus platyura*	Keeltail needlefish	Ise/Taotao/Kasufu
NEEDLEFISHES	BELONIDAE	*Tylosurus crocodilus*	Crocodilian needlefish	Kasufe
BLENNIES	BLENNIDAE	*Blenniella chrysospilos*	Red-spotted blenny	Manoko
BLENNIES	BLENNIDAE	*Blenniella periophthalmus*	Blue-dashed rockskypper	Manoko
BLENNIES	BLENNIDAE	*Cirripectes castaneus*	Chestnut Blenny	Manoko selesele
BLENNIES	BLENNIDAE	*Cirripectes chelomatus*	Lady Musgrave blenny	
BLENNIES	BLENNIDAE	*Cirripectes filamentosus*	Filamentous blenny	Manoko
BLENNIES	BLENNIDAE	*Cirripectes stigmaticus*	Reticulated Blenny	Manoko tuututu
BLENNIES	BLENNIDAE	*Cirripectes variolosus*	Pacific plate blenny	Manoko
BLENNIES	BLENNIDAE	*Ecsenius opisthofrontalis*	Comical blenny	
BLENNIES	BLENNIDAE	*Ecsenius bicolor*	Bicolour blenny	
BLENNIES	BLENNIDAE	*Entomacrodus striatus*	Blackspotted rockskypper	Manoko
BLENNIES	BLENNIDAE	*Istiblennius edentulus*	Rippled rockskypper	Manoko
BLENNIES	BLENNIDAE	*Meiacanthus atrodorsalis*	Yelowtail fangblenny	Manoko
BLENNIES	BLENNIDAE	*Plagiotremus laudandus*	Bicolour fangblenny	
BLENNIES	BLENNIDAE	*Plagiotremus rhinorhynchus*	Bluestriped fangblenny	
BLENNIES	BLENNIDAE	*Plagiotremus tapeinosoma*	Piano fangblenny	
FLOUNDERS	BOTHIDAE	*Bothus mancus*	Flowery mancus	Ali
FLOUNDERS	BOTHIDAE	*Bothus pantherinus*	Leopard flounder	Ali
FUSILIERS	CAESIONIDAE	*Caesio caerulaura*	Scissortail fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Caesio cuning*	Red-bellied fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Caesio lunaris*	Lunar fusilier	
FUSILIERS	CAESIONIDAE	*Caesio teres*	Blue and yellow fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Pterocaesio diagramma*	Two-lined fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Pterocaesio lativittata*	Wideband fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Pterocaesio marri*	Marr's fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Pterocaesio tile*	Neon fusilier	Ulia
FUSILIERS	CAESIONIDAE	*Pterocaesio trilineata*	Three-stripe fusilier	
CROUCHERS	CARACANTHIDAE	*Caracanthus maculatus*	Spotted croucher	

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JACKS	CARANGIDAE	*Alectis ciliaris*	African pompano	
JACKS	CARANGIDAE	*Atule mate*	Yellowtail scad	
JACKS	CARANGIDAE	*Carangoides equula*	Whitefin trevally	Aseu
JACKS	CARANGIDAE	*Carangoides ferdau*	Barred jack	Pula
JACKS	CARANGIDAE	*Carangoides malarbaricus*	Malarbar trevally	Lupo
JACKS	CARANGIDAE	*Carangoides orthogrammus*	Gold-spot trevally	Filu
JACKS	CARANGIDAE	*Caranx ignobilis*	Giant trevally	Tinoulua/Ulua/Aseu
JACKS	CARANGIDAE	*Caranx lugubris*	Black trevally	Tafauli
JACKS	CARANGIDAE	*Caranx melampygus*	Bluefin trevally	Ulua (NNM)/Aseu (NKL)
JACKS	CARANGIDAE	*Caranx sexfasciatus*	Bigeye trevally	Teu/Ulua/Aseu (FNF)
JACKS	CARANGIDAE	*Decapterus macarellus*	Mackerel scad	Atule
JACKS	CARANGIDAE	*Decapterus macrosoma*	Shorfin scad	
JACKS	CARANGIDAE	*Elegatis bipinnulata*	Rainbow runner	Kamai
JACKS	CARANGIDAE	*Gnathanodon speciosus*	Golden trevally	Lupolupo/Lupo
JACKS	CARANGIDAE	*Scomberoides lysan*	Doublespotted queenfish	Lai/Ata
JACKS	CARANGIDAE	*Scomberoides tala*	Barred queenfish	Lai
JACKS	CARANGIDAE	*Scomberomerus commersonianus*	Talang queenfish	palu
JACKS	CARANGIDAE	*Selar boops*	Oxeye scad	Atule
JACKS	CARANGIDAE	*Selar crumenophthalmus*	Bigeye scad	Atule, Salala
JACKS	CARANGIDAE	*Seriola dumerilii*	Greater amberjack	Kamai
JACKS	CARANGIDAE	*Seriola lalandi*	Yellowtail kingfish	Kamai
JACKS	CARANGIDAE	*Seriola rivoliana*	Deep-water ampberjack	Palu matu
JACKS	CARANGIDAE	*Trachinotus bailloni*	Blackspotted dart	Lai
JACKS	CARANGIDAE	*Trachinotus blochii*	Snub-nosed dart	Lai
JACKS	CARANGIDAE	*Trachinotus botla*	Common dart	Lai
JACKS	CARANGIDAE	*Uraspis secunda*	Cottonmouth jack	
PEARLFIHES	CARAPODIDAE	*Encheliophis homei*	Silver pearlfish	
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus albimarginatus*	Silvertip shark	Mago
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus amblyrhynchos*	Grey reef shark	Mago

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REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus limbatus*	Small blacktip shark	
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus longimanus*	Oceanic whitetip shark	Mago
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus melanopterus*	Blacktip reef shark	Mago
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus obscurus*	Dusky Shark	
REQUIEM SHARKS	CARCHARHINIDAE	*Carcharhinus plumbeus*	Sandbar Shark	
REQUIEM SHARKS	CARCHARHINIDAE	*Galeocerdo cuvier*	Tiger shark	Mago/Uninuni
REQUIEM SHARKS	CARCHARHINIDAE	*Isurus sp.*	Mako shark	Mago
REQUIEM SHARKS	CARCHARHINIDAE	*Negaprion acutidens*	Indo-Pacific Lemon Shark	Mago
REQUIEM SHARKS	CARCHARHINIDAE	*Prionace glauca*	Blue shark	
REQUIEM SHARKS	CARCHARHINIDAE	*Triaenodon obesus*	White tip reef shark	Mago (FNF)
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon auriga*	Threadfin butterflyfish	Tifitifi/Maninipapa/Laulofou/Moipe pe (NKL/FNF)/Koile (NNM)
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon bennetti*	Bennett's butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon citrinellus*	Citron butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon ephippium*	Saddled butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon flavirostris*	Black butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon kleinii*	Blacklip butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon lineolatus*	Lined butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon lunula*	Racoon butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon lunulatus*	Oval butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon melannotus*	Blackback butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon mertensii*	Merten's butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon meyeri*	Meyer's butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon ornatissimus*	Ornate butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon pelewensis*	Dot-dash butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon plebeius*	Blueblotch butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon quadrimaculatus*	Fourspot butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon rafflesii*	Latticed butterflyfish	

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BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon reticulatus*	Reticulated butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon semeion*	Dotted butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon trifascialis*	Chevron butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon trifasciatus*	Redfin butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon ulietensis*	Doublebarred butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon unimaculatus*	Teardrop butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Chaetodon vagabundus*	Vagbond butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Forcipiger flavissimus*	Forcepsfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Forcipiger longirostris*	Longnose butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Hemitaurichthys polylepis*	Pyramid butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Hemitaurichthys thompsoni*	Thompson's butterflyfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Heniochus acuminatus*	Longfin bannerfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Heniochus chrysostomus*	Pennant bannerfish	Moepepe
BUTTERFLYFISHES	CHAETODONTIDAE	*Heniochus monoceros*	Masked bannerfish	
BUTTERFLYFISHES	CHAETODONTIDAE	*Heniochus varius*	Humphead bannerfish	
MILKFISHES	CHANIDAE	*Chanos chanos*	Milkfish	Paneava
HAWKFISHES	CIRRITHIDAE	*Cirrhitichthys oxycephalus*	Pixie hawkfish	Patuki
HAWKFISHES	CIRRITHIDAE	*Cirrhitus pinnulatus*	Stocky hawkfish	Patuki
HAWKFISHES	CIRRITHIDAE	*Neocirrhites armattus*	Flame hawkfish	Patuki
HAWKFISHES	CIRRITHIDAE	*Paracirrhites arcatus*	Arc-eye hawkfish	Patukilautalo
HAWKFISHES	CIRRITHIDAE	*Paracirrhites forsteri*	Blackside hawkfish	Patukilautalo
HAWKFISHES	CIRRITHIDAE	*Paracirrhites hemistictus*	Halfspotted hawkfish	Patukilautalo
HERRINGS	CLUPEIDAE	*Spratelloides delicatulus*	Delicate roundherring	Kavaliki
EELS AND MORAYS	CONGRIDAE	*Conger cinereus*	Longfin African conger	
DOLPHINFISHES	CORYPHAENIDAE	*Coryphaena hippurus*	Common dolphin fish	Masimasi
STINGRAYS	DASYATIDAE	*Himantura uarnak*	Reticulate Whipray	Fai pusi
STINGRAYS	DASYATIDAE	*Taeniura meyeni*	Marbled Stingray	Fai Uli

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STINGRAYS	DASYATIDAE	*Dasyatis kuhlii*	Blue-spotted stingray	Fai kili
PORCUPINEFISHES	DIODONTIDAE	*Diodon hystrix*	Porcupine fish, pufferfish	Tautau/Sue
REMORAS	ECHENEIDIDAE	*Echeneis naucrates*	Sharksucker	Talitaliuli
REMORAS	ECHENEIDIDAE	*Remora remora*	Remora	
BATFISHES	EPHIPPIDAE	*Platax orbicularis*	Orbicular platax	Laulaufou
BATFISHES	EPHIPPIDAE	*Platax pinnatus*	Pinnate Bat Fish	Laulaufou
BATFISHES	EPHIPPIDAE	*Platax teira*	Blunthead platax	Api
FLYINGFISHES	EXOCOETIDAE	*Cheilopogon spp.*	Flying fish	Isave
FLYINGFISHES	EXOCOETIDAE	*Cypselurus cyanopterus*	Margined flying fish	Isave
FLYINGFISHES	EXOCOETIDAE	*Cypselurus poecilopterus*	Yellow-wing flyingfish	Isave
FLYINGFISHES	EXOCOETIDAE	*Cypselurus suttoni*	Flying Fish	Isave
CORNETFISHES	FISTULARIDAE	*Fistularia commersonii*	Smooth cornetfish	Taotaoama
SNAKE MACKERELS	GEMPYLIDAE	*Promethichthys prometheus*	Snake mackerel	Palu kanane
SNAKE MACKERELS	GEMPYLIDAE	*Ruvettus pretiosus*	Castor oilfish	Palu talatala
THREADFINS	GERRIDAE	*Gerres oyena*	Blacktip mojarra	Matu (FNF)
NURSE SHARKS	GINGLYMOSTORMATIDAE	*Nebrius concolor*	Giant sleepy shark	
GOBIES	GOBIIDAE	*Amblygonius nocturnus*	Nocturn goby	
GOBIES	GOBIIDAE	*Amblygobius phalaena*	Calico goby	Manoko
GOBIES	GOBIIDAE	*Asterropteryx striatus*	Striped goby	
GOBIES	GOBIIDAE	*Bryanops natans*	Redeye Goby	Manoleo
GOBIES	GOBIIDAE	*Ctenogobiops feroculus*	Fierce shrimpgoby	Manoko
GOBIES	GOBIIDAE	*Ctenogobiops pomastictus*	Gold-speckled shrimpgoby	Manoko
GOBIES	GOBIIDAE	*Enneapterygius* sp.		
GOBIES	GOBIIDAE	*Eviota latifasciata*	Brown-banded pygmygoby	
GOBIES	GOBIIDAE	*Eviota prasites*	Red & white-spotted pygmygoby	
GOBIES	GOBIIDAE	*Eviota sigillata*	Sigillata pygmygoby	
GOBIES	GOBIIDAE	*Eviota zebrina*	Zebra goby	
GOBIES	GOBIIDAE	*Eviota* sp.		

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GOBIES	GOBIIDAE	*Gobiodon echinocephalus*	Redhead coralgoby	
GOBIES	GOBIIDAE	*Gobiodon* sp.		
GOBIES	GOBIIDAE	*Pleurosicya mossambica*	Common ghostgoby	
GOBIES	GOBIIDAE	*Trimma halonevum*	Skinspot dwarfgoby	
GOBIES	GOBIIDAE	*Trimma* sp.		
GOBIES	GOBIIDAE	*Valenciennea muralis*	Mural goby	Manoko
GOBIES	GOBIIDAE	*Valenciennea puellaris*	Orange diamond goby	
GOBIES	GOBIIDAE	*Valenciennea strigata*	Bluestreak goby	Manoko
SOAPFISHES	GRAMMISTIDAE	*Pogonoperca punctata*	Spotted soapfish	Patuki/Lafalafa
HALFBEAKS	HEMIRAMPHIDAE	*Hyporhamphus dussumieri*	Dussumier's halfbeak	Tute
COW SHARKS	HEXANCHIDAE	*Hexanchus griseus*	Bluntnose sixgill shark	
SQUIRRELFISHES	HOLOCENTRIDAE	*Adioryx spinifer*	Scarlet squirrelfish	Taa
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis adusta*	Shadowfin soldierfish	
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis amaena*	Brick soldierfish	Malau
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis berndti*	Bigscale soldierfish	Malau
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis hexagona*	Double Tooth Soldierfish	Malau
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis kuntee*	Epaulet soldierfish	Malau
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis murdjan*	Blotcheye soldierfish	
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis violacea*	Lattice soldierfish	Malau puku
SOLDIERFISHES	HOLOCENTRIDAE	*Myripristis vittata*	Whitetip soldierfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Neoniphon argenteus*	Clearfin squirrelfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Neoniphon opercularis*	Blackfin squirrelfish	Talakisi
SQUIRRELFISHES	HOLOCENTRIDAE	*Neoniphon sammara*	Spotfin squirrelfish	Talakisi
SQUIRRELFISHES	HOLOCENTRIDAE	*Ostichthys japonicus*	Japanese soldierfish, Brocade perch	
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron caudimaculatum*	Tailspot squirrelfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron diadema*	Crown squirrelfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron microstoma*	Smallmouth squirrelfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron punctatissimum*	Peppered squirrelfish	
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron rubrum*	Redcoat Squirrelfish	Malu

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SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron spiniferum*	Long-jawed squirrelfish	Taa malau (NKL/NNM)
SQUIRRELFISHES	HOLOCENTRIDAE	*Sargocentron tiere*	Blue lined squirrelfish	
SAILFISHES	ISTIOPHORIDAE	*Istiophorus platypterus*	Indo-Pacific sailfish	
SAILFISHES	ISTIOPHORIDAE	*Makaira indica*	Black marlin	Ulau/Sakula
SAILFISHES	ISTIOPHORIDAE	*Makaira mazara*	Blue marlin	Sakula
SAILFISHES	ISTIOPHORIDAE	*Makaira nigricans*	Blue marlin	Sakula
FLAGTAILS	KUHLIDAE	*Kuhlia mugil*	Fiveband flagtail	Safole
SEA CHUBS	KYPHOSIDAE	*Kyphosus bigibbus*	Gray chub	Nanue
SEA CHUBS	KYPHOSIDAE	*Kyphosus cinerascens*	Highfin chub	Nanue
SEA CHUBS	KYPHOSIDAE	*Kyphosus vaigiensis*	Brassy chub	Nanue
WRASSES	LABRIDAE	*Anampses caeruleopunctatus*	Blue-spotted wrasse	Uloulo/Kimoa/Kiole
WRASSES	LABRIDAE	*Anampses melanurus*	Blacktail wrasse	
WRASSES	LABRIDAE	*Anampses meleagrides*	Spotted wrasse	
WRASSES	LABRIDAE	*Anampses twisti*	Yellowbreasted wrasse	
WRASSES	LABRIDAE	*Bodianus axillaris*	Axilspot hogfish	
WRASSES	LABRIDAE	*Bodianus diana*	Diana's hogfish	
WRASSES	LABRIDAE	*Cheilinus chlorurus*	Floral wrasse	
WRASSES	LABRIDAE	*Cheilinus fasciatus*	Redbreasted wrasse	Gole
WRASSES	LABRIDAE	*Cheilinus oxycephalus*	Snooty wrasse	
WRASSES	LABRIDAE	*Cheilinus trilobatus*	Tripletail wrasse	Gole/Safole
WRASSES	LABRIDAE	*Cheilinus undulatus*	Humpheaded Maori wrasse	Tagafa
WRASSES	LABRIDAE	*Cheilio inermis*	Cigar Wrasse	
WRASSES	LABRIDAE	*Cirrhilabrus cyanopleura*	Blueside wrasse	
WRASSES	LABRIDAE	*Cirrhilabrus exquisitus*	Exquisite wrasse	
WRASSES	LABRIDAE	*Cirrhilabrus punctatus*	Dotted wrasse	
WRASSES	LABRIDAE	*Coris aygula*	Clown coris	
WRASSES	LABRIDAE	*Coris gaimard*	Yellow tail coris	
WRASSES	LABRIDAE	*Epibulus insidiator*	Slingjaw wrasse	
WRASSES	LABRIDAE	*Gomphosus varius*	Bird wrasse	Kimoa/Kioli/Tai

