INSTITUTE OF APPLIED SCIENCES
THE UNIVERSITY OF THE SOUTH PACIFIC

CORAL DIVERSITY SURVEY : VOLIVOLI BEACH, VITI LEVU AND DRAVUNI AND GREAT ASTROLABE REEF, FIJI, 2006

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by

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This report consists of two parts:

1. Reef corals of the Volivoli Beach area near Rakiraki, Viti Levu, Fiji

   and

2. Reef corals of the Great Astrolabe Reef and Dravuni Island near Kadavu Island, Fiji

They share a common list of references, and a single master table of coral species and the locations where they were found (Appendix A), both found at the end of the two individual reports.

1. Reef corals of the Volivoli Beach area near Rakiraki, Viti Levu, Fiji

Executive Summary

- A list of corals was compiled for 4 sites near Volivoli Beach, near Rakiraki, Viti Levu, Fiji. The survey involved about 4 hours of scuba diving by D. Fenner to a maximum depth of 20.6 meters.

- The reefs near Volivoli have a diverse coral fauna. A total of 134 species in 49 genera of hard corals (126 species and 45 genera of zooxanthellate Scleractinia) were observed during the present survey. This is lower than the number (253) found in the Mamanucas and Coral Coast by the author in a previous study. However, additional species are found with additional search dives, and the previous study had 21 sites compared to just 4 in the present study.

- The number of species found after 4 dives (134) is more than that found in the Mamanucas in the same number of dives (111). These numbers indicate that the diversity of corals at Volivoli Beach is well within the range for Fiji, and may even be slightly higher than average for Fiji.

- This brief study found 40.5% of the (333) species of hard corals reported so far from all of Fiji by all studies. Additional study would find many more. This high diversity supports the value of efforts to use these reefs sustainably.

- Species numbers at visually sampled sites ranged from 51 to 90, with an average of 69 per site. Sites in the Mamanucas produced an average of 70 species per site. Reefs in the Philippines produce about 90 species per site, American Samoa produces about 71 per site, and Hawaii produces about 17 per site. The Philippines is in the area of highest coral diversity in the world, called the "Coral Triangle." Hawaii is in the eastern Pacific, a species-depauperate area. Volivoli thus has a very typical diversity for Fiji, about 77% of that in the most diverse area in the world, truly an amazingly high level.

- The overwhelming majority (95%) of corals on these reefs are zooxanthellate Scleractinia, with only a few non-sclearctinian and azooxanthellate species, as is typical of Indo-Pacific reefs.

- Four rare species were found.

- Three species that have not been reported from Fiji in published reports were found, two of which represent an extension of the known range for that species. One of these was originally described from the Red Sea, and known from the Indian Ocean but not known anywhere in the Pacific Ocean. The nearest it was known was from Cocos-Keeling Island, west of Australia in the Indian Ocean. This find was a very surprising and exciting find, even though it is not a new species. It was also found in the Mamanucas and Great Astrolabe Reef. It is not uncommon.

- These reefs support a very high coral diversity, typical of the best reef sites in Fiji, and should be used sustainably.

Introduction

The following is a report of the reef coral fauna of 4 dive sites off Volivoli, near Rakiraki, northern Viti Levu, Fiji, found in August, 2006.

The principle aim of the coral survey was to provide an inventory of the coral species growing on reefs and associated habitats and compare the coral fauna on different sites. This includes species growing on sand or other soft sediments within and around reefs. The primary group of corals is the zooxanthellate scleractinian corals, that is, those that contain single-cell algae and which contribute to building the reef. Also included are a small number of zooxanthellate non-scleractinian corals which also produce skeletons large enough to contribute to the reef (e.g., *Millepora, Heliopora, Tubipora, Distichopora*: fire coral, blue coral, organ-pipe coral, and thick lace coral, respectively), and a small number of azooxanthellate scleractinian corals (*Tubastrea*). All produce calcium carbonate skeletons that contribute to reef building to some degree.

The results of this survey facilitate a comparison of the faunal richness of these northern Viti Levu coral reefs with other reefs in Fiji and other regional reefs. However, the list of corals presented below is very incomplete, due to the limited number of dives in the survey (4 hours of diving), the highly patchy distribution of corals and the difficulty in identifying some species in the water. Corals are sufficiently difficult to identify that there are significant differences between leading experts on some identifications.