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WRASSES	LABRIDAE	*Halichoeres biocellatus*	Two-spotted wrasse	
WRASSES	LABRIDAE	*Halichoeres hortulanus*	Checkerboard wrasse	
WRASSES	LABRIDAE	*Halichoeres margaritaceus*	Pink-belly wrasse	
WRASSES	LABRIDAE	*Halichoeres marginatus*	Dusky wrasse	
WRASSES	LABRIDAE	*Halichoeres melanurus*	Tail-spot wrasse	
WRASSES	LABRIDAE	*Halichoeres melasmapomus*	Ocellated wrasse	
WRASSES	LABRIDAE	*Halichoeres nebulosus*	Nebulous wrasse	
WRASSES	LABRIDAE	*Halichoeres ornatissimus*	Ornate wrasse	
WRASSES	LABRIDAE	*Halichoeres trimaculatus*	Threespot wrasse	
WRASSES	LABRIDAE	*Hemigymnus fasciatus*	Barred thicklip	
WRASSES	LABRIDAE	*Hemigymnus melapterus*	Blackeye thicklip	
WRASSES	LABRIDAE	*Hologymnosus doliatus*	Pastel ringwrasse	
WRASSES	LABRIDAE	*Labrichthys unilineatus*	Tubelip wrasse	
WRASSES	LABRIDAE	*Labroides bicolor*	Bicolor Cleaner Wrasse	
WRASSES	LABRIDAE	*Labroides dimidiatus*	Bluestreak Cleaner Wrasse	
WRASSES	LABRIDAE	*Labroides pectoralis*	Blackspot cleaner wrasse	
WRASSES	LABRIDAE	*Labropsis australis*	Southern tubelip	
WRASSES	LABRIDAE	*Labropsis xanthonota*	Yellowback tubelip	
WRASSES	LABRIDAE	*Macropharyngodon meleagris*	Blackspotted wrasse	
WRASSES	LABRIDAE	*Novaculichthys taeniourus*	Rockmover wrasse	Gole
WRASSES	LABRIDAE	*Oxycheilinus digramma*	Cheeklined wrasse	
WRASSES	LABRIDAE	*Oxycheilinus orientalis*	Slender wrasse	
WRASSES	LABRIDAE	*Oxycheilinus rhodocrous*	Oriental wrasse	
WRASSES	LABRIDAE	*Oxycheilinus unifasciatus*	Ringtail wrasse	
WRASSES	LABRIDAE	*Pseudocheilinus evanidus*	Disappearing wrasse	
WRASSES	LABRIDAE	*Pseudocheilinus hexataenia*	Sixstripe wrasse	
WRASSES	LABRIDAE	*Pseudocheilinus octotaenia*	Eightstripe wrasse	
WRASSES	LABRIDAE	*Pseudodax moluccanus*	Chiseltooth wrasse	
WRASSES	LABRIDAE	*Pteragogus cryptus*	Cryptic wrasse	

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WRASSES	LABRIDAE	*Stethojulis bandanensis*	Red-shoulder wrasse	
WRASSES	LABRIDAE	*Stethojulis trilineata*	Fourlined wrasse	
WRASSES	LABRIDAE	*Stethojulis interrupta*	Cutribbon wrasse	
WRASSES	LABRIDAE	*Stethojulis strigiventer*	Three-ribbon wrasse	
WRASSES	LABRIDAE	*Thalassoma amblycephalum*	Twotone wrasse	
WRASSES	LABRIDAE	*Thalassoma hardwicki*	Sixbar wrasse	
WRASSES	LABRIDAE	*Thalassoma lunare*	Crescent wrasse	
WRASSES	LABRIDAE	*Thalassoma lutescens*	Sunset wrasse	
WRASSES	LABRIDAE	*Thalassoma purpureum*	Surge wrasse	Uloulo
WRASSES	LABRIDAE	*Thalassoma quinquevittatum*	Fivestrip wrasse	
WRASSES	LABRIDAE	*Thalassoma trilobatum*	Christmas wrasse	
WRASSES	LABRIDAE	*Wetmorella albofasciata*	Whitebanded pygmy wrasse	
LAMNIFORMES	LAMNIDAE	*Carcharodon carcharias*	Great white shark	
LAMNIFORMES	LAMNIDAE	*Isurus oxyrinchus*	Shortfin mako	
PONYFISHES	LEIOGNATHIDAE	*Gazza minuta*	Toothpony	
PONYFISHES	LEIOGNATHIDAE	*Leiognathus equulus*	Common ponyfish	
EMPERORS	LETHRINIDAE	*Gnathodentex aurolineatus*	Goldlined emperor	Mu
EMPERORS	LETHRINIDAE	*Gnathodentex mossambicus*	Large eyed sea bream	
EMPERORS	LETHRINIDAE	*Gymnocranius japonicus*	Japanese large-eye bream	
EMPERORS	LETHRINIDAE	*Gymnocranius microdon*	Blue-spotted large-eye bream	
EMPERORS	LETHRINIDAE	*Lethrinus amboinensis*	Ambon emperor	
EMPERORS	LETHRINIDAE	*Lethrinus atkinsoni*	Pacific yellowtail emperor	
EMPERORS	LETHRINIDAE	*Lethrinus chrysostomus*	Sweetlip emperor	
EMPERORS	LETHRINIDAE	*Lethrinus elongatus*	Long-nosed emperor	Filoa
EMPERORS	LETHRINIDAE	*Lethrinus erythracanthus*	Yellowfin emperor	Saputu (FNF)
EMPERORS	LETHRINIDAE	*Lethrinus erythropterus*	Longfin emperor	
EMPERORS	LETHRINIDAE	*Lethrinus genivittatus*	Longspine emperor	
EMPERORS	LETHRINIDAE	*Lethrinus harak*	Thumbprint emperor	Tanutanu (NKL/FNF)
EMPERORS	LETHRINIDAE	*Lethrinus kallopterus*	Yellow spotted emperor	

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EMPERORS	LETHRINIDAE	*Lethrinus lentjan*	Pinkear emperor	
EMPERORS	LETHRINIDAE	*Lethrinus mahsena*	Yellow-tailed emperor	
EMPERORS	LETHRINIDAE	*Lethrinus microdon*	Smalltooth emperor	
EMPERORS	LETHRINIDAE	*Lethrinus miniatus*	Long nosed emperor	Filoa
EMPERORS	LETHRINIDAE	*Lethrinus nebulosus*	Spangled emperor	Tanutanu
EMPERORS	LETHRINIDAE	*Lethrinus obsoletus*	Orange-striped emperor	Tanutanu (FNF)
EMPERORS	LETHRINIDAE	*Lethrinus olivaceus*	Longface emperor	Kapatiko
EMPERORS	LETHRINIDAE	*Lethrinus ornatus*	Ornate emperor	
EMPERORS	LETHRINIDAE	*Lethrinus reticulatus*	Red snout emperor	
EMPERORS	LETHRINIDAE	*Lethrinus variegatus*	Variegated emperor	Noto
EMPERORS	LETHRINIDAE	*Lethrinus xanthochilus*	Yellowlip emperor	Gutula/Filoa (NNM)/Kapatiko (NKL)
EMPERORS	LETHRINIDAE	*Monotaxis grandoculis*	Bigeye emperor	Kailo/Muu (NNM/NKL/FNF)/Mufala
EMPERORS	LETHRINIDAE	*Wattsia mossambica*	Mozambique large-eye bream	
SNAPPERS	LUTJANIDAE	*Aphareus furca*	Smalltooth jobfish/Blue jobfish	Palusega
SNAPPERS	LUTJANIDAE	*Aphareus rutilans*	Rusty jobfish	Sega loa, Palusega
SNAPPERS	LUTJANIDAE	*Aprion microlepis*	Blue-green snapper	
SNAPPERS	LUTJANIDAE	*Aprion virescens*	Green jobfish	Utu
SNAPPERS	LUTJANIDAE	*Etelis carbunculus*	Red snapper	Palu malau Puku
SNAPPERS	LUTJANIDAE	*Etelis coruscans*	Longtail snapper	Palu malau loa
SNAPPERS	LUTJANIDAE	*Etelis oculatus*	Queen snapper	Palu loa
SNAPPERS	LUTJANIDAE	*Etelis radiosus*	Scarlet snapper	Palu
SNAPPERS	LUTJANIDAE	*Lutjanus adetii*	Yellow-banded snapper	Savane
SNAPPERS	LUTJANIDAE	*Lutjanus argentimaculatus*	River snapper	
SNAPPERS	LUTJANIDAE	*Lutjanus bohar*	Twinspot snapper	Fagamea
SNAPPERS	LUTJANIDAE	*Lutjanus ehrenbergi*	Blackspot snapper	
SNAPPERS	LUTJANIDAE	*Lutjanus fulviflamma*	Dory snapper	Taaiva
SNAPPERS	LUTJANIDAE	*Lutjanus fulvus*	Blacktail snapper	Tagau (NKL/FNF)/Takape (NNM)
SNAPPERS	LUTJANIDAE	*Lutjanus gibbus*	Humpback snapper	Tagau/Taea (NKL/FNF)

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SNAPPERS	LUTJANIDAE	*Lutjanus kasmira*	Bluestriped snapper	Savane
SNAPPERS	LUTJANIDAE	*Lutjanus lemniscatus*	Dark-tailed Perch	Tagau
SNAPPERS	LUTJANIDAE	*Lutjanus malabaricus*	Malabar blood snapper	
SNAPPERS	LUTJANIDAE	*Lutjanus monostigma*	Onespot snapper	Taiva
SNAPPERS	LUTJANIDAE	*Lutjanus quinquelineatus*	Five-lined SeaPerch	Savane
SNAPPERS	LUTJANIDAE	*Lutjanus rivulatus*	Blubberlip snapper	Tagau
SNAPPERS	LUTJANIDAE	*Lutjanus rufolineatus*	Moluccan snapper	
SNAPPERS	LUTJANIDAE	*Lutjanus russellii*	Russell's snapper	Tagau
SNAPPERS	LUTJANIDAE	*Lutjanus semicinctus*	Black-banded snapper	
SNAPPERS	LUTJANIDAE	*Macolor macularis*	Midnight snapper	Tonu
SNAPPERS	LUTJANIDAE	*Macolor niger*	Black and white snapper	
SNAPPERS	LUTJANIDAE	*Paracaesio kusakarii*	Saddleback snapper	Palu kailo
SNAPPERS	LUTJANIDAE	*Paracaesio stonei*	Cocoa snapper	
SNAPPERS	LUTJANIDAE	*Paracaesio xanthura*	Yellowtail false fusilier	Palu ulia
SNAPPERS	LUTJANIDAE	*Pristipomoides amoenus*	Ornate jobfish	
SNAPPERS	LUTJANIDAE	*Pristipomoides auricilla*	Goldflag jobfish	
SNAPPERS	LUTJANIDAE	*Pristipomoides filamentosus*	Crimson jobfish	Palu matu
SNAPPERS	LUTJANIDAE	*Pristipomoides flavipinnis*	Golden eye jobfish	Palu/palu sina
SNAPPERS	LUTJANIDAE	*Pristipomoides multidens*	Goldbanded jobfish	
SNAPPERS	LUTJANIDAE	*Pristipomoides zonatus*	Banded flower snapper	Palu savane
SNAPPERS	LUTJANIDAE	*Tropidinius zonatus*	Banded flower snapper	palu savane
SAND TILEFISHES	MALACANTHIDAE	*Hoplolatilus starcki*	Bluehead sandtilefish	
SAND TILEFISHES	MALACANTHIDAE	*Malacanthus latovittatus*	Blue sandtilefish	
DARTFISHES	MICRODESMIDAE	*Nemateleotris magnifica*	Fire dartfish	
DARTFISHES	MICRODESMIDAE	*Ptereleotris evides*	Twotone dartfish	
DARTFISHES	MICRODESMIDAE	*Ptereleotris microlepis*	Smallscale dartfish	
DARTFISHES	MICRODESMIDAE	*Ptereleotris zebra*	Zebra dartfish	
MANTAS	MOBULIDAE	*Manta alfredi*	Manta ray	Faifalua
MANTAS	MOBULIDAE	*Manta birostris*	Giant manta	Fai Faalua

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MANTAS	MOBULIDAE	*Mobula japanica*	DeviLagoon reefay	
FILEFISHES	MONACANTHIDAE	*Aluterus scriptus*	Scrawled filefish	Kimoa ote tai
FILEFISHES	MONACANTHIDAE	*Amanses scopas*	Broom filefish	Sumu
FILEFISHES	MONACANTHIDAE	*Cantherhines dumerilii*	Barred filefish	Sumu
FILEFISHES	MONACANTHIDAE	*Oxymonacanthus longirostris*	Longnose filefish	Sumu
MULLETS	MUGILIDAE	*Crenimugil crenilabis*	Fringelip mullet	Kanase (NKL)
MULLETS	MUGILIDAE	*Liza vaigiensis*	Squaretail mullet	Kafakafa (NKL)
MULLETS	MUGILIDAE	*Mugil cephalus*	Striped mullet	Kanase
MULLETS	MUGILIDAE	*Valamugil seheli*	Bluespot mullet	Kanase
GOATFISHES	MULLIDAE	*Mulloidichthys flavolineatus*	Yellowstripe goatfish	Kaivete/Kalo (FNF)
GOATFISHES	MULLIDAE	*Mulloidichthys vanicolensis*	Yellowfin goatfish	Kalo/Vete (FNF)
GOATFISHES	MULLIDAE	*Parupeneus barberinus*	Dot-dash goatfish	Malili/Afulu (NKL/FNF)
GOATFISHES	MULLIDAE	*Parupeneus bifasciatus*	Twobarred goatfish	Afulu
GOATFISHES	MULLIDAE	*Parupeneus ciliatus*	Cardinal goatfish	
GOATFISHES	MULLIDAE	*Parupeneus cyclostomus*	Goldsaddle goatfish	
GOATFISHES	MULLIDAE	*Parupeneus multifasciatus*	Multibar goatfish	Afulu
GOATFISHES	MULLIDAE	*Parupeneus pleurostigma*	Sidespot goatfish	
GOATFISHES	MULLIDAE	*Parupeneus spilurus*	Blackspot goatfish	
GOATFISHES	MULLIDAE	*Upeneus arge*	Molucca goatfish	Maalili
GOATFISHES	MULLIDAE	*Upeneus vittatus*	Yellowstriped goatfish	Mailili
MORAYS	MURENIDAE	*Echidna nebulosa*	Snowflake moray	
MORAYS	MURENIDAE	*Gymnothorax fimbriatus*	Fimbriate moray	Pusi
MORAYS	MURENIDAE	*Gymnothorax javanicus*	Giant moray	
EAGLE RAYS	MYLIOBATIDAE	*Aetobatus narinari*	Spotted eagle ray	Fai Manu
BOXFISHES	OSTRACIIDAE	*Ostracion cubicus*	Yellow boxfish	Moamoa/Pokisi
BOXFISHES	OSTRACIIDAE	*Ostracion meleagris*	Spotted boxfish	Moamoa/Pokisi
SWEEPERS	PEMPHERIDIDAE	*Parapriacanthus ransonneti*	Pygmy sweeper	
SWEEPERS	PEMPHERIDIDAE	*Pempheris oualensis*	Copper sweeper	Matapa
SWEEPERS	PEMPHERIDIDAE	*Pempheris schwenkii*	Silver Sweeper	Matapa

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EEL CATFISHES	PLOTOSIDAE	*Plotosus lineatus*	Striped eel catfish	Manoko vao
THREADFINS	POLYNEMIDAE	*Polydactylus sexfilis*	Sixfeeler threadfin	Afulu
ANGELFISHES	POMACANTHIDAE	*Apolemichthys griffisi*	Griffis' angelfish	Moimoi/Moipepe
ANGELFISHES	POMACANTHIDAE	*Apolemichthys trimaculatus*	Threespot angelfish	
ANGELFISHES	POMACANTHIDAE	*Apolemichthys xanthopunctatus*	Goldspotted angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge bicolor*	Bicolor angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge bispinosus*	Two-spined angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge flavissima*	Lemonpeel angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge loricula*	Flame angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge multifasciata*	Multibar angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge vrolikii*	Pearlscale angelfish	
ANGELFISHES	POMACANTHIDAE	*Centropyge heraldi*	Yellow bannerfin angelfish	
ANGELFISHES	POMACANTHIDAE	*Pomacanthus imperator*	Emperor angelfish	
ANGELFISHES	POMACANTHIDAE	*Pomacanthus sexstriatus*	Sixbar angelfish	
ANGELFISHES	POMACANTHIDAE	*Pygoplites diacanthus*	Regal angelfish	
DAMSELFISHES	POMACENTRIDAE	*Abudefduf bengalensis*	Bengal Sergeant	Mutumutu
DAMSELFISHES	POMACENTRIDAE	*Abudefduf septemfasciatus*	Seven-bar sergeant	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Abudefduf sordidus*	Blackspot sergeant	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Acanthochromis polyacanthus*	Spiny chromis	Moimoi-uli
DAMSELFISHES	POMACENTRIDAE	*Amblyglyphidodon aureus*	Golden damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Amblyglyphidodon leucogaster*	Yellowbelly damselfish	
DAMSELFISHES	POMACENTRIDAE	*Amphirion chrysopterus*	Orange-fin anemonefish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Amphirion clarkii*	Clark's anemonefish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chromis acares*	Midget chromis	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chromis amboinensis*	Ambon chromis	
DAMSELFISHES	POMACENTRIDAE	*Chromis atripes*	Darkfin chromis	
DAMSELFISHES	POMACENTRIDAE	*Chromis iomelas*	Half-and-half chromis	
DAMSELFISHES	POMACENTRIDAE	*Chromis margaritifer*	Bicolor chromis	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chromis ternatensis*	Ternate chromis	Mutumutu/Moimoi

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DAMSELFISHES	POMACENTRIDAE	*Chromis vanderbilti*	Vanderbilt's chromis	
DAMSELFISHES	POMACENTRIDAE	*Chromis viridis*	Bluegreen chromis	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chromis weberi*	Weber's chromis	
DAMSELFISHES	POMACENTRIDAE	*Chromis xanthura*	Pale-tail chromis	
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera biocellata*	Twospot damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera caeruleolineata*	Blueline damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera cyanea*	Blue devil	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera glauca*	Gray damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera leucopoma*	Surge damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Chrysiptera unimaculata*	Onespot demoiselle	
DAMSELFISHES	POMACENTRIDAE	*Dascyllus aruanus*	Humbug dascyllus	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Dascyllus reticulatus*	Reticulate dascyllus	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Dascyllus trimaculatus*	Threespot dascyllus	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Plectroglyphidodon dickii*	Dick's damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Plectroglyphidodon johnstonianus*	Blue-eye damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Plectroglyphidodon lacrymatus*	Jewel damsel	
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus amboinensis*	Ambon damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus bankanensis*	Speckled damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus brachialis*	Charcoal damsel	
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus coelestis*	Neon damsel	
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus grammorhynchus*	Bluespot damsel	
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus pavo*	Peacock damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Pomacentrus vaiuli*	Ocellate damselfish	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Pomachromis richardsoni*	Richardson's reef-damsel	
DAMSELFISHES	POMACENTRIDAE	*Stegastes fasciolatus*	South Pacific gregory	Mutumutu/Moimoi
DAMSELFISHES	POMACENTRIDAE	*Stegastes nigricans*	Dusky gregory	Mutumutu/Moimoi
BIGEYES	PRIACANTHIDAE	*Priacanthus hamrur*	Moontail bullseye	Matapa
ORECTOLOBIFORMES	RHINCODONTIDAE	*Rhincodon typus*	Whale shark	Tapapa
GUITARFISHES	RHINOBATIDAE	*Rhynchobatus djiddensis*	Giant guitarfish	Fai Magoo

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PARROTFISHES	SCARIDAE	*Bolbometopon muricatum*	Bumphead parrotfish	Taona/Tafaga/Laea (NNM/NKL/FNF)
PARROTFISHES	SCARIDAE	*Calotomus carolinus*	Stareye parrotfish	Laea/Ulafi/Uloulo/Lavia
PARROTFISHES	SCARIDAE	*Cetoscarus bicolor*	Bicolor parrotfish	
PARROTFISHES	SCARIDAE	*Chlorurus frontalis*	Reefcrest parrotfish	
PARROTFISHES	SCARIDAE	*Chlorurus japanensis*	Japanese parrotfish	Laea (NKL/FNF)
PARROTFISHES	SCARIDAE	*Chlorurus microrhinos*	Steephead parrotfish	Homo (NNM/NKL)/Laea (FNF)
PARROTFISHES	SCARIDAE	*Chlorurus sordidus*	Daisy parrotfish	
PARROTFISHES	SCARIDAE	*Hipposcarus longiceps*	Longnose parrotfish	
PARROTFISHES	SCARIDAE	*Scarus altipinnis*	Minifin parrotfish	
PARROTFISHES	SCARIDAE	*Scarus chameleon*	Chameleon parrotfish	
PARROTFISHES	SCARIDAE	*Scarus dimidiatus*	Yellowbarred parrotfish	
PARROTFISHES	SCARIDAE	*Scarus festivus*	Festive parrotfish	
PARROTFISHES	SCARIDAE	*Scarus flavipectoralis*	Yellowfin parrotfish	
PARROTFISHES	SCARIDAE	*Scarus forsteni*	Whitespot parrotfish	
PARROTFISHES	SCARIDAE	*Scarus frenatus*	Bridled parrotfish	Ulafi
PARROTFISHES	SCARIDAE	*Scarus ghobban*	Bluebarred parrotfish	Ulafi (FNF)/Ika hole (NKL)/Ulafi, Ika hole (NNM)
PARROTFISHES	SCARIDAE	*Scarus globiceps*	Globehead parrotfish	
PARROTFISHES	SCARIDAE	*Scarus niger*	Swarthy parrotfish	
PARROTFISHES	SCARIDAE	*Scarus oviceps*	Dark-capped parrotfish	
PARROTFISHES	SCARIDAE	*Scarus psittacus*	Palenose parrotfish	
PARROTFISHES	SCARIDAE	*Scarus quoyi*	Quoy's parrotfish	
PARROTFISHES	SCARIDAE	*Scarus rivulatus*	Rivulated parrotfish	
PARROTFISHES	SCARIDAE	*Scarus rubroviolaceus*	Redlip parrotfish	
PARROTFISHES	SCARIDAE	*Scarus schlegeli*	Schlegel's parrotfish	
PARROTFISHES	SCARIDAE	*Scarus spinus*	Greencap parrotfish	
PARROTFISHES	SCARIDAE	*Scarus tricolor*	Tricolor parrotfish	
PARROTFISHES	SCARIDAE	*Scarus xanthopleura*	Red parrotfish	
MACKERELS/TUNAS	SCOMBRIDAE	*Acanthocybium solandri*	Wahoo	Paala

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MACKERELS/TUNAS	SCOMBRIDAE	*Auxis thazard*	Frigate mackerel	
MACKERELS/TUNAS	SCOMBRIDAE	*Euthynnus affinis*	Mackerel tuna	Atualo/Tavatava
MACKERELS/TUNAS	SCOMBRIDAE	*Grammatorcynus bicarinatus*	Shark mackerel	
MACKERELS/TUNAS	SCOMBRIDAE	*Grammatorcymus bilineatus*	Double lined mackerel	
MACKERELS/TUNAS	SCOMBRIDAE	*Gymnosarda nuda*	Dogtooth tuna	
MACKERELS/TUNAS	SCOMBRIDAE	*Gymnosarda unicolor*	Dogtooth tuna	Valu
MACKERELS/TUNAS	SCOMBRIDAE	*Katsuwonus pelamis*	Skipjack tuna	Atu
MACKERELS/TUNAS	SCOMBRIDAE	*Rastrelliger kanakurta*	Indian mackerel	Salala
MACKERELS/TUNAS	SCOMBRIDAE	*Sarda orientalis*	Bonito	
MACKERELS/TUNAS	SCOMBRIDAE	*Scomberomorus commerson*	Narrowbarred spanish mackerel	Paala
MACKERELS/TUNAS	SCOMBRIDAE	*Thunnus alalunga*	Albacore	
MACKERELS/TUNAS	SCOMBRIDAE	*Thunnus albacares*	Yellowfin tuna	Takua, kasi/tavataua
MACKERELS/TUNAS	SCOMBRIDAE	*Thunnus obesus*	Bigeye tuna	
MACKERELS/TUNAS	SCOMBRIDAE	*Thunnus thynnus*	Bluefin tuna	
SCORPIONFISHES	SCORPAENIDAE	*Pterois antennata*	Ragged Finned Firefish	Sakulele
SCORPIONFISHES	SCORPAENIDAE	*Pterois radiata*	Clearfin turkeyfish	Tai/Senofeu
SCORPIONFISHES	SCORPAENIDAE	*Pterois volitans*	Turkeyfish	Tai/Senofeu
SCORPIONFISHES	SCORPAENIDAE	*Scorpaenopsis oxycephala*	Tassled scorpionfish	Tai/Senofeu
SCORPIONFISHES	SCORPAENIDAE	*Scorpaenopsis verrucosa*	Reef Stonefish	Nofu
SCORPIONFISHES	SCORPAENIDAE	*Sebastapistes cyanostigma*	Yellow-spotted scorpionfish	
GROUPERS	SERRANIDAE	*Aethaloperca rogaa*	Redmouth grouper	
GROUPERS	SERRANIDAE	*Anyperodon leucogrammicus*	Slender grouper	
GROUPERS	SERRANIDAE	*Balenoperca chabanaudi*	Arrowhead soapfish	
GROUPERS	SERRANIDAE	*Cephalopholis aurantia*	Golden hind	Mataele
GROUPERS	SERRANIDAE	*Cephalopholis sonnerati*	Tomato hind	Munua
GROUPERS	SERRANIDAE	*Cephalopholis argus*	Peacock hind	Loi (NNM/NKL/FNF)
GROUPERS	SERRANIDAE	*Cephalopholis igarashiensis*	Yellow-banded grouper	
GROUPERS	SERRANIDAE	*Cephalopholis leopardus*	Leopard Hind	
GROUPERS	SERRANIDAE	*Cephalopholis miniata*	Coral hind	

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GROUPERS	SERRANIDAE	*Cephalopholis sexmaculata*	Six-blotch Hind	
GROUPERS	SERRANIDAE	*Cephalopholis spiloparaea*	Strawberry hind	Gatala
GROUPERS	SERRANIDAE	*Cephalopholis urodeta*	Darkfin hind	Mata ele/Gatala
GROUPERS	SERRANIDAE	*Epinephelus areolatus*	Areolate grouper	
GROUPERS	SERRANIDAE	*Epinephelus chlorostigma*	Brownspotted grouper	Feata
GROUPERS	SERRANIDAE	*Epinephelus coeruleopunctatus*	Whitespotted grouper	
GROUPERS	SERRANIDAE	*Epinephelus coioides*	Orange-spotted grouper	
GROUPERS	SERRANIDAE	*Epinephelus cyanopodus*	Speckled grouper	
GROUPERS	SERRANIDAE	*Epinephelus fasciatus*	Blacktip grouper	
GROUPERS	SERRANIDAE	*Epinephelus fuscoguttatus*	Brownmarbled grouper	Palati (NNM)/Fapuku (NKL/FNF)
GROUPERS	SERRANIDAE	*Epinephelus hexagonatus*	Starspotted grouper	Eve
GROUPERS	SERRANIDAE	*Epinephelus hoedti*	Speckled blue grouper	
GROUPERS	SERRANIDAE	*Epinephelus howlandi*	Blacksaddle grouper	
GROUPERS	SERRANIDAE	*Epinephelus lanceolatus*	Snubnose grouper	Palugatala
GROUPERS	SERRANIDAE	*Epinephelus macrospilos*	Snubnose grouper	
GROUPERS	SERRANIDAE	*Epinephelus maculatus*	Highfin grouper	Fapuku
GROUPERS	SERRANIDAE	*Epinephelus melanostigma*	Blackspot grouper	Fapuku
GROUPERS	SERRANIDAE	*Epinephelus merra*	Dwarf spotted grouper	Gataliki
GROUPERS	SERRANIDAE	*Epinephelus microdon*	Marbled cod	Gatala liki/Fapuku
GROUPERS	SERRANIDAE	*Epinephelus millaris*	Netfin grouper	
GROUPERS	SERRANIDAE	*Epinephelus morrhua*	Curve banded grouper	Palugatala
GROUPERS	SERRANIDAE	*Epinephelus octofasciatus*	Eightbar grouper	
GROUPERS	SERRANIDAE	*Epinephelus ongus*	White-streaked Grouper	
GROUPERS	SERRANIDAE	*Epinephelus polyphekadion*	Camouflage grouper	
GROUPERS	SERRANIDAE	*Epinephelus retouti*	Redtipped grouper	
GROUPERS	SERRANIDAE	*Epinephelus septemfasciatus*	Seven-banded grouper	Palupatuki
GROUPERS	SERRANIDAE	*Epinephelus socialis*	Surge grouper	
GROUPERS	SERRANIDAE	*Epinephelus spilotoceps*	Foursaddle grouper	
GROUPERS	SERRANIDAE	*Epinephelus tauvina*	Greasy grouper	Eve

Common name (family)	Family	Genus Specie	Common name (specie)	Tuvaluan name
GROUPERS	SERRANIDAE	*Gracila albomarginata*	Slenderspine grouper	
GROUPERS	SERRANIDAE	*Grammistes sexlineatus*	Sixline soapfish	Patuki/Lafalafa
GROUPERS	SERRANIDAE	*Plectropomus areolatus*	Squaretail coralgrouper	
GROUPERS	SERRANIDAE	*Plectropomus laevis*	Blacksaddled coralgrouper	Tonu (FNF)
GROUPERS	SERRANIDAE	*Plectropomus leopardus*	Leopard coralgrouper	Tonu
GROUPERS	SERRANIDAE	*Plectropomus maculatus*	Spotted coralgrouper	Tonu
ANTHIAS	SERRANIDAE	*Pseudanthias bartletorum*	Bartlett's athias	Moimoi
ANTHIAS	SERRANIDAE	*Pseudanthias dispar*	Redfin anthias	
ANTHIAS	SERRANIDAE	*Pseudanthias evansi*	Yellowback anthias	
ANTHIAS	SERRANIDAE	*Pseudanthias pascalus*	Purple queen	Moimoi
GROUPERS	SERRANIDAE	*Saloptia powelli*	Golden grouper	
GROUPERS	SERRANIDAE	*Variola albimarginata*	White-edged lyretail	Pula
GROUPERS	SERRANIDAE	*Variola louti*	Yellow-edged lyretail	Pula lautalo
RABBITFISHES	SIGANIDAE	*Siganus argenteus*	Streamlined spinefoot	Maiava (NKL/FNF)
RABBITFISHES	SIGANIDAE	*Siganus canaliculatus*	White-spotted rabbitfish	
RABBITFISHES	SIGANIDAE	*Siganus corallinus*	Coral spinefoot	Maiava puku
RABBITFISHES	SIGANIDAE	*Siganus fuscescens*	Mottled spinefoot	Maiava
RABBITFISHES	SIGANIDAE	*Siganus niger*	Black foxface	
RABBITFISHES	SIGANIDAE	*Siganus punctatus*	Goldspotted spinefoot	Maiava
RABBITFISHES	SIGANIDAE	*Siganus spinus*	Little spinefoot	Maiava
RABBITFISHES	SIGANIDAE	*Siganus vermiculatus*	Vermiculated spinefoot	Maiava
RABBITFISHES	SIGANIDAE	*Siganus vulpinus*	Foxface	Laulaufou
BARRACUDAS	SPHYRAENIDAE	*Sphyraena barracuda*	Great barracuda	Ono
BARRACUDAS	SPHYRAENIDAE	*Sphyraena forsteri*	Forster seapike	Taotao
BARRACUDAS	SPHYRAENIDAE	*Sphyraena qenie*	Blackfin barracuda	
HAMMERHEAD SHARKS	SPHYRNIDAE	*Sphyrna lewini*	Scalloped hammerhead	Mago fuasu
HAMMERHEAD SHARKS	SPHYRNIDAE	*Sphyrna zygaena*	Smooth hammerhead	
ZEBRA SHARKS	STEGOSTOMATIDAE	*Stegostoma fasciatum*	Leopard shark	Moemoeao
LIZARDFISHES	SYNODONTIDAE	*Saurida gracilis*	Slender lizardfish	

Common name (family)	Family	Genus Specie	Common name (specie)	Tuvaluan name
LIZARDFISHES	SYNODONTIDAE	*Synodus variegatus*	Reef lizardfish	Tanifa
PUFFERS	TETRAODONTIDAE	*Arothron hispidus*	Stripebelly puffer	Hue, Puhi
PUFFERS	TETRAODONTIDAE	*Arothron manilensis*	Striped puffer	
PUFFERS	TETRAODONTIDAE	*Arothron meleagris*	Guineafowl puffer	Fuatate/Puni/Sue
PUFFERS	TETRAODONTIDAE	*Arothron nigropunctatus*	Blackspotted puffer	
PUFFERS	TETRAODONTIDAE	*Arothron stellatus*	Stellate puffer	Tautu
PUFFERS	TETRAODONTIDAE	*Canthigaster solandri*	Solander's toby	
PUFFERS	TETRAODONTIDAE	*Canthigaster valentini*	Model toby	
HOUNDSHARKS	TRIAKIDAE	*Mustelus griseus*	Spotless smooth-hound	Mago
SWORDFISHES	XIPHIIDAE	*Xiphias gladius*	Broad-Bill Sword-Fish	Ulau
MOORISH IDOL	ZANCLIDAE	*Zanclus cornutus*	Moorish idol	Maninipapa

1B: Marine macroinvertebrates

New recorded macroinvertebrates

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Annelida	Polychaeta	Sabellida	Sea worms	Eunicidae	*Eunice viridis*		Palolo worm	Palolo
Annelida	Polychaeta	Sabellida	Sea worms	Serpulidae	*Spirobranchus giganteus*		Christmas tree worm	
Arthropoda	Malacostraca	Decapoda	Crab	Calappidae	*Calappa sp.*			Kaviki
Arthropoda	Malacostraca	Decapoda	Crab	Carpiliidae	*Carpilius maculatus*		Spotted reef crab	Paka
Arthropoda	Malacostraca	Decapoda	Crab	Coenobitidae	*Birgus latro*		Coconut crab	Uu
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Aniculus maximus*			
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Clibanarius seurati*		Hermit crab	
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Dardanus guttatus*		Hermit crab	
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Dardanus lagopodes*		Hermit crab	
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Dardanus megistos*		White-spotted hermit crab	
Arthropoda	Malacostraca	Decapoda	Crab	Diogenidae	*Trizopagrus strigatus*		Cone shell hermit crab	
Arthropoda	Malacostraca	Decapoda	Crab	Dromiidae	*Cryptodromia canaliculata*	*Cryptodromia fallax*		

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Arthropoda	Malacostraca	Decapoda	Crab	Dromiidae	*Cryptodromia hilgendorfi*			
Arthropoda	Malacostraca	Decapoda	Crab	Dynomenidae	*Dynomene praedator*			
Arthropoda	Malacostraca	Decapoda	Crab	Epialtidae	*Tylocarcinus dumerilii*			
Arthropoda	Malacostraca	Decapoda	Crab	Epialtidae	*Menaethius monoceros*			
Arthropoda	Malacostraca	Decapoda	Crab	Epialtidae	*Perinea tumida*			
Arthropoda	Malacostraca	Decapoda	Crab	Eriphiidae	*Eriphia scabricula*			
Arthropoda	Malacostraca	Decapoda	Crab	Eriphiidae	*Eriphia sebana*		Smooth redeyed crab	
Arthropoda	Malacostraca	Decapoda	Crab	Gecarcinidae	*Cardisoma carnifex*		Brown land crab	Kaipea, pakea
Arthropoda	Malacostraca	Decapoda	Crab	Grapsidae	*Grapsus grapsus*			Kamakama
Arthropoda	Malacostraca	Decapoda	Crab	Grapsidae	*Grapsus albolineatus*			
Arthropoda	Malacostraca	Decapoda	Crab	Grapsidae	*Pachygrapsus laevis*	*Pachygrapsus planifrons*		
Arthropoda	Malacostraca	Decapoda	Crab	Grapsidae	*Pachygrapsus plicatus*		Pleated Rock Crab	
Arthropoda	Malacostraca	Decapoda	Crab	Percnidae	*Percnon planissimum*			
Arthropoda	Malacostraca	Decapoda	Crab	Pilumninae	*Pilumnus caerulescens*			
Arthropoda	Malacostraca	Decapoda	Crab	Portunidae	*Thalamita admete*			
Arthropoda	Malacostraca	Decapoda	Crab	Portunidae	*Thalamita crenata*			
Arthropoda	Malacostraca	Decapoda	Crab	Portunidae	*Thalamita picta*			
Arthropoda	Malacostraca	Decapoda	Crab	Portunidae	*Catoptrus nitidus*			
Arthropoda	Malacostraca	Decapoda	Crab	Tetraliidae	*Tetralia glaberrima*			
Arthropoda	Malacostraca	Decapoda	Crab	Trapeziidae	*Trapezia digitalis*			
Arthropoda	Malacostraca	Decapoda	Crab	Trapeziidae	*Trapezia ferruginea*	*Trapezia bidentata*		
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Carpilodes pallida*	*Liomera pallida*		
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Carpilodes vaillantianus*	*Liomera bella*		
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Chlorodiella laevissima*			

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Chlorodiella niger*			
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Chlorodiella venusta*			
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Chlorodopsis areolata*			
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Chlorodopsis venusta*	*Pilodius scabriculus*		
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Kraussia rugulosa*			
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Leptodius sanguineus*			
Arthropoda	Malacostraca	Decapoda	Crab	Xanthidae	*Zozymus aeneus*	*Zosimus aeneus*		
Arthropoda	Malacostraca	Decapoda	Lobster	Palinuridae	*Panulirus ornatus*		Ornate Spiny Lobster	Ula/Tapa tapa (NNM)/Feke (FNF/NKL)
Arthropoda	Malacostraca	Decapoda	Lobster	Palinuridae	*Panulirus penicillatus*		Pronghorn spiny lobster	Ula/Tapa tapa (NNM)/Feke (FNF/NKL)
Arthropoda	Malacostraca	Decapoda	Lobster	Palinuridae	*Panulirus versicolor*		Painted spiny lobster	Ula/Tapa tapa (NNM)/Feke (FNF/NKL)
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus bucephalus*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus frontalis*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus fucatus*		Snapping shrimp	Palusega
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus lanceloti*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus macrochirus*	*Alpheus sulcatus*	Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus pachychirus*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus pacificus*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus paragracilis*	*Metalpheus paragracilis*	Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus parvirostris*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Alpheus strenuus*		Snapping shrimp	