Methods

Corals were surveyed in 4 scuba dives by D. Fenner to a maximum depth of 20.6 m. A list of coral species was recorded at each site. The basic method consisted of underwater observations. The name of each species identified was marked on a plastic sheet on which species names were printed. The recorder followed the path of the resort dive guide, and most time was spent on the low to middle reef wall. Sample areas of all habitats encountered were surveyed. Many corals can be identified to species with certainty in the water and a few must be identified alive since they cannot be identified without living tissues. Also, there are some that are easier to identify alive than from skeletons. Field guides assisted identification (Veron and Stafford-Smith, 2002; Veron, 2000; Wallace, 1999ab). Two small samples of one species of staghorn (*Acropora*) were collected with permission, to determine whether this was a new species, or a species not known from Fiji. These two samples were examined at the University of the South Pacific and contributed to their collection. Additional references supporting identification are listed in references (Best & Suharsono, 1991; Boschma, 1959; Cairns & Zibrowius, 1997; Claereboudt, M. 1990; Dai, 1989; Dai & Lin 1992; Dineson, 1980; Fenner, in preparation; Hodgson, 1985; Hodgson & Ross, 1981; Hoeksema, 1989; Hoeksema & Best, 1991; Hoeksema & Best 1992; Moll & Best, 1984; Nemenzo 1986; Nishihira, 1986; Ogawa & Takamashi, 1993, 1995; Randall & Cheng, 1984: Sheppard & Sheppard, 1991; Suharsono, 1996; Veron, 1985, 1986, 1990, 2000; Veron & Nishihira, 1995; Veron & Pichon 1976, 1980, 1982; Veron, Pichon & Wijman-Best, 1977; Wallace 1994, 1997a, Wallace & Wolstenholme 1998).

Dive sites are listed in Table 3.

Results

A total of 134 species in 49 genera of stony corals (126 species and 45 genera of zooxanthellate Scleractinia) were found in the survey of these reefs, (Appendix A). All of these species are illustrated in Veron (2000) and Veron and Stafford-Smith (2002). This is lower than the number (253) found in the Mamanucas and Coral Coast by the author in a previous study. However, additional species are found with additional search dives, and the previous study had 21 sites compared to just 4 in the present study.

The number of species found after 4 dives (134) is more than that found in the Mamanucas in the same number of dives (111). These numbers indicate that the diversity of corals at Volivoli Beach is well within the range for Fiji, and may even be slightly higher than average for Fiji.

This brief study found 40.5% of the (333) species of hard corals reported so far from all of Fiji by all studies. Additional study would find many more. This high diversity supports the value of efforts to use these reefs sustainably.

Species numbers at visually sampled sites ranged from 51 to 90, with an average of 69 per site. Sites in the Mamanucas produced an average of 70 species per site. Reefs in the Philippines produce about 90 species per site, American Samoa produces about 71 per site, and Hawaii produces about 17 per site. The Philippines is in the area of highest coral diversity in the world, called the "Coral Triangle." Hawaii is in the eastern Pacific, a species-depauperate area. Volivoli thus has a very typical diversity for Fiji, about ¾ (77%) of that in the most diverse area in the world, truly an amazingly high level.

General faunal composition

The coral fauna consists mainly of Scleractinia. The genera with the largest numbers of species found were *Acropora, Montipora, Porites, Fungia, Pavona,* and *Lobophyllia, Favia, Echinopora, Pectinia,* and *Goniastrea.* These 12 genera account for about 51% of the total observed species (Table 1). (Families are less stable and usefiıl in corals than genera, and thus were not used.)

Table 1

Genera with the greatest number of species

Rank	Genus	No. species
1	*Acropora*	33
2	*Pavona*	7
3	*Fungia*	5
4	*Turbinaria*	5
5	*Psammocora*	4
6	*Hydnophora*	4

Acropora, Montipora, and *Porites* are usually the three most species-rich genera on rich Indo-Pacific reefs, in that order. The farther down the list one moves, the more variable the order becomes, with both the number of species and the differences between genera decreasing. *Montipora* and *Porites* had surprisingly few species seen at Volivoli, perhaps from the small sample. In the Mamanucas, the genera followed the usual order, *Acropora, Montipora, Porites, Pavona, Fungia.*

Most of the corals were zooxanthellate (algae-containing, reef-building) Scleractinian corals, with 95% of the corals in this group. There were 2 species that are azooxanthellate (lacking algae) Scleractinia for 1.5% of the total, and there were 5 corals that were not Scleractinia, for 3.5% of the total.