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Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Athanas djiboutensis*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Automate gardineri*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Gnathophyllidae	*Gnathophyllum fasciolatum*	*Gnathophyllum americanum*		
Arthropoda	Malacostraca	Decapoda	Shrimp	Gonodactylidae	*Gonodactylus chiragra*		Dark-green mantis shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Hymenoceridae	*Hymenocera elegans*	*Hymenocera picta*	Harlequin shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Jousseaumea sibogae*	*Salmoneus serratidigitus*		
Arthropoda	Malacostraca	Decapoda	Shrimp	Lysiosquillidae	*Lysiosquilla maculata*		Common banded mantis shrimp	Valo
Arthropoda	Malacostraca	Decapoda	Shrimp	Palaemonidae	*Onycocaris quadratophthalma*			
Arthropoda	Malacostraca	Decapoda	Shrimp	Palaemonidae	*Periclimenes grandis*	*Cuapetes grandis*		
Arthropoda	Malacostraca	Decapoda	Shrimp	Palaemonidae	*Periclimenes suvadivensis*			
Arthropoda	Malacostraca	Decapoda	Shrimp	Hippolytidae	*Saron marmoratus*		Common marble shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Stenopodidae	*Stenopus hispidus*		Redbanded Coral Shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Synalpheus charon*		Snapping shrimp	
Arthropoda	Malacostraca	Decapoda	Shrimp	Alpheidae	*Synalpheus paraneomeris*		Snapping shrimp	
Arthropoda	Malacostraca	Isopoda		Corallanidae	*Alcirona insularis*			
Arthropoda	Malacostraca	Isopoda	Chiton	Stenetriidae	*Hansenium chiltoni*			
Arthropoda	Malacostraca	Amphipoda		Maeridae	*Maera insignis*	*Mallacoota insignis*		
Arthropoda	Malacostraca	Amphipoda		Leucothoidae	*Paranamixis bocki*			
Arthropoda	Malacostraca	Isopoda		Cirolanidae	*Cirolana cranchi*			
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Actinopyga echinites*		Deepwater redfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Actinopyga mauritiana*		Surf redfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Actinopyga miliaris*		Hairy blackfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Actinopyga varians*		Surf redfish	Funafuna

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Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Bohadschia argus*		Leopardfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Bohadschia vitiensis*		Brown sandfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Bohadschia marmorata*		Chalky sandfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria atra*		Lollyfish	Loli
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria edulis*		Pinkkfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria fuscogilva*		White teatfish	Funafuna faiu
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria fuscopunctata*		Elephant trunkfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria hilla*		Tiger tail sea cucumber	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria nobilis*		Black teatfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria scabra*		Sandfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Holothuria whitmaei*		Black teatfish	Funafuna faiu
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Stichopus chloronotus*		Greenfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Stichopus hermanni*		Curryfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Thelenota ananas*		Prickly redfish	Funafuna
Echinodermata	Holothuroidea	Aspidochirotida	Sea cucumber	Holothuriidae	*Thelenota anax*		Amberfish	Funafuna
Echinodermata	Echinoidea	Diadematoidea	Sea urchin	Diadematidae	*Diadema savignyi*		Longspine black urchin	Vana
Echinodermata	Echinoidea	Camarotonda	Sea urchin	Echinometridae	*Echinometra mathaei*		Rock-boring urchin	Vana
Echinodermata	Echinoidea	Camarotonda	Sea urchin	Echinometridae	*Echinostrephus aciculatus*		Needle spine urchin	Vana
Echinodermata	Echinoidea	Diadematoidea	Sea urchin	Diadematidae	*Echinothrix calamaris*		Black (banded) sea urchin	Vana
Echinodermata	Echinoidea	Diadematoidea	Sea urchin	Diadematidae	*Echinothrix diadema*		Coarse spined urchin	Vana
Echinodermata	Echinoidea	Camarotonda	Sea urchin	Echinometridae	*Heterocentrus mamillatus*		Slate pencil urchin	Vana
Echinodermata	Asteroidea	Valvatida	Sea star	Acanthasteridae	*Acanthaster planci*		Crown-of-thorns starfish	Kalauna
Echinodermata	Asteroidea	Valvatida	Sea star	Ophidiasteridae	*Celerina heffernani*		Heffernani's sea star	
Echinodermata	Asteroidea	Valvatida	Sea star	Oreasteridae	*Culcita novaeguineae*		Cushion star	

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Echinodermata	Asteroidea	Valvatida	Sea star	Ophidiasteridae	*Linckia laevigata*		Cobalt star	
Echinodermata	Asteroidea	Valvatida	Sea star	Ophidiasteridae	*Linckia multiflora*		Pink or Comet Sea Star	
Echinodermata	Asteroidea	Valvatida	Sea star	Ophidiasteridae	*Neoferdina cumingi*		Cuming's Sea Star	
Foraminifera	Polythalamea	Rotaliida	Foraminifera	Amphisteginidae	*Amphistegina lessonii*			
Foraminifera	Polythalamea	Carterinida	Foraminifera	Carterinidae	*Carterina spiculotesta*			
Foraminifera	Polythalamea	Rotaliida	Foraminifera	Calcarinidae	*Tinoporus baculatus*			
Mollusca	Bivalvia	Arcoida	Bivalve	Arcidae	*Arca ventricosa*			Kohi
Mollusca	Bivalvia	Arcoida	Bivalve	Arcidae	*Barbatia lacerata*			Kohi
Mollusca	Bivalvia	Arcoida	Bivalve	Arcidae	*Barbatia velata*	*Barbatia revelata*		Kohi
Mollusca	Bivalvia	Lucinoida	Bivalve	Lucinidae	*Codakia tigerina*		Pacific tiger lucine	
Mollusca	Bivalvia	Mytiloida	Bivalve	Mytilidae	*Septifer bilocularis*			Kohi
Mollusca	Bivalvia	Ostreoida	Bivalve	Gryphaeidae	*Hyotissa hyotis*		Honeycomb oyster	
Mollusca	Bivalvia	Ostreoida	Bivalve	Ostreidae	*Lopha cristagalli*		Cock's comb oyster	
Mollusca	Bivalvia	Ostreoida	Bivalve	Ostreidae	*Saccostrea cucullata*	*Saccostrea cucullata*	Sydney Cupped Oyster	
Mollusca	Bivalvia	Pectinoida	Bivalve	Pectinidae	*Chlamys pallium*		Scallop shell	
Mollusca	Bivalvia	Pectinoida	Bivalve	Pectinidae	*Pedum spondyloideum*		Pedum oyster	
Mollusca	Bivalvia	Pectinoida	Bivalve	Spondyllidae	*Spondylus squamosus*		Ducal thorny oyster	Hopu nifo, Hopu teka (NNM)/Sopu u (FNF, NKL)
Mollusca	Bivalvia	Pectinoida	Bivalve	Spondyllidae	*Spondylus varius*			
Mollusca	Bivalvia	Pterioida	Bivalve	Pteriidae	*Isognomon sp.*		Purse oyster	
Mollusca	Bivalvia	Pterioida	Bivalve	Pteriidae	*Pteria margaritifera*	*Pinctada margaritifera*	Blacklip pearl oyster	Laumilo (gold/yellow), Ngu (white), Firlulupe (grey/bluish), Tifa

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Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Cardium sueziensis*	*Fragum sueziense*		
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Fragum fragum*			
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Fragum unedo*			
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Fulvia tenuicostata*			
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Trachycardium angulatum*		Angulate cockle	
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Trachycardium orbita*		Orbit cockle	
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Trachycardium transcendens*			
Mollusca	Bivalvia	Veneroida	Bivalve	Chamidae	*Chama imbricata*			Hopu papa
Mollusca	Bivalvia	Veneroida	Bivalve	Mesodesmatidae	*Paphies striata*			
Mollusca	Bivalvia	Veneroida	Bivalve	Psammobiidae	*Asaphis violascens*		Pacific asaphis	Kosi?
Mollusca	Bivalvia	Veneroida	Bivalve	Tellinidae	*Tellina pinguis*			
Mollusca	Bivalvia	Veneroida	Bivalve	Tellinidae	*Tellina rugosa*		Rugose tellin	
Mollusca	Bivalvia	Veneroida	Bivalve	Tellinidae	*Tellina scobinata*			
Mollusca	Bivalvia	Veneroida	Bivalve	Tellinidae	*Tellina virgata*	*Tellinella virgata*	Virgate tellin	
Mollusca	Bivalvia	Veneroida	Bivalve	Trapezidae	*Trapezium oblongum*			
Mollusca	Bivalvia	Veneroida	Bivalve	Psammobiidae	*Gari sp.*		Sanguine clam	
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Hippopus hippopus*		Bear paw giant clam	Fasua
Mollusca	Bivalvia	Veneroida	Bivalve	Veneridae	*Tapes literata*		Littleneck clam	Nikatona
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Tridacna crocea*			Fasua
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Tridacna derasa*		Southern giant clam	Fasua
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Tridacna gigas*			Fasua
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Tridacna maxima*		Elongate giant clam	Fasua nao
Mollusca	Bivalvia	Veneroida	Bivalve	Cardiidae	*Tridacna squamosa*		Fluted giant clam	Fasua taka
Mollusca	Bivalvia	Veneroida	Bivalve	Veneridae	*Lioconcha castrensis*		Camp pitar venus	
Mollusca	Bivalvia	Veneroida	Bivalve	Veneridae	*Lioconcha ornata*			
Mollusca	Bivalvia	Veneroida	Bivalve	Veneridae	*Periglypta reticulata*	*Antigona reticulata*		
Mollusca	Bivalvia	Veneroida	Bivalve	Veneridae	*Pitar pellucidus*			

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Mollusca	Cephalopoda	Nautilida	Nautilus	Nautilidae	*Nautilus pompilius*		Emperor nautilus	
Mollusca	Cephalopoda	Spirulida	Squid	Spirulidae	*Spirula spirula*		Ram's horn squid	
Mollusca	Polyplacophora	Chitonida	Chiton	Cryptoplacidae	*Cryptoplax jugosus*	*Chiton jugosus*		
Mollusca	Cephalopoda	Octopoda	Octopus	Octopodidae	*Octopus cyanea*		Big blue octopus	Feke
Mollusca	Cephalopoda	Octopoda	Octopus	Octopodidae	*Octopus globosus*		Globe octopus	Feke
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Eulimidae	*Balcis sp.*		Obelisk shells	
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium aluco*	*Pseudovertagus aluco*	Aluco vertagus	
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium alveolus*	*Cerithium punctatum*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium articulacum*	*Rhinoclavis articulata*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium asper cerith*	*Rhinoclavis aspera*	Rough vertagus	
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium atromarginatum*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium brevis*	*Clypeomorus brevis*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium citrinum*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium columna*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium echinatum*		Spinose cerith	
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium elegantissimum*	*Bittium elegantissimum*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium fasciatum*	*Rhinoclavis fasciata*	Banded vertagus	
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium impendens*	*Bittium impendens*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium moniliferum*	*Clypeomorus batillariaeformis*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium nodulosum*		Giant knobbed cerith	Sipo
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium oceanicum*	*Clypeomorus bifasciatus*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium pfeifferri*	*Rhinoclavis sordidula*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium pharos*	*Rhinoclavis fasciata*		

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Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium rostratum*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium salebrosum*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium sinensis*	*Rhinoclavis sinensis*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium spiculum*	*Cerithium nesioticum*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium strictum*	*Cerithium egenum*		
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Cerithium zebrum*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Cerithiidae	*Rhinoclavis aspera*			
Mollusca	Gastropoda	Caenogastropoda	Sea snail	Planaxidae	*Planaxis sulcatus*			Uga
Mollusca	Gastropoda	Cephalaspidea	Sea snail	Bullidae	*Bulla sp.*		Bubble shell	
Mollusca	Gastropoda	Cycloneritimorpha	Sea snail	Neritidae	*Nerita albicilla*		Oxpalate nerite	
Mollusca	Gastropoda	Cycloneritimorpha	Sea snail	Neritidae	*Nerita plicata*		Plicate nerite	
Mollusca	Gastropoda	Cycloneritimorpha	Sea snail	Neritidae	*Nerita posini*			
Mollusca	Gastropoda	Cycloneritimorpha	Sea snail	Neritidae	*Neritina oualaniensis*			
Mollusca	Gastropoda	Cycloneritimorpha	Sea snail	Neritidae	*Neritina reticulata*			
Mollusca	Gastropoda	Heterobranchia (Subclass)	Sea snail	Pyramidellidae	*Pyramidella terebellum*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Bursidae	*Bursa bufonia*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Bursidae	*Bursa rubeta*	*Tutufa rubeta*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cassidae	*Casmaria erinaceus*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cassidae	*Cassis cornuta*		Horned helmet	
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cassidae	*Cassis ponderosa*	*Casmaria ponderosa*	Atlantic casmaria	
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cassidae	*Cassis rufa*	*Cypraecassis rufa*	Bullmouth helmet	
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cassidae	*Cassis vibex*	*Casmaria erinaceus*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea annulus*	*Monetaria annulus*	Goldring cowrie	Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea arabica*	*Mauritia arabica*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea argus*	*Arestorides argus*		Pule kena

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Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea aurantium*			Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea becki*	*Erosaria beckii*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea bistrinotata*	*Pustularia bistrinotata*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea caputserpentis*	*Monetaria caputserpentis*	Serpent's head cowrie	Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea carneola*	*Lyncina carneola*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea childreni*	*Ipsa childreni*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea chinensis*	*Ovatipsa chinensis*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea cicercula*	*Pustularia cicercula*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea clandestina*	*Palmadusta clandestina*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea cribraria*	*Cribrarula cribraria*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea depressa*	*Mauritia depressa*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea eglantina*	*Mauritia eglantina*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea erosa*	*Erosaria erosa*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea errones*	*Erronea errones*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea felina*	*Melicerona felina*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea fimbriata*	*Purpuradusta fimbriata*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea goodalli*			Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea gracilis*	*Purpuradusta gracilis*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea helvola*	*Erosaria helvola*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea irrorata*	*Erosaria irrorata*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea isabella*	*Luria isabella*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea labrolineata*			Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea lynx*	*Lyncina lynx*		Pule kena

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Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea maculifera*	*Mauritia maculifera*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea mappa*	*Leporicypraea mappa*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea mauritiania*	*Mauritia mauritiana*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea moneta*	*Monetaria moneta*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea nucleus*	*Nucleolaria nucleus*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea obvelata*	*Monetaria obvelata*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea ovum*	*Erronea ovum*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea poraria*	*Erosaria poraria*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea scurra*	*Mauritia scurra*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea serrulifera*			Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea staphylaea*	*Staphylaea staphylaea*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea talpa*	*Talparia talpa*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea teres*	*Blasicrura teres*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea testudinaria*	*Chelycypraea testudinaria*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea tigris*		Tiger cowrie	Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea ventriculus*		Tummy cowrie	Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea vitellus*	*Lyncina vitellus*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Cypraea ziczac*	*Palmadusta ziczac*		Pule kena
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Naria irrorata*	*Erosaria irrorata*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Cypraeidae	*Palmadusta clandestina*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Hipponicidae	*Amalthea australis*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Littorinidae	*Littoraria scabra*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Littorinidae	*Tectarius pagodus*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Charonia tritonis*		Trumpet triton	

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium aquatile*	*Monoplex aquatilis*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium articulatus*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium distortio anus*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium fasciatus*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium gemmatum*	*Monoplex gemmatus*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium lotorium*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium maculosum*	*Charonia maculosum*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium muricinum*		Venus shell	
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium nicobaricum*	*Monoplex nicobaricus*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium pileare*	*Monoplex pilearis, Monoplex macrodon*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium rubeculum*	*Septa rubecula*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium serriale*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium sinense*	*Ranularia sinensis*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Ranellidae	*Cymatium tritonis*	*Charonia tritonis*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Seraphsidae	*Terebellum terebellum*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Lambis chiragra*	*Harpago chiragra*	Spider conch	Kalea (NNM)/Matag a (FNF, NKL)
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Lambis crocata*		Spider conch	Kalea (NNM)/Matag a (FNF, NKL)
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Lambis lambis*		Common spider conch	Kalea (NNM)/Matag a (FNF, NKL)

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Lambis truncata*		Spider conch	Kalea (NNM)/Matag a (FNF, NKL)
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus aurisdianae*	*Euprotomus aurisdianae*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus bulla*	*Euprotomus bulla*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus epidromis*	*Labiostrombus epidromis*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus erythrinus*	*Canarium erythrinum*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus fragilis*	*Terestrombus fragilis*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus fusiformis*	*Canarium fusiforme*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus gibberulus*	*Gibberulus gibberulus*	Gibbose conch	
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus labiatus*	*Canarium labiatum, Gibberulus gibberulus*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus lentiginosus*	*Lentigo lentiginosus*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus luhuanus*	*Conomurex luhuanus*	Strawberry conch	Panea
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Strombidae	*Strombus microurceue*			
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Truncatellidae	*Truncatella valida*	*Truncatella guerinii*		
Mollusca	Gastropoda	Littorinimorpha	Sea snail	Vermetidae	*Dendropoma maxima*		Great worm shell	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Buccinidae	*Cantharus undosus*	*Pollia undosa*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Buccinidae	*Engina mendicaria*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Buccinidae	*Phos senticosus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Colubrariidae	*Colubraria muricata*		Maculated dwarf triton	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus ammiralis*			Uga(NNM)/ Fakamili (NKL, FNF) (all cones)

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Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus arenatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus aulicus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus auricomus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus betulinus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus catus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus capitaneus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus chaldeus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus coronatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus distans*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus ebraeus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus episcopus*	*Conus pennaceus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus flavidus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus frigidus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus generalis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus geographus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus glans*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus imperialis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus leopardus*		Leopard cone	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus litteratus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus lividus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus marmoreus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus miles*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus miliaris*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus musicus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus nasatella*	*Conus nussatella*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus pulicarius*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus rattus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus retifer*			

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Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus sponsalis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus striatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus sugillatus*	*Conus muriculatus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus sulcatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus suturatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus tenuistriatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus terebra*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus tessulatus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus tulipa*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus vexillum*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus virgo*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Conidae	*Conus vitulinus*	*Conus planorbis*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Costellariidae	*Vexillum rubrocostatum*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Fasciolariidae	*Pleuroploca filamentosa*	*Fasciolaria filamentosa*	Filamentous horse conch	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Harpidae	*Harpa amouretta*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Chrysame eremitarum*	*Mitra eremitarum*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra acuminata*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra acupicta*	*Vexillum acupictum*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra ambigua*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra paupercula*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra chrysalis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra clathrus*	*Neocancilla clathrus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra contracta*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra cucumerina*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra dactylus*	*Pterygia dactylus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra eremitarum*			

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Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra exasperata*	*Vexillum exasperatum*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra ferruginea*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra fusca*	*Scabricola fusca*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra granatina*	*Scabricola scabriuscula*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra imperialis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra litterata*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra mitra*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra nucea*	*Pterygia nucea*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra olivaeformis*	*Imbricaria olivaeformis*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra pacificum*	*Vexillum pacificum*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra papalis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra papilio*	*Neocancilla papilio*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra paupercula*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra pellisserpentis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra punctata*	*Imbricaria punctata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra retusa*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra rugosum*	*Vexillum rugosum*	Rugose miter	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra stricta*	*Mitra stictica*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra turrigerum*	*Vexillum turrigerum*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Mitra verrucosa*	*Ziba verrucosa*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Mitridae	*Scabricola vicdani*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Chicoreus ramosus*		Ramose murex	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Coralliophila neritoidea*	*Coralliophila violacea*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Coralliophila radula*			

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Drupella cornus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Drupa morum*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Drupa ricina*	*Drupa ricinus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Drupa rubusidaeus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Drupina grossularia*	*Drupa grossularia*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Chicoreus brunneus*		Adusta murex	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Murex ramosus*	*Chicoreus ramosus*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Purpura armigera*	*Reishia armigera*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Thais aculeata*		Rock shell	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Thais armigera*	*Reishia armigera*	Belligerent rock shell	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Muricidae	*Thais tuberosa*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Nassariidae	*Nassarius papillosus*		Pimpled Nassa	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Olividae	*Oliva miniacea*		Olive shell	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Olividae	*Oliva oliva*		Olive shell	
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Impages hectica*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra affinifi*	*Terebra affinis*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra archimedis*	*Terebra funiculata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra areolata*	*Oxymeris areolata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra argus*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra cingulifera*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra crenulata*	*Oxymeris crenulata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra dimidiata*	*Oxymeris dimidiata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra kilburni*	*Myurella kilburni*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra maculata*	*Oxymeris maculata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra paucistriata*	*Myurella paucistriata*		
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra rugosum*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra stictica*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra subulata*			

Phylum	Clas	Order	Common name	Family	Genus Specie	Accepted name	Common name (specie)	Tuvaluan name
Mollusca	Gastropoda	Neogastropoda	Sea snail	Terebridae	*Terebra textilis*			
Mollusca	Gastropoda	Neogastropoda	Sea snail	Turbinellidae	*Vasum ceramicum*			
Mollusca	Gastropoda	Nudibranchia	Sea slug	Chromodorididae	*Chromodoris geometrica*			
Mollusca	Gastropoda	Nudibranchia	Sea slug	Phyllidiidae	*Phyllidia coelestis*			
Mollusca	Gastropoda	Nudibranchia	Sea slug	Phyllidiidae	*Phyllidia pustulosa*	*Phyllidiella pustulosa*	Vesicular sea slug	
Mollusca	Gastropoda	Nudibranchia	Sea slug	Phyllidiidae	*Phyllidia varicosa*			
Mollusca	Gastropoda	Nudibranchia	Sea slug	Plakobranchidae	*Plakobranchus ocellatus*			
Mollusca	Gastropoda	Sacoglossa	Sea slug	Polyceridae	*Nembrotha kubaryana*	*Nembrotha nigerrima*		
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Trochidae	*Trochus maculata*	*Trochus maculatus*		
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Trochidae	*Trochus sarcellus*			
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Trochidae	*Trochus verrucosus*	*Trochus maculatus*		
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Trochus niloticus*	*Tectus niloticus*	Trochus shell	Munikau
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Trochus pyramis*	*Tectus pyramis*	Pyramid top	
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Turbo argyrostomus*		Silvermouth turban	Alili
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Turbo bruneus*			Alili
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Turbo chrysostoma*	*Turbo chrysostomus*		Alili
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Turbo petholatus*			Alili
Mollusca	Gastropoda	Vestigastropoda (Subclass)	Sea snail	Turbinidae	*Turbo setosus*		Rough turban	Alili
Mollusca	Scaphopoda	Dentaliida	Scaphopoda	Dentaliidae	*Dentalium elephantinum*			
Platyhelminthes	Rhabditophora	Polycladia	Planarian	Ilyplanidae	*Discoplana subviridis*	*Ilyella gigas*		
Sipuncula	Sipunculidea	Golfingiida	Worm	Sipunculidae	*Siphonosoma australe*		Peanut worm	Ipo

1C: Cnidarians

CLASS	ORDER	FAMILY	Genus Specie
ANTHOZOA	ACTINARIA	STICHODACTYLIDAE	*Stichodactyla spp.*
ANTHOZOA	ALCYONARIA	XENIIDAE	*Xenia elongata*
ANTHOZOA	ANTIPATHARIA	ANTIPATHIDAE	*Antipathes atlantica*
ANTHOZOA	ANTIPATHARIA	ANTIPATHIDAE	*Antipathes brookii*
ANTHOZOA	HELIOPORACEA	HELIOPORIDAE	*Heliopora coerulea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora abrolhosensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora abrotanoides*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora aculeus*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora acuminata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora anthocercis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora aspera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora austera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cerealis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora chesterfieldensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora clathrata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora conigera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora copiosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora crateriformis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cuneata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cytherea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora dendrum*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora digitifera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora divaricata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora donei*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora echinata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora efflorescens*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora elseyi*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora eurystoma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora exquisita*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora florida*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora formosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora globiceps*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora grandis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora granulosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora horrida*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora humilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora hyacinthus*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora inermis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora insignis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora intermedia*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora kirstyae*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora latistella*

ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora listeri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora longicyathus*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora loripes*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora lovelli*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora lutkeni*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora microclados*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora microphthalma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora millepora*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora monticulosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nana*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nasuta*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nobilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora palmerae*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora paniculata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora parilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora polystoma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora prostrata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora pulchra*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora rambleri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora retusa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora robusta*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora rosaria*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora samoensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora sarmentosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora schmitti*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora secale*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora selago*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora solitaryensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora speciosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora spicifera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora subglabra*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora subulata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tenuis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora teres*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tortuosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tutuilensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora valenciennesi*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora valida*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora vaughani*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora verweyi*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora yongei*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Anacropora forbesi*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Anacropora puertogalerae*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora cucullata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora expansa*

ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora gracilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora incrustans*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora listeri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora macrostoma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora myriophthalma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora ocellata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora randalli*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora scabra*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora suggesta*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Isopora cuneata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Isopora palifera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora aequituberculata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora altasepta*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora angulata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora australiensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora calcarea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora caliculata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora capitata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora capricornis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora cebuensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora corbettensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora crassituberculata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora danae*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora digitata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora efflorescens*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora effusa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora floweri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora foliosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora foveolata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora grisea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora hispida*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora hoffmeisteri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora incrassata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora informis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora lobulata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora millepora*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora mollis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora monasteriata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora nodosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora peltiformis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora samarensis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora spongodes*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora spumosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora tuberculosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora turgescens*

ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora undata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora venosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora verrucosa*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Coeloseris mayeri*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Gardineroseris planulata*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris explanata*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris gardineri*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris hawaiiensis*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris incrustans*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris mycetoseroides*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris papyracea*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris scabra*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris solida*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris yabei*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pachyseris rugosa*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pachyseris speciosa*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona bipartita*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona cactus*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona clavus*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona decussata*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona duerdeni*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona explanulata*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona frondifera*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona maldivensis*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona minuta*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona varians*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona venosa*
ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Madracis kirbyi*
ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Stylocoeniella armata*
ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Stylocoeniella guentheri*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Bourneotrochus stellulatus*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Caryophyllia smithii*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Trochocyathus hastatus*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Trochocyathus vasiformis*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Heterocyathus aequicostatus*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Heteropsammia cochlea*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria frondens*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria mesenterina*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria patula*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria peltata*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria reniformis*
ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria stellulata*
ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia cristata*
ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia glabrescens*
ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia yaeyamaensis*

ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Physogyra lichtensteini*
ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Plerogyra simplex*
ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Plerogyra sinuosa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Barabattoia amicorum*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Barabattoia laddi*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Caulastrea curvata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Caulastrea furcata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea chalcidicum*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea decadia*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea microphthalma*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea ocellina*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea serailia*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Diploastrea heliopora*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora gemmacea*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora hirsutissima*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora horrida*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora lamellosa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora mammiformis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora pacificus*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia danae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia favus*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia helianthoides*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia lizardensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia maritima*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia matthaii*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia pallida*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia rotumana*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia rotundata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia speciosa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia stelligera*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia veroni*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites abdita*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites bestae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites chinensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites complanata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites flexuosa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites halicora*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites pentagoa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites russelli*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea aspera*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea australensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea edwardsi*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea favulus*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea palauensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea pectinata*

ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea retiformis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea bottae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea inaequalis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea pruinosa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea purpurea*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea transversa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptoria phrygia*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea annuligera*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea curta*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea magnistellata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea mulitpunctata*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea valenciennesi*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Oulophyllia bennettae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Oulophyllia crispa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra contorta*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra daedalea*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra lamellina*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra pini*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra ryukyuensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra sinensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Plesiastrea versipora*
ANTHOZOA	SCLERACTINIA	FLABELLIDAE	*Rhizotrochus levidensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis albitentaculata*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis crassa*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis echinata*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia concinna*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia fragilis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia fungites*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia granulosa*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia horrida*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia moluccensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia paumotensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia repanda*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia scruposa*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia scrutaria*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia sinensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia tenuis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia vaughani*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Halomitra pileus*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Herpolitha limax*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Lithophyllon mokai*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Podabacia crustacea*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Podabacia motuporensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Polyphyllia novaehiberniae*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Sandalolitha dentata*

ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Sandalolitha robusta*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Zoopilus echinatus*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora exesa*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora grandis*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora microconos*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora pilosa*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora rigida*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Merulina ampliata*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Merulina scabricula*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Paraclavarina triangularis*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Scapophyllia cylindrica*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea bowerbanki*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea echinata*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea hillae*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea ishigakiensis*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Blastomussa wellsi*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Cynarina lacrymalis*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia corymbosa*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia diminuta*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia hataii*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia hemprichii*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia pachysepta*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Micromussa amakusensis*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Scolymia vitiensis*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia agaricia*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia radians*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia recta*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia valenciennesii*
ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea astreata*
ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea fascicularis*
ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea horrescens*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Echinophyllia aspera*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Echinophyllia echinata*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Mycedium elephantotus*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Mycedium mancaoi*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Oxypora lacera*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia alcicornis*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia elongata*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia lactuca*
ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia paeonia*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora capitata*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora damicornis*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora danae*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora elegans*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora eydouxi*

ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora ligulata*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora meandrina*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora verrucosa*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora woodjonesi*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora zelli*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora caliendrum*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora hystrix*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora stellata*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Stylophora pistillata*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Stylophora subseriata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora allingi*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora catalai*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora fenestrata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora marionensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora ocellata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora spongiosa*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora tizardi*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora verrilliana*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora columna*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora djiboutiensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora lobata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora minor*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora pandoraensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora somaliensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora stokesi*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora stutchburyi*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora tenuidens*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites annae*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites arnaudi*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites attenuata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites australiensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites cylindrica*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites deformis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites horizontalata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites latistela*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lichen*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lobata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lutea*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites murrayensis*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites nigescens*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites rus*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites solida*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites stephensoni*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites vaughani*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea columna*

ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea exesa*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea fossata*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea wellsi*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora contigua*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora digitata*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora explanulata*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora haimeana*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora nierstraszi*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora profundacella*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora superficialis*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora vaughani*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Pseudosiderastrea tayami*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Siderastrea savignyana*
ANTHOZOA	STOLONIFERA	TUBIPORIDAE	*Tubipora musica*
CUBOZOA	CUBOMEDUSAE	CHIRODROPIDAE	*Chironex fleckeri*
HYDROZOA	ANTHOMEDUSAE	PORPITIDAE	*Velella velella*
HYDROZOA	LEPTOMEDUSAE	SERTULARIIDAE	*Sertularia tubuliformis*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora exaesa*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora platyphylla*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora squarrosa*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora tenera*
HYDROZOA	SIPHONOPHORA	PHYSALIIDAE	*Physalia spp.*

1D: Marine algae

PHYLUM	FAMILY	Genus Specie
CHLOROPHYTA	ANADYOMENACEAE	*Microdictyon japonicum*
CHLOROPHYTA	ANADYOMENACEAE	*Microdictyon setchellianum*
CHLOROPHYTA	BOODLEACEAE	*Boodlea composita*
CHLOROPHYTA	BOODLEACEAE	*Phyllodictyon anastomosans*
CHLOROPHYTA	CAULERPACEAE	*Caulerpa cupressoides*
CHLOROPHYTA	CAULERPACEAE	*Caulerpa mexicana*
CHLOROPHYTA	CAULERPACEAE	*Caulerpa racemosa*
CHLOROPHYTA	CAULERPACEAE	*Caulerpa serrulata*
CHLOROPHYTA	CAULERPACEAE	*Caulerpa urvilliana*
CHLOROPHYTA	DASYCLADACEAE	*Neomeris van-bosseae*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda copiosa*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda cylindrica*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda gracilis*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda incrassata*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda macrolobata*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda opuntiae*
CHLOROPHYTA	HALIMEDACEAE	*Halimeda tuna*
CHLOROPHYTA	POLYPHYSACEAE	*Parvocaulis parvulus*

CHLOROPHYTA	SIPHONOCLADACEAE	*Cladophoropsis membranaceae*
CHLOROPHYTA	SIPHONOCLADACEAE	*Cladophoropsis zollingeri*
CHLOROPHYTA	SIPHONOCLADACEAE	*Dictyosphaeria cavernosa*
CHLOROPHYTA	SIPHONOCLADACEAE	*Dictyosphaeria versluysii*
CHLOROPHYTA	UDOTEACEAE	*Avrainvillea pacifica*
CHLOROPHYTA	UDOTEACEAE	*Udotea sp.*
CHLOROPHYTA	ULVACEAE	*Ulva procera*
CHLOROPHYTA	VALONIACEAE	*Valonia aegagropila*
CHLOROPHYTA	VALONIACEAE	*Valonia ventricosa*
CYANOBACTERIA	OSCILLATORIACEAE	*Lyngbya confervoides*
CYANOBACTERIA	OSCILLATORIACEAE	*Lyngbya majuscula*
CYANOBACTERIA	OSCILLATORIACEAE	*Lyngbya semiplena*
CYANOBACTERIA	PHORMIDIACEAE	*Hydrocoleus coccineus*
CYANOBACTERIA	PHORMIDIACEAE	*Phormidium corium*
CYANOBACTERIA	PHORMIDIACEAE	*Phormidium lyngbyaceum*
CYANOBACTERIA	PHORMIDIACEAE	*Phormidium nigroviride*
CYANOBACTERIA	RIVULARIACEAE	*Calothrix confervicola*
FUCOPHYCEA	DICTYOTACEAE	*Dictyota cervicornis*
FUCOPHYCEA	DICTYOTACEAE	*Dictyota dichotoma*
FUCOPHYCEA	DICTYOTACEAE	*Padina australis*
FUCOPHYCEA	DICTYOTACEAE	*Padina commersonii*
FUCOPHYCEA	DICTYOTACEAE	*Pocockiella variegata*
FUCOPHYCEA	ECTOCARPACEAE	*Ectocarpus indicus*
RHODOPHYTA	ARESCHOUGIACEAE	*Eucheuma (Kappaphycus) cottonii*
RHODOPHYTA	CERAMIACEAE	*Centroceras clavulatum*
RHODOPHYTA	CERAMIACEAE	*Ceramium personatum*
RHODOPHYTA	CORALLINACEAE	*Hydrolithon farinosum*
RHODOPHYTA	CORALLINACEAE	*Hydrolithon gardineri*
RHODOPHYTA	CORALLINACEAE	*Hydrolithon onkodes*
RHODOPHYTA	CORALLINACEAE	*Jania rubens*
RHODOPHYTA	CORALLINACEAE	*Lithophyllum fasciculatum f. subtilis*
RHODOPHYTA	CORALLINACEAE	*Lithophyllum frutescens*
RHODOPHYTA	GALAXAURACEAE	*Galaxaura filamentosa*
RHODOPHYTA	GRACILARIACEAE	*Gracilaria coronopifolia*
RHODOPHYTA	HAPALIDIACEAE	*Mesophyllum funafutiensis*
RHODOPHYTA	HYPNEACEAE	*Hypnea sp.*
RHODOPHYTA	LIAGORACEAE	*Liagora sp.*
RHODOPHYTA	RHODOMELACEAE	*Herposiphonia secunda*
RHODOPHYTA	RHODOMELACEAE	*Laurencia intricata*
RHODOPHYTA	RHODOMELACEAE	*Roschera calodictyon*
RHODOPHYTA	SOLIERIACEAE	*Wurdemannia miniata*

1E: Sea birds

FAMILY	Genus Specie	Common name	Tuvaluan name
ANATIDAE	*Anas clypeata*	Northern shoveeller	Tola
ANATIDAE	*Anas platyrhynchos*	Mallard	Tola
ANATIDAE	*Cairina moschata*	Muscovy Duck	Taki
ARDEIDAE	*Egretta sacra*	Pacific reef heron	Matuku
CHARADIDAE	*Arenaria interpres*	Ruddy Turnstone	Kolili
CHARADIIDAE	*Charadrius hiaticula*	Ringed plover	
CHARADIIDAE	*Pluvialis apricaria*	Plover/Eurasian golden plover	Vivitai
CHARADIIDAE	*Pluvialis dominica*	Pacific golden plover	Tuli
COLUMBIDAE	*Columba livia*	Feral Pigeon	Pisini
COLUMBIDAE	*Ducula pacifica*	Pacific pigeon	Lupe
COLUMBIDAE	*Gallicolumba erythoptera*	Ground dove	Lupe palangi
CUCULIDAE	*Eudynamis taitensis*	Long tailed cuckoo	Kaleva
FREGATIDAE	*Fregata ariel*	Lesser frigatebird	Katafa
FREGATIDAE	*Fregata minor*	Great frigatebird	Katafa
LARIDAE	*Larus cirrocephalus*	Grey-headed gull	Talaliki
PHAETONTIDAE	*Phaethon lepturus*	White tailed tropic bird	Tavake
PHAETONTIDAE	*Phaethon rubricauda*	Red tailed tropic bird	Tavaketoto
PHASIANIDAE	*Gallus gallus*	Red junglefowl/Domestic fowl	Moa
PROCELLARIIDAE	*Petrodoma alba*	Phoenix petrel	Lulu
PROCELLARIIDAE	*Puffinus assimilis*	Little or Dusky shearwater	Takupu?
PROCELLARIIDAE	*Puffinus lherminieri*	Audubon's shearwater	Takupu
PROCELLARIIDAE	*Puffinus nativitatis*	Christmas Island shearwater	
PROCELLARIIDAE	*Puffinus pacificus*	Wedge-tailed shearwater	Lulu
RALLIDAE	*Gallirallus philippensis*	Buff-banded Rail	Manukiki
SCOLOPACIDAE	*Calidris alba*	Sanderling	Kolili
SCOLOPACIDAE	*Heteroscelus brevipes*	Grey-tailed Tattler	
SCOLOPACIDAE	*Heteroscelus incanus*	Wandering Tattler	Kilikilitai
SCOLOPACIDAE	*Limosa lapponica*	Pacific or Bar-tailed godwit	Kaka/Kotau
SCOLOPACIDAE	*Numenius phaeopus*	Whimbrel	Fouga
SCOLOPACIDAE	*Numenius tahitensis*	Bristle-thighed curlew	Fouga
STERNIDAE	*Anous minutus*	Black noddy	Lakia
STERNIDAE	*Anous stolidus*	Brown noddy	Gogo
STERNIDAE	*Gygis alba*	White tern	Akiaki
STERNIDAE	*Procelsterna cerulea*	Blue Noddy	
STERNIDAE	*Sterna bergii*	Great crested tern	
STERNIDAE	*Sterna fuscata*	Sooty tern	Talaliki
STERNIDAE	*Sterna lunata*	Grey-backed tern	Kalakala
STERNIDAE	*Sterna sumatrana*	Black napped tern	Matapula
SULIDAE	*Sula dactylatra*	Masked booby	Kotaa
SULIDAE	*Sula leucogaster*	Brown booby	Kotaa
SULIDAE	*Sula sula*	Red footed booby	Te-Kena

1F: Marine mammals

FAMILY	Genus Specie	Common name
BALAENOPTERIDAE	*Balaenoptera edeni*	Bryde's Whale
BALAENOPTERIDAE	*Balaenoptera physalus*	Fin Whale
BALAENOPTERIDAE	*Megaptera novaeangliae*	Humpback Whale
DELPHINIDAE	*Feresa attenuata*	Pygmy Killer Whale
DELPHINIDAE	*Globicephala macrorhynchus*	Short-finned Pilot Whale
DELPHINIDAE	*Grampus griseus*	Grey Dolphin
DELPHINIDAE	*Lagenodelphis hosei*	Fraser's Dolphin
DELPHINIDAE	*Orcinus orca*	Orca/Killer whale
DELPHINIDAE	*Peponocephala electra*	Melon-headed Whale
DELPHINIDAE	*Pseudorca crassidens*	False Killer Whale
DELPHINIDAE	*Stenella attenuata*	Pantropical spotted dolphin
DELPHINIDAE	*Stenella coeruleoalba*	Striped Dolphin
DELPHINIDAE	*Stenella longirostris*	Spinner dolphin
DELPHINIDAE	*Steno bredanensis*	Rough-toothed Dolphin
DELPHINIDAE	*Tursiops sp.*	Bottlenose dolphin
PHYSETERIDAE	*Kogia breviceps*	Pygmy Sperm Whale
PHYSETERIDAE	*Kogia sima*	Dwarf Sperm Whale
PHYSETERIDAE	*Physeter macrocephalus*	Sperm whale
ZIPHIIDAE	*Mesoplodon densirostris*	Blainville's Beaked Whale
ZIPHIIDAE	*Mesoplodon ginkgodens*	Ginkgo-toothed Beaked Whale
ZIPHIIDAE	*Ziphius cavirostris*	Cuvier's Beaked Whale

1G: Marine turtles

FAMILY	Genus Specie	Common name
CHELONIIDAE	*Caretta caretta*	Loggerhead sea turtle
CHELONIIDAE	*Chelonia mydas*	Green turtle
CHELONIIDAE	*Eretmochelys imbricata*	Hawksbill turtle (Cahouane)
CHELONIIDAE	*Dermochelys coriacea*	Leatherback turtle

1H: Sponges

FAMILY	Genus specie
SPONGIIDAE	*Spongia officinalis mollissima*
SPONGIIDAE	*Spongia zimocca*
SPONGIIDAE	*Euspongia irregularis*
CALLYSPONGIIDAE	*Callyspongia glomerata*

1I: Mangrove species

FAMILY	Genus specie
COMBRETACEAE	*Lumnitzera littorea*
RHIZOPHORIDAE	*Rhizophora stylosa*

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Tuvalu Fisheries Di.	1992	Annual report	Ministry of Natural Resources
Tuvalu Fisheries D.	1993	Annual report	Ministry of Natural Resources
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3: LIST OF MARINE SPECIES LISTED UNDER THE CITES CONVENTION FOR TUVALU

3A: Marine species listed under the CITES Convention, Appendix I

CLASS	ORDER	FAMILY	Genus Specie
REPTILIA	TESTUDINES	CHELONIIDAE	*Caretta caretta*
REPTILIA	TESTUDINES	CHELONIIDAE	*Chelonia mydas*

3B: Marine species listed under the CITES Convention, Appendix II

CLASS	ORDER	FAMILY	Genus Specie
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Bourneotrochus stellulatus*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Caryophyllia smithii*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Trochocyathus hastatus*
ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Trochocyathus vasiformis*
ANTHOZOA	ANTIPATHARIA	ANTIPATHIDAE	*Antipathes atlantica*
ANTHOZOA	ANTIPATHARIA	ANTIPATHIDAE	*Antipathes brookii*
ANTHOZOA	HELIOPORACEA	HELIOPORIDAE	*Heliopora coerulea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora austera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora crateriformis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cuneata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cytherea*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora digitifera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora efflorescens*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora eurystoma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora granulosa*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora horrida*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora humilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora hyacinthus*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora intermedia*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora latistella*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora loripes*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nana*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nobilis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora spicifera*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tenuis*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora incrustans*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora listeri*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora myriophthalma*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora ocellata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora caliculata*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora foveolata*

ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora turgescens*
ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora verrucosa*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona explanulata*
ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona varians*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea serailia*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Diploastrea heliopora*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia danae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia favus*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia pallida*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia rotumana*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea bottae*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea purpurea*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea transversa*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea curta*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra daedalea*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra lamellina*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra sinensis*
ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Plesiastrea versipora*
ANTHOZOA	SCLERACTINIA	FLABELLIDAE	*Rhizotrochus levidensis*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis crassa*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia repanda*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia scrutaria*
ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Sandalolitha robusta*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora exesa*
ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora microconos*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea echinata*
ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia hemprichii*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora damicornis*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora danae*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora eydouxi*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora ligulata*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora meandrina*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora verrucosa*
ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Stylophora pistillata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lichen*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lobata*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lutea*
ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites rus*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea columna*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea fossata*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora contigua*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora haimeana*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora profundacella*
ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora superficialis*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora exaesa*

HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora platyphylla*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora squarrosa*
HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora tenera*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Hippopus hippopus*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna crocea*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna derasa*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna gigas*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna maxima*
BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna squamosa*
ACTINOPTERYGII	PERCIFORMES	LABRIDAE	*Cheilinus undulatus*
CHONDRICHTHYES	LAMNIFORMES	LAMNIDAE	*Carcharodon carcharias*
CHONDRICHTHYES	ORECTOLOBIFORMES	RHINCODONTIDAE	*Rhincodon typus*
MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Orcinus orca*
MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Stenella attenuata*
MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Tursiops sp.*
MAMMALIA	CETARTIODACTYLA	PHYSETERIDAE	*Physeter macrocephalus*

4: IUCN RED LIST OF THREATENED SPECIES FOR TUVALU MARINE SPECIES

Red List categories: EN: Endangered;V: Vulnerable; NT: Near Threatened; LC: Least Concern; LR/CD: Lower Risk/Conservation Dependent; DD: Data Deficient (IUCN, 2009).

Phylum	Class	Order	Family	Scientific Name	Status	Population trend
ARTHROPODA	CRUSTACEA	DECAPODA	COENOBITIDAE	*Birgus latro*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	LABRIDAE	*Cheilinus undulatus*	EN	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SCOMBRIDAE	*Thunnus alalunga*	DD	Needs updating
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SCOMBRIDAE	*Thunnus albacares*	LC	Needs updating
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SCOMBRIDAE	*Thunnus obesus*	NT	Needs updating
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus melanostigma*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus tauvina*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Anyperodon leucogrammicus*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis argus*	LC	Stable
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis leopardus*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis miniata*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis sexmaculata*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis sonnerati*	LC	Stable
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis spiloparaea*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis urodeta*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus chlorostigma*	LC	Stable
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus coeruleopunctatus*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus cyanopodus*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus fasciatus*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus hexagonatus*	LC	Stable
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus howlandi*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus macrospilos*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus maculatus*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus merra*	LC	Stable

CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus miliaris*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus ongus*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus spilotoceps*	LC	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus fuscoguttatus*	NT	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus polyphekadion*	NT	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus socialis*	NT	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus lanceolatus*	V	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Aethaloperca rogaa*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Cephalopholis aurantia*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Gracila albomarginata*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus octofasciatus*	DD	Unknown
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Variola albimarginata*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Variola louti*	LC	Stable
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Epinephelus morrhua*	LC	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Plectropomus areolatus*	V	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	SERRANIDAE	*Plectropomus laevis*	V	Decreasing
CHORDATA	ACTINOPTERYGII	PERCIFORMES	XIPHIIDAE	*Xiphias gladius*	DD	Needs updating
CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	*Anous minutus*	LC	Unknown
CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	*Anous stolidus*	LC	
CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	*Procelsterna cerulea*	LC	Unknown
CHORDATA	AVES	CHARADRIIFORMES	LARIDAE	*Sterna lunata*	LC	
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Carcharhinus amblyrhynchos*	NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Carcharhinus longimanus*	V	Decreasing
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Carcharhinus melanopterus*	NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Carcharhinus obscurus*	NT	Decreasing
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Carcharhinus plumbeus*	LR/NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Galeocerdo cuvier*	NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Prionace glauca*	NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	CARCHARHINIDAE	*Triaenodon obesus*	LR/NT	Unknown

CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	SPHYRNIDAE	*Sphyrna lewini*	NT	Unknown
CHORDATA	CHONDRICHTHYES	CARCHARHINIFORMES	SPHYRNIDAE	*Sphyrna zygaena*	NT	Unknown
CHORDATA	CHONDRICHTHYES	HEXANCHIFORMES	HEXANCHIDAE	*Hexanchus griseus*	NT	Unknown
CHORDATA	CHONDRICHTHYES	LAMNIFORMES	LAMNIDAE	*Isurus oxyrinchus*	NT	Unknown
CHORDATA	CHONDRICHTHYES	LAMNIFORMES	LAMNIDAE	*Carcharodon carcharias*	V	Unknown
CHORDATA	CHONDRICHTHYES	ORECTOLOBIFORMES	RHINCODONTIDAE	*Rhincodon typus*	V	Decreasing
CHORDATA	CHONDRICHTHYES	RAJIFORMES	MOBULIDAE	*Mobula japanica*	NT	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	BALAENOPTERIDAE	*Balaenoptera edeni*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	BALAENOPTERIDAE	*Balaenoptera physalus*	EN	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	BALAENOPTERIDAE	*Megaptera novaeangliae*	EN	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Feresa attenuata*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Globicephala macrorhynchus*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Orcinus orca*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Pseudorca crassidens*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Stenella longirostris*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Grampus griseus*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Lagenodelphis hosei*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Peponocephala electra*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Stenella attenuata*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Stenella coeruleoalba*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	DELPHINIDAE	*Steno bredanensis*	LC	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	PHYSETERIDAE	*Kogia breviceps*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	PHYSETERIDAE	*Kogia sima*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	PHYSETERIDAE	*Physeter macrocephalus*	V	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	ZIPHIIDAE	*Mesoplodon densirostris*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	ZIPHIIDAE	*Mesoplodon ginkgodens*	DD	Unknown
CHORDATA	MAMMALIA	CETARTIODACTYLA	ZIPHIIDAE	*Ziphius cavirostris*	LC	Unknown
CHORDATA	REPTILIA	TESTUDINES	CHELONIIDAE	*Chelonia mydas*	EN	Decreasing
CNIDARIA	ANTHOZOA	HELIOPORACEA	HELIOPORIDAE	*Heliopora coerulea*	V	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora copiosa*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora exquisita*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora inermis*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora insignis*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora parilis*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora prostrata*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora rambleri*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora rosaria*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora schmitti*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora teres*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tutuilensis*	DD	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora abrotanoides*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cerealis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora chesterfieldensis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora clathrata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora cytherea*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora elseyi*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora grandis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora latistella*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora longicyathus*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora microphthalma*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nobilis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora pulchra*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora robusta*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora samoensis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora sarmentosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora subglabra*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora subulata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tortuosa*	LC	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora valenciennesi*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora verweyi*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora yongei*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Anacropora forbesi*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora gracilis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora listeri*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora myriophthalma*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora ocellata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora randalli*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora scabra*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora suggesta*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora aequituberculata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora danae*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora digitata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora floweri*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora grisea*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora hispida*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora hoffmeisteri*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora informis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora millepora*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora mollis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora monasteriata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora spongodes*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora spumosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora tuberculosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora turgescens*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora verrucosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora austera*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora digitifera*	NT	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora divaricata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora florida*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora formosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora granulosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora humilis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora hyacinthus*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora loripes*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora lutkeni*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora millepora*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora monticulosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nana*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora nasuta*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora secale*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora selago*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora tenuis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora expansa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora macrostoma*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Isopora palifera*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora capitata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora efflorescens*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora effusa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora foliosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora foveolata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora incrassata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora nodosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora peltiformis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora undata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora venosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora abrolhosensis*	V	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora aculeus*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora acuminata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora anthocercis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora aspera*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora dendrum*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora donei*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora echinata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora globiceps*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora horrida*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora kirstyae*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora listeri*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora lovelli*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora microclados*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora palmerae*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora paniculata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora polystoma*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora retusa*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora solitaryensis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora speciosa*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora spicifera*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora valida*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Acropora vaughani*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Anacropora puertogalerae*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Astreopora cucullata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Isopora cuneata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora altasepta*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora angulata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora australiensis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora calcarea*	V	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora caliculata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora capricornis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora cebuensis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora corbettensis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora crassituberculata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora lobulata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	ACROPORIDAE	*Montipora samarensis*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Coeloseris mayeri*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Gardineroseris planulata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris explanata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris gardineri*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris hawaiiensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris mycetoseroides*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris papyracea*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris scabra*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris solida*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pachyseris speciosa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona clavus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona duerdeni*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona explanulata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona frondifera*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona maldivensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona varians*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona minuta*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris incrustans*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Leptoseris yabei*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pachyseris rugosa*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona bipartita*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona cactus*	V	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona decussata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	AGARICIIDAE	*Pavona venosa*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Madracis kirbyi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Stylocoeniella armata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	ASTROCOENIIDAE	*Stylocoeniella guentheri*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	CARYOPHYLLIIDAE	*Heterocyathus aequicostatus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Heteropsammia cochlea*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria frondens*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria mesenterina*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria patula*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria peltata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria reniformis*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	DENDROPHYLLIIDAE	*Turbinaria stellulata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia glabrescens*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia yaeyamaensis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Plerogyra simplex*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Plerogyra sinuosa*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Euphyllia cristata*	V	Stable
CNIDARIA	ANTHOZOA	SCLERACTINIA	EUPHYLLIDAE	*Physogyra lichtensteini*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Barabattoia amicorum*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Caulastrea furcata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea chalcidicum*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea decadia*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea microphthalma*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea serailia*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora gemmacea*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora hirsutissima*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora lamellosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia danae*	LC	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia favus*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia pallida*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia rotumana*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia speciosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites pentagoa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea aspera*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea australensis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea edwardsi*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea pectinata*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea retiformis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea pruinosa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea purpurea*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea transversa*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea curta*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra contorta*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra daedalea*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra pini*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra sinensis*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Plesiastrea versipora*	LC	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Diploastrea heliopora*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora horrida*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora mammiformis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Echinopora pacificus*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia helianthoides*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia lizardensis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia maritima*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia matthaii*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia rotundata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia stelligera*	NT	Decreasing

CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favia veroni*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites abdita*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites bestae*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites chinensis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites complanata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites flexuosa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites halicora*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Favites russelli*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea favulus*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Goniastrea palauensis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea bottae*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptastrea inaequalis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Leptoria phrygia*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea annuligera*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea magnistellata*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea valenciennesi*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Oulophyllia bennettae*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Oulophyllia crispa*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra lamellina*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Platygyra ryukyuensis*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Barabattoia laddi*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Caulastrea curvata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Cyphastrea ocellina*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FAVIIDAE	*Montastrea mulitpunctata*	V	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis crassa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis echinata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia concinna*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia fragilis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia granulosa*	LC	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia horrida*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia moluccensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia paumotensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia repanda*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia scruposa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia scrutaria*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia sinensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia tenuis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia vaughani*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Halomitra pileus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Herpolitha limax*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Lithophyllon mokai*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Podabacia crustacea*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Sandalolitha dentata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Sandalolitha robusta*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Zoopilus echinatus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Ctenactis albitentaculata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Fungia fungites*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Podabacia motuporensis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	FUNGIIDAE	*Polyphyllia novaehiberniae*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora grandis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora pilosa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora rigida*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Merulina ampliata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Merulina scabricula*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Scapophyllia cylindrica*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora exesa*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Hydnophora microconos*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MERULINIDAE	*Paraclavarina triangularis*	NT	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea echinata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia corymbosa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia hataii*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia hemprichii*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia agaricia*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia radians*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia recta*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Symphyllia valenciennesii*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea hillae*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Blastomussa wellsi*	NT	Decreasing
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Cynarina lacrymalis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia pachysepta*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Micromussa amakusensis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Scolymia vitiensis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea bowerbanki*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Acanthastrea ishigakiensis*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	MUSSIDAE	*Lobophyllia diminuta*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea horrescens*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea fascicularis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	OCULINIDAE	*Galaxea astreata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Echinophyllia aspera*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Echinophyllia echinata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Mycedium elephantotus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Mycedium mancaoi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Oxypora lacera*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia elongata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia paeonia*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia alcicornis*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PECTINIIDAE	*Pectinia lactuca*	V	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora capitata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora damicornis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora ligulata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora meandrina*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora verrucosa*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora woodjonesi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora zelli*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora hystrix*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Stylophora subseriata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora eydouxi*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora caliendrum*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Seriatopora stellata*	NT	Stable
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Stylophora pistillata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	POCILLOPORIDAE	*Pocillopora elegans*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora ocellata*	DD	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora tizardi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora djiboutiensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora pandoraensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora somaliensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora stutchburyi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora tenuidens*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites arnaudi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites australiensis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites latistela*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lichen*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lutea*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites rus*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites solida*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites vaughani*	LC	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora catalai*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora spongiosa*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora columna*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora lobata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora minor*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Goniopora stokesi*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites annae*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites cylindrica*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites deformis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites lobata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites murrayensis*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites stephensoni*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora allingi*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora fenestrata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora marionensis*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Alveopora verrilliana*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites attenuata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites horizontalata*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	PORITIDAE	*Porites nigescens*	V	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea columna*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea exesa*	LC	Stable
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Coscinaraea wellsi*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora explanulata*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora haimeana*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora nierstraszi*	LC	Stable
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora profundacella*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora superficialis*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Siderastrea savignyana*	LC	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora contigua*	NT	Unknown

CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora digitata*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Psammocora vaughani*	NT	Unknown
CNIDARIA	ANTHOZOA	SCLERACTINIA	SIDERASTREIDAE	*Pseudosiderastrea tayami*	NT	Unknown
CNIDARIA	ANTHOZOA	STOLONIFERA	TUBIPORIDAE	*Tubipora musica*	NT	Unknown
CNIDARIA	HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora platyphylla*	LC	Unknown
CNIDARIA	HYDROZOA	MILLEPORINA	MILLEPORIDAE	*Millepora tenera*	LC	Unknown
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna crocea*	LC	Needs updating
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Hippopus hippopus*	LR/CD	Needs updating
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna maxima*	LR/CD	Needs updating
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna squamosa*	LR/CD	Needs updating
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna derasa*	V	Needs updating
MOLLUSCA	BIVALVIA	VENEROIDA	TRIDACNIDAE	*Tridacna gigas*	V	Needs updating

APPENDIX

APPENDIX 1:

Biodiversity survey
STATISTICAL SIGNIFICANCE TEST RESULTS

APPENDIX 2:

Biodiversity survey
FUNCTIONAL GROUPS OF FISH

APPENDIX 3:

Biodiversity survey
IUCN RED LIST REEF FISH SPECIES FOR TUVALU

APPENDIX 4:

Conservation areas survey
DESCRIPTION OF THE STATIONS

APPENDIX 1
BIODIVERSITY SURVEY: STATISTICAL SIGNIFICANCE TEST RESULTS

0.5a. ANOVA for fish species richness by atoll and depth.

Univariate Tests of Significance for Total n of species (Tuvalu biodiversity data) Sigma-restricted parameterization Effective hypothesis decomposition					
	SS	Degr. of - Freedom	MS	F	p
Intercept	171928.2	1	171928.2	1488.885	0.000000
Atoll	446.5	2	223.2	1.933	0.151079
Depth range	8308.0	2	4154.0	35.973	0.000000
Atoll*Depth range	1075.8	4	268.9	2.329	0.062653
Error	9699.9	84	115.5		

1a. ANOVA for total fish density by atoll (Nanumea, Funafuti, Nukulaelae) and exposure (lagoon and sheltered habitats)<

Univariate Tests of Significance for total fish density. Sigma-restricted parameterization Effective hypothesis decomposition					
	SS	Degr. of - Freedom	MS	F	p
Intercept	367326968	1	367326968	166.4314	0.000000
Atoll	11974301	2	5987151	2.7127	0.072958
Exposure	20835027	1	20835027	9.4401	0.002971
Atoll*Exposure	11661223	2	5830612	2.6418	0.077947
Error	163323752	74	2207078		

1b. Tukey's HSD post-hoc test to separate significant differences between atolls and exposure levels.

Tukey HSD test; variable total fish density. Approximate Probabilities for Post Hoc Tests Error: Between MS = 2207E3, df = 74.000								
	Atoll	Exposure	1 - 3593.2	2 - 1822.0	3 - 2624.8	4 - 1327.2	5 - 1814.8	6 - 1793.4
1	Nanumea	Lagoon		0.050790	0.603446	0.004845	0.028708	0.025872
2	Nanumea	Sheltered	0.050790		0.771070	0.963782	1.000000	1.000000
3	Nukulaelae	Lagoon	0.603446	0.771070		0.278948	0.710140	0.686975
4	Nukulaelae	Sheltered	0.004845	0.963782	0.278948		0.954879	0.962655
5	Funafuti	Lagoon	0.028708	1.000000	0.710140	0.954879		1.000000
6	Funafuti	Sheltered	0.025872	1.000000	0.686975	0.962655	1.000000	

2a. ANOVA for total fish biomass by atoll (Nanumea, Funafuti, Nukulaelae) and exposure (lagoon and sheltered habitats).

Univariate Tests of Significance for Total fish biomass. Sigma-restricted parameterization. Effective hypothesis decomposition					
	SS	Degr. of - Freedom	MS	F	p
Intercept	23543377	1	23543377	228.2903	0.000000
Atoll	1039225	2	519613	5.0385	0.008882
Exposure	271382	1	271382	2.6315	0.109017
Atoll*Exposure	1719783	2	859892	8.3380	0.000542
Error	7631555	74	103129		

2b. Tukey's HSD post-hoc test to separate significant differences between atolls and exposure levels.

Tukey HSD test; variable Total biomass (Tuvalu fish biomass) Approximate Probabilities for Post Hoc Tests Error: Between MS = 1031E2, df = 74.000								
	Atoll	Expo2	{1} - 370.52	{2} - 690.28	{3} - 263.47	{4} - 577.86	{5} - 832.14	{6} - 550.66
1	Nanumea	Lagoon		0.156539	0.963658	0.613224	0.004424	0.684876
2	Nanumea	Sheltered	0.156539		0.020476	0.955288	0.855657	0.863693
3	Nukulaelae	Lagoon	0.963658	0.020476		0.170476	0.000327	0.190954
4	Nukulaelae	Sheltered	0.613224	0.955288	0.170476		0.312489	0.999931
5	Funafuti	Lagoon	0.004424	0.855657	0.000327	0.312489		0.143811
6	Funafuti	Sheltered	0.684876	0.863693	0.190954	0.999931	0.143811	

3a. Multivariate test for differences in composition of fish families between atolls and exposure levels.

Multivariate Tests of Significance (Tuvalu fish density) Sigma-restricted parameterization Effective hypothesis decomposition						
	Test	Value	F	Effect - df	Error - df	p
Intercept	Pillai's	0.933819	118.1715	8	67	0.000000
Atoll	Pillai's	0.876768	6.6349	16	136	0.000000
Exposure	Pillai's	0.582772	11.6979	8	67	0.000000
Atoll*Exposure	Pillai's	0.895776	6.8954	16	136	0.000000

3b. Univariate tests for differences in composition of fish families between atolls and exposure levels.

	Degr. of	Butterfly	Butterfly	Butterfly	Butterfly
Intercept	1	27348.37	27348.37	173.2478	0.000000
Atoll	2	1272.49	636.25	4.0305	0.021802
Exposure	1	299.09	299.09	1.8947	0.172821
Atoll*Exposure	2	1960.29	980.15	6.2091	0.003215
Error	74	11681.42	157.86		
Total	79	15414.20			
		Damselfish	Damselfish	Damselfish	Damselfish
Intercept	1	186513674	186513674	104.4986	0.000000
Atoll	2	20320563	10160282	5.6925	0.005017
Exposure	1	29486867	29486867	16.5207	0.000119
Atoll*Exposure	2	23684321	11842160	6.6348	0.002237
Error	74	132078471	1784844		
Total	79	199736480			
		Wrasse	Wrasse	Wrasse	Wrasse
Intercept	1	2092034	2092034	273.6812	0.000000
Atoll	2	16617	8309	1.0869	0.342575
Exposure	1	107811	107811	14.1040	0.000342
Atoll*Exposure	2	5767	2884	0.3772	0.687066
Error	74	565660	7644		
Total	79	701296			

		Surgeon	Surgeon	Surgeon	Surgeon
Intercept	1	1778418	1778418	487.9371	0.000000
Atoll	2	57770	28885	7.9250	0.000761
Exposure	1	167107	167107	45.8484	0.000000
Atoll*Exposure	2	347471	173735	47.6670	0.000000
Error	74	269713	3645		
Total	79	785958			

		Parrot	Parrot	Parrot	Parrot
Intercept	1	529034.6	529034.6	264.4628	0.000000
Atoll	2	237552.9	118776.4	59.3760	0.000000
Exposure	1	887.3	887.3	0.4436	0.507473
Atoll*Exposure	2	150623.7	75311.9	37.6482	0.000000
Error	74	148030.5	2000.4		
Total	79	542941.6			

		Grouper	Grouper	Grouper	Grouper
Intercept	1	2893.470	2893.470	73.16062	0.000000
Atoll	2	248.217	124.108	3.13805	0.049191
Exposure	1	173.470	173.470	4.38614	0.039657
Atoll*Exposure	2	4.617	2.308	0.05837	0.943348
Error	74	2926.667	39.550		
Total	79	3353.550			

		Snapper	Snapper	Snapper	Snapper
Intercept	1	48330.2	48330.24	34.79240	0.000000
Atoll	2	994.1	497.06	0.35783	0.700397
Exposure	1	83.0	82.97	0.05973	0.807601
Atoll*Exposure	2	21852.1	10926.06	7.86555	0.000799
Error	74	102793.7	1389.10		
Total	79	125716.0			

		Emperor	Emperor	Emperor	Emperor
Intercept	1	1803.41	1803.409	8.304780	0.005172
Atoll	2	1135.95	567.975	2.615550	0.079879
Exposure	1	200.38	200.379	0.922753	0.339881
Atoll*Exposure	2	988.22	494.108	2.275391	0.109902
Error	74	16069.33	217.153		
Total	79	18537.95			

4a. Multivariate test for differences in composition of fish functional groups between atolls and exposure levels.

Multivariate Tests of Significance (Tuvalu fish density) Sigma-restricted parameterization Effective hypothesis decomposition						
	Test	Value	F	Effect - df	Error - df	p
Intercept	Pillai's	0.940817	75.81518	13	62	0.000000
Atoll	Pillai's	1.182754	7.01357	26	126	0.000000
Exposure	Pillai's	0.779060	16.81685	13	62	0.000000
Atoll*Exposure	Pillai's	1.211858	7.45151	26	126	0.000000

4b. Univariate tests for differences in composition of fish functional groups between atolls and exposure levels.

	Degr. of	OC	OC	OC	OC
Intercept	1	7832.742	7832.742	117.6899	0.000000
Atoll	2	1634.967	817.483	12.2830	0.000025
Exposure	1	131.045	131.045	1.9690	0.164735
Atoll*Exposure	2	2347.033	1173.517	17.6325	0.000001
Error	74	4925.000	66.554		
Total	79	8935.800			
	Degr. of	FC	FC	FC	FC
Intercept	1	2013.034	2013.034	63.58533	0.000000
Atoll	2	409.008	204.504	6.45963	0.002596
Exposure	1	544.095	544.095	17.18622	0.000089
Atoll*Exposure	2	305.342	152.671	4.82238	0.010748
Error	74	2342.750	31.659		
Total	79	3527.550			
	Degr. of	SS	SS	SS	SS
Intercept	1	178724.1	178724.1	125.2350	0.000000
Atoll	2	96643.3	48321.7	33.8598	0.000000
Exposure	1	21982.1	21982.1	15.4033	0.000193
Atoll*Exposure	2	114879.7	57439.8	40.2491	0.000000
Error	74	105606.1	1427.1		
Total	79	355235.6			
	Degr. of	ES	ES	ES	ES
Intercept	1	92775.00	92775.00	225.8977	0.000000
Atoll	2	32686.49	16343.25	39.7941	0.000000
Exposure	1	14036.46	14036.46	34.1773	0.000000
Atoll*Exposure	2	2479.49	1239.75	3.0187	0.054923
Error	74	30391.42	410.69		
Total	79	78359.20			

	Degr. of	Cr	Cr	Cr	Cr
Intercept	1	362304.5	362304.5	151.5613	0.000000
Atoll	2	14694.4	7347.2	3.0735	0.052208
Exposure	1	86836.9	86836.9	36.3261	0.000000
Atoll*Exposure	2	133718.3	66859.1	27.9689	0.000000
Error	74	176895.7	2390.5		
Total	79	387469.6			
	Degr. of	Br	Br	Br	Br
Intercept	1	3.8788	3.878788	1.223140	0.272328
Atoll	2	7.4667	3.733333	1.177273	0.313821
Exposure	1	3.8788	3.878788	1.223140	0.272328
Atoll*Exposure	2	7.4667	3.733333	1.177273	0.313821
Error	74	234.6667	3.171171		
Total	79	252.8000			
	Degr. of	Det	Det	Det	Det
Intercept	1	510840.0	510840.0	332.2155	0.000000
Atoll	2	20795.0	10397.5	6.7618	0.002009
Exposure	1	8308.2	8308.2	5.4031	0.022848
Atoll*Exposure	2	47754.4	23877.2	15.5281	0.000002
Error	74	113788.1	1537.7		
Total	79	186229.6			
	Degr. of	Be	Be	Be	Be
Intercept	1	6283220	6283220	154.6514	0.000000
Atoll	2	39489	19745	0.4860	0.617040
Exposure	1	60002	60002	1.4768	0.228132
Atoll*Exposure	2	367102	183551	4.5178	0.014086
Error	74	3006492	40628		
Total	79	3480480			
	Degr. of	PI	PI	PI	PI
Intercept	1	15417367	15417367	35.25253	0.000000
Atoll	2	745340	372670	0.85213	0.430648
Exposure	1	547821	547821	1.25262	0.266673
Atoll*Exposure	2	2404814	1202407	2.74936	0.070510
Error	74	32363213	437341		
Total	79	36350590			
	Degr. of	TP	TP	TP	TP
Intercept	1	5349741	5349741	120.2432	0.000000
Atoll	2	921922	460961	10.3608	0.000108
Exposure	1	1093538	1093538	24.5789	0.000004
Atoll*Exposure	2	1696152	848076	19.0617	0.000000
Error	74	3292335	44491		
Total	79	6737027			

	Degr. of	OP	OP	OP	OP
Intercept	1	84196319	84196319	64.75625	0.000000
Atoll	2	18769065	9384533	7.21774	0.001369
Exposure	1	46200733	46200733	35.53346	0.000000
Atoll*Exposure	2	43753643	21876821	16.82569	0.000001
Error	74	96215079	1300204		
Total	79	195825049			
	Degr. of	IntP	IntP	IntP	IntP
Intercept	1	69842.6	69842.56	50.64767	0.000000
Atoll	2	478.6	239.31	0.17354	0.841025
Exposure	1	1088.2	1088.24	0.78916	0.377233
Atoll*Exposure	2	26497.7	13248.86	9.60766	0.000195
Error	74	102045.2	1378.99		
Total	79	129220.0			
	Degr. of	LaP	LaP	LaP	LaP
Intercept	1	1323.034	1323.034	27.50063	0.000001
Atoll	2	223.758	111.879	2.32552	0.104835
Exposure	1	63.034	63.034	1.31023	0.256042
Atoll*Exposure	2	11.158	5.579	0.11597	0.890665
Error	74	3560.083	48.109		
Total	79	3852.800			

5a. Multivariate test for differences in benthic composition between atolls and exposure levels.

Multivariate Tests of Significance (Tuvalu transect benthic data) Sigma-restricted parameterization Effective hypothesis decomposition						
	Test	Value	F	Effect - df	Error - df	p
Intercept	Pillai's	0.959476	331.4705	5	70	0.00
Atoll	Pillai's	1.212081	21.8443	10	142	0.00
"Expo2"	Pillai's	0.864678	89.4568	5	70	0.00
Atoll*"Expo2"	Pillai's	1.368332	30.7603	10	142	0.00

5b. Univariate tests for differences in benthic composition between atolls and exposure levels.

	Degr. of	CA	CA	CA	CA
Intercept	1	11755.57	11755.57	105.3525	0.000000
Atoll	2	1642.39	821.19	7.3595	0.001216
"Expo2"	1	11280.02	11280.02	101.0907	0.000000
Atoll*"Expo2"	2	1660.59	830.29	7.4410	0.001136
Error	74	8257.16	111.58		
Total	79	22920.69			

	Degr. of	MA	MA	MA	MA
Intercept	1	4948.670	4948.670	50.84192	0.000000
Atoll	2	413.208	206.604	2.12262	0.126949
"Expo2"	1	121.367	121.367	1.24691	0.267756
Atoll*"Expo2"	2	822.342	411.171	4.22431	0.018314
Error	74	7202.750	97.334		
Total	79	8506.750			
	Degr. of	SC	SC	SC	SC
Intercept	1	5454.55	5454.545	69.40898	0.000000
Atoll	2	10500.00	5250.000	66.80614	0.000000
"Expo2"	1	5382.06	5382.061	68.48661	0.000000
Atoll*"Expo2"	2	10360.47	5180.233	65.91837	0.000000
Error	74	5815.33	78.586		
Total	79	31116.00			
	Degr. of	TA	TA	TA	TA
Intercept	1	1938.264	1938.264	86.87167	0.000000
Atoll	2	1159.774	579.887	25.99014	0.000000
"Expo2"	1	762.507	762.507	34.17503	0.000000
Atoll*"Expo2"	2	2126.885	1063.443	47.66276	0.000000
Error	74	1651.074	22.312		
Total	79	6103.089			
	Degr. of	HCC	HCC	HCC	HCC
Intercept	1	51009.29	51009.29	220.6654	0.000000
Atoll	2	1254.68	627.34	2.7139	0.072880
"Expo2"	1	13043.56	13043.56	56.4262	0.000000
Atoll*"Expo2"	2	4656.59	2328.29	10.0722	0.000135
Error	74	17105.94	231.16		
Total	79	34377.76			

APPENDIX 2
BIODIVERSITY SURVEY: FUNCTIONAL GROUPS OF FISH

Functional group	Species	Functional group	Species
Obligate corallivores	*Chaetodon lunulatus*	**Benthic invertivores**	*Aluteres scriptus*
	Chaetodon meyeri		*Anampses twistii*
	Chaetodon ornatissimus		*Anampses caerulaurea*
	Chaetodon pelewensis		*Apogon fraenatus*
	Chaetodon reticulatus		*Arothron nigropunctatus*
	Chaetodon trifascialis		*Aulostomus chinensis*
			Balistapus undulates
Facultative corallivores	*Chaetodon auriga*		*Balistoides viridescens*
	Chaetodon citrinellus		*Bodianus axillaris*
	Chaetodon ephippium		*Canthigaster solandri*
	Chaetodon lunula		*Canthigaster valentine*
	Chaetodon vagabundus		*Cantherines dumerilii*
			Chaetodon quadrimaculatus
Planktivores	*Acanthurus thompsoni*		*Chaetodon semeion*
	Caesio teres		*Chaetodon ulietensis*
	Hemitaurichthys polylepis		*Cheilinus fasciatus*
	Odonus niger		*Cheilinus undulates*
	Pseudanthias dispar		*Cheilinus chlorurus*
	Pseudanthias bartlettorum		*Cheilodipterus quinquelineatus*
	Pseudanthias pascalus		*Cirrhilabrus punctatus*
	Pterocaesio trilineata		*Coris gaimard*
	Chromis atripes		*Heniochus acuminatus*
	Chromis iomelas		*Heniochus chrysostomus*
	Chromis margaritifer		*Heniochus monoceros*
	Chromis ternatensis		*Epibulus insidiator*
	Chromis vanderbilti		*Forcipiger flavissimus*
	Chromis viridis		*Melichthys niger*
	Chromis weberi		*Melichthys vidua*
	Chromis xanthura		*Mulloidichthys flavissimus*
	Pomachromis richardsoni		*Mulloidichthys vanicolensis*
	Pterocaesio tile		*Myripristis berndti*
			Myripristis kuntee
Excavating scarids	*Bolbometapon muricatum*		*Myripristis murdjan*
	Cetoscarus bicolor		*Neoniphon opercularis*
	Chlorurus frontalis		*Neoniphon sammara*
	Chlorurus microrhinus		*Ostracion cubicus*
	Chlorurus sordidus		*Oxcheilinus unifasciatus*
			Oxycheilinus digrammus
Scraping scarids	*Hipposcarus longiceps*		*Oxymonacanthus longirostris*
	Scarus altipinnis		*Parupeneus barberinus*
	Scarus frenatus		*Parupeneus bifasciatus*
	Scarus ghobban		*Parupeneus cyclostomus*
	Scarus niger		*Parupeneus multifasciatus*
	Scarus psittacus		*Pseudobalistes*
	Scarus schlegeli		*flavimarginatus*
	Scarus festivus		*Pseudobalistes fuscus*
	Scarus forsteni		*Rhinecanthus aculeatus*
	Scarus globiceps		*Sargocentron caudimaculatus*
	Scarus oviceps		*Sargocentron spiniferum*
	Scarus rubroviolaceus		*Sufflamen bursa*
	Scarus russelli		*Zanclus cornutus*
	Scarus spinus		*Hemigymnus fasciatus*
	Scarus tricolor		*Gomphosus varius*
			Halichoeres biocellatus

Algal croppers	*Acanthurus nigricans* *Acanthurus nigroris* *Acanthurus triostegus* *Naso annulatus* *Naso caesius* *Naso lituratus* *Naso unicornis* *Naso vlamingii* *Siganus argenteus* *Siganus punctatus* *Zebrasoma flavescens* *Zebrasoma scopas* *Zebrasoma veliferum*		*Halichoeres hortulanus* *Halichoeres trimaculatus* *Labropsis australis* *Labroides bicolour* *Labroides dimidiatus* *Labroides pectoralis* *Labrichthys unilineatus* *Labrichthys xanthonota* *Macropharygodon meleagris* *Pseudocheilinus evanidus* *Pseudocheilinus hexataenia* *Pseudocheilinus octotaenia* *Pteragogus cryptus* *Stethojulis bandanensis* *Stethojulis strigiventer* *Thalassoma amblycephalum* *Thalassoma Hardwicke* *Thalassoma lutescens* *Thelassoma quinquelineata* *Wetmorella spp.* *Centropyge bicolour* *Centropyge flavissimus* *Centropyge loricula* *Pygoplites diacanthus* *Paracirrhites arcatus* *Paracirrhites forsteri* *Paracirrhites hemistictus* *Lethrinus xanthocheilus* *Lethrinus erythropterus* *Lethrinus obsoletus* *Lethrinus olivaceus* *Gnathodentex aureolineatus* *Gymnocranius microdon* *Platax orbicularis*
Algal browsers	*Kyphosus vaigiensis*		
Intermediate predators	*Cephalopholis argus* *Cephalopholis urodeta* *Epinephelus merra* *Epinephelus fasciatus* *Aphareus furca* *Lutjanus gibbus* *Lutjanus fulvus* *Lutjanus kasmira* *Lutjanus monostigma* *Macolor macularis* *Macolor niger* *Monotaxis grandoculis* *Carangoides ferdau* *Caranx melampygus* *Elegatis bipinnulata*		
Large predators	*Anyperadon leucogrammicus* *Epinephelus fuscoguttatus* *Epinephelus polyphekadion* *Gracilia albimarginata* *Plectropomus aerolatus* *Plectropomus laevis* *Variola louti* *Aprion virescens* *Lutjanus bohar* *Sphyraena barracuda* *Triaenodon obesus*	**Omnivorous pomacentrids and small fish**	*Amblyglyphidodon leucogaster* *Amphiprion clarkia* *Chrusiptera biocellata* *Dascyllus aruanus* *Dascyllus reticulates* *Pomacentrus amboinensis* *Pomacentrus brachialis* *Pomacentrus coelestis* *Pomacentrus pavo* *Plagiotremus laudandus* *Nemateleotris magnifica* *Ptereleotris evides* *Ptereleotris microlepis* *Amblygobius phalaena* *Ctenogobiops* spp.
Detritivores	*Acanthurus blochii* *Acanthurus grammoptilus* *Acanthurus guttatus* *Acanthurus nigricauda* *Acanthurus nigrofuscus* *Acanthurus pyroferus* *Acanthurus xanthopterus* *Ctenochaetus binotatus* *Ctenochaetus cyanocheilus* *Ctenochaetus marginatus* *Ctenochaetus striatus*		
Territorial grazers	*Acanthurus lineatus* *Plectroglyphidodon dickii* *Plectroglyphidodon lacrymatus* *Pomacentrus vaiuli* *Stegastes fasciolatus* *Stegastes nigricans*		

APPENDIX 3
BIODIVERSITY SURVEY: IUCN RED LIST REEF FISH SPECIES FOR TUVALU

Tuvaluan fish species listed in the IUCN Red List, with a focus on fisheries target species and species of universal conservation value. Species in the threatened categories are in bold and highlighted in orange. Note: most of the small wrasses, butterflyfish and angelfish recorded in this survey are listed as Least Concern, with a few listed as Data Deficient; these are not reproduced here in the interest of space.

Species	Common Name	IUCN status	Seen during survey (Y/N)
Aetheloperca rogaa	Redmouth grouper	Data deficient	Y
Aetobatus narinari	**Spotted eagle ray**	**Near Threatened**	**Y**
Alectis ciliaris	African pompano	Least Concern	N
Alopias pelagicus	**Pelagic thresher shark**	**Vulnerable**	**N**
Anyperadon leucogrammicus	Slender grouper	Least Concern	Y
Bodianus axillaris	Axilspot hogfish	Least Concern	Y
Bodianus diana	Diana's hogfish	Least Concern	N
Bolbometapon muricatum	**Bumphead parrotfish**	**Vulnerable**	**Y**
Caesio caerulaurea	Scissortail fusilier	Least Concern	Y
Caranx sexfasciatus	Bigeye trevally	Least Concern	Y
Carcharhinus amblyrhynchos	**Grey reef shark**	**Near Threatened**	**Y**
Carcharhinus limbatus	**Common blacktip shark**	**Near Threatened**	**N**
Carcharhinus longimanus	**Oceanic whitetip shark**	**Vulnerable**	**N**
Carcharhinus melanopterus	**Blacktip reef shark**	**Near Threatened**	**Y**
Carcharhinus obscurus	**Dusky shark**	**Near Threatened**	**N**
Carcharhinus plumbeus	**Sandbar shark**	**Lower Risk / Near Threatened**	**N**
Carcharodon carcharias	**Great white shark**	**Vulnerable**	**N**
Cephalopholis aurantia	Golden hind	Data Deficient	N
Cephalopholis argus	Peacock hind	Least Concern	Y
Cephalopholis leopardus	Leopard Hind	Least Concern	Y
Cephalopholis miniata	Coral hind	Least Concern	Y
Cephalopholis sexmaculata	Six-blotch hind	Least Concern	Y
Cephalopholis spiloparaea	Strawberry hind	Least Concern	N
Cephalopholis urodela	Darkfin hind	Least Concern	Y
Cheilinus chlorurus	Floral wrasse	Least Concern	Y
Cheilinus fasciatus	Redbreasted wrasse	Least Concern	Y
Cheilinus oxycephalus	Snooty wrasse	Least Concern	Y
Cheilinus trilobatus	Tripletail wrasse	Least Concern	Y
Cheilinus undulatus	**Maori wrasse**	**Endangered**	**Y**
Coryphaena hippurus	Mahi mahi	Least Concern	Y
Epinephelus chlorostigma	Brownspotted grouper	Least Concern	N
Epinephelus coeruleopunctatus	Whitespotted grouper	Least Concern	N
Epinephelus cyanopodus	Speckled grouper	Least Concern	N
Epinephelus fasciatus	Blacktip grouper	Least Concern	Y
Epinephelus fuscoguttatus	**Brown-marbled grouper**	**Near Threatened**	**Y**
Epinephelus hexagonatus	Starspotted grouper	Least Concern	Y
Epinephelus howlandi	Blacksaddle grouper	Least Concern	N

Species	Common Name	IUCN status	Seen during survey (Y/N)
Epinephelus lanceolatus	**Giant grouper**	**Vulnerable**	**N**
Epinephelus macrospilos	Snubnose grouper	Least Concern	Y
Epinephelus maculatus	Highfin grouper	Least Concern	Y
Epinephelus melanostigma	Blackspot grouper	Data Deficient	Y
Epinephelus merra	Dwarf spotted grouper	Least Concern	Y
Epinephelus millaris	Netfin grouper	Least Concern	Y
Epinephelus morrhua	Curve banded grouper	Least Concern	N
Epinephelus octofasciatus	Eightbar grouper	Data Deficient	N
Epinephelus ongus	White-streaked Grouper	Least Concern	N
Epinephelus polyphekadion	**Camouflage grouper**	**Near Threatened**	**Y**
Epinephelus socialis	**Surge grouper**	**Near Threatened**	**N**
Epinephelus spilotoceps	Foursaddle grouper	Least Concern	N
Epinephelus tauvina	Greasy grouper	Data Deficient	Y
Etelis carbunculus	Deep-water red snapper	Data Deficient	Y
Galeocerdo cuvier	**Tiger shark**	**Near Threatened**	**N**
Gracila albomarginata	Slenderspine grouper	Data Deficient	Y
Hexanchus griseus	**Bluntnose sixgill shark**	**Near Threatened**	**N**
Himantura uarnak	**Honeycomb stingray**	**Vulnerable**	**Y**
Isurus oxyrinchus	**Shortfin mako shark**	**Near Threatened**	**N**
Lethrinus genivittatus	Threadfin emperor	Least Concern	N
Lethrinus reticulatus	Red-snout emperor	Data Deficient	N
Mobula japonica	**Japanese devilray**	**Near Threatened**	**N**
Mugil cephalus	Flat-head grey mullet	Least Concern	Y
Mustelus griseus	Spotless smooth-hound	Data Deficient	N
Naso vlamingii	Bignose unicornfish	Least Concern	Y
Neotrygon kuhlii	Blue-spotted stingray	Data Deficient	Y
Parupeneus multifasciatus	Manybar goatfish	Least Concern	Y
Plectropomus areolatus	**Squaretail coralgrouper**	**Vulnerable**	**Y**
Plectropomus laevis	**Blacksaddled coralgrouper**	**Vulnerable**	**Y**
Prionace glauca	**Blue shark**	**Near Threatened**	**N**
Rhincodon typus	**Whale shark**	**Vulnerable**	**N**
Sphyrna lewini	**Scalloped hammerhead**	**Near Threatened**	**N**
Sphyrna zygaena	**Smooth hammerhead**	**Near Threatened**	**N**
Stegostoma fasciatum	**Leopard shark**	**Vulnerable**	**N**
Sufflamen fraenatum	Masked triggerfish	Least Concern	Y
Thunnus alalunga	Albacore tuna	Data Deficient	N
Thunnus albacares	Yellowfin tuna	Least Concern	Y
Thunnus obesus	**Bigeye tuna**	**Near Threatened**	**N**
Triaenodon obesus	**Whitetip reef shark**	**Lower Risk / Near Threatened**	**Y**
Variola albimarginata	White-edged lyretail	Least Concern	Y
Variola louti	Yellow-edged lyretail	Least Concern	Y
Xiphias gladius	Broadbill swordfish	Data Deficient	N

IUCN Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Not evaluated (NE)	A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

APPENDIX 4
CONSERVATION AREAS SURVEY: DESCRIPTION OF THE STATIONS

The following sheets give a detailed description of each station in terms of substrate composition and nature, targeted macroinvertebrates population abundance and composition and targeted fish population abundance and composition.

Species richness was calculated as the mean number of species per transect.

Density was calculated as the mean number of individuals per m^2.

Surfaces covered by transects are given in the table below:

Island	Taxa	Transect surface	Description
Funafuti	Macroinvertebrate	$100m^2$	1 transect= 25m*4m
	Fish	$250m^2$	1 transect= 25m*10m
Nukulaelae	Macroinvertebrate	$200m^2$	1 transect= 50m*4m
	Fish	$500m^2$	1 transect= 50m*10m
Nanumea	Macroinvertebrate	$200m^2$	1 transect= 50m*4m
	Fish	$500m^2$	1 transect= 50m*10m

Fish pictures included in the following sheets are taken from the database FishBase (Froese and Pauly 2011), most of them being taken by Dr. J. E. Randall.
Macroinvertebrate pictures were taken by Sandrine Job and Thomas Vignaud.
Aerial pictures are from Google Earth.
Maps were provided by Tuvalu Department of Land and Survey.

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Table1:

Gilliane Le Gallic, *Alofa Tuvalu President*, General coordination - **Sandrine Job**, *Marine biologist*, Literature review, field coordination, CA surveys, habitat survey - **Daniela Ceccarelli**, *Marine biologist*, Coral reef fish biodiversity survey - **Tupulaga Poulasi**, *Fisheries officer*, Community-based related aspects, CA surveys - **Semese Alefaio**, *Marine biologist*, Community-based related aspects, CA surveys - **Thomas Vignaud**, *Marine biologist*, Underwater photographer - **Séverine Jacquet**, *Alofa Tuvalu Treasurer*, *engineer in water science and technology*, *Phd in marine environment* - **Fanny Héros**, *Alofa Tuvalu Project officer*, Assistant general coordination

Table 2:

Patea Sela and **Esela Lopati**, CA survey, Nanumea - **Tahaoga Isako** and **Kaufiti Saloa**, Boat driver, Nanumea - **Patrick Malaki** and **Morris Melitiana**, Boat driver and CA survey, Nanumea - **Iosua Filiki** and **Monise Peni**, Boat driver, Nukulaelae - **Faiva Namoliki**, **Kinieti Pene**, **Losua Tepaolo**, **Mataua Lima** and **Lee Faeva Moresi**, CA survey, Nukulaelae - **Simon Salea**, Manaui Crew, CA survey Nanumea & Nukulaelae - The Manaui crew: **Tima Talapai,** - **Mauatu Tepoga, Kaumoe Pene, Kokea Toaki** - **Nelly Senida**, Manaui Crew Boat driver, Nanumea & Funafuti - **Panei Togapili**, Tuvalu Fisheries, CA survey, Nukulaelae & Funafuti - **Teulu Sigalo**, Tuvalu Fisheries, CA survey, Nanumea & Funafuti - **Kirisi Salanoa**, Funafuti Conservation Area, CA survey, Funafuti - **Paeniu Lopati** and **Moeo Finauga**, Tuvalu Fisheries, CA survey, Funafuti - **Aso Veu**, Tuvalu Fisheries, Boat driver, Funafuti - **Tennis Manu**, Boat driver, Funafuti.

Table 3:

Nanumea people: **Teu Manuella, Filofale Taofusi, Tafito Miho, Fati Petolua, George Teaso**
Nanumea Kaupule members: **Eli Teuea, Tie Maheu, Isala Katalake, Tuivaka Paitela, Toai Vevea, Muna Tefeke**
Nukulaelae people: **Maly Tulimanu, Letioa Tom, Pua Koliano, Mamele Galu, Silika Lenese, Tamiloga Silo, Luta Lake**
Nukulaelae Kaupule members: **Ekueta Telava, Tom Lake, Petaia Mose Paeniu, Kelisiano Losefa, Faiva Tinei**
Funafuti Kaupule members: **Andrew Ionatana, Uluao Lauti, Meneua Teagai, Kaitu Nokisi, Apinelu Tili, Heiloa Loua, Suka Taupale**
TANGO: **Taukiei Kitara**
Tuvalu Department of Environment: **Mataio Tekinene**
Tuvalu Fisheries: **Nikolasi Apinelu and Sam Finikaso**
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NAPA: **Nakala Nia**
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FishBase *(Froese and Pauly 2011):* most of them from **Dr J.E. Randall**

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