Zoogeographic affinities of the coral fauna

The reef corals of Fijian reefs belong to the overall Indo-west Pacific faunal province. A few species span the entire range of the province, but most do not. The area of highest biodiversity in corals appears to be an area enclosing the Philippines, central and eastern Indonesia, and northern New Guinea (Hoeksema, 1992), eastern Papua New Guinea and perhaps the Solomon Islands (Karlson et al 2004). Areas of somewhat lower diversity include Eastern Australia's Great Barrier Reef, Southern New Guinea, and the Ryukyu Islands of Southern Japan. Some evidence (Best et al 1989) indicates western Indonesia may not be included in the area of highest diversity.

The biodiversity of corals falls off from the Coral Triangle in all directions, reaching 80 species at an island near Tokyo, 65 species at Lord Howe Island southeast of Australia, about 56 species in Hawaii, and about 20 species at Pacific Panama. Species fall-off is significantly less to the west in the Indian Ocean and Red Sea. About 300 species may currently be known in the Red Sea, though this area, like many others, is insufficiently studied to provide accurate figures.

Most coral species found in this area have fairly wide distributions within the Indo-Pacific. A majority of corals have a pelagic larval stage, with a minimum of a few days pelagic development for broadcast spawners (a majority of species), and larval settling competency lasting for at least a few weeks. A minority of species release brooded larvae that may be capable of anything from immediate settlement to a long pelagic dispersal period. Most of the corals found in these reefs have ranges that extend both east and west of the Fiji, some ranging from the Red Sea to Tahiti. Some species have ranges that extend just to the west of Fiji, that is, Fiji is at the eastern boundary of their range. None known extend just to the east of Fiji, and none are known to be endemic to just Fiji.

Diversity at individual sites

The number of species for each dive is presented in Table 3.

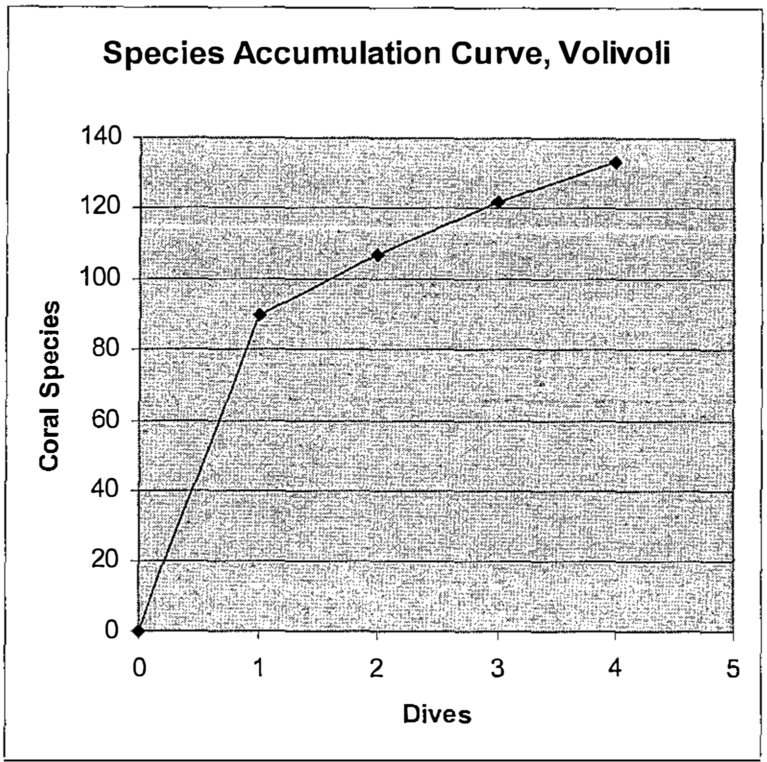
Table 3

Number of coral species for each dive

Dive	Site	Number of species	Duration
1.	Junction	90	63 min
2.	Canyons	66	59
3.	Sally	69	68
4.	Mani	51	81

Species are typically added to the list rapidly at first and then at a slower rate near the end of the surveys. This is because additional searching always finds more species, but the more searching that has already been done the fewer additional species will be found. This study was so brief that many more species are left in the area to find, though a good measure of the overall diversity was obtained in this very short study. The species accumulation curve can be seen in Figure 1.

Figure 1



Habitats and Reefs

Corals are habitat-builders and appear to have less niche-specialization than some other groups. Some zonation occurs by depth and exposure to waves or currents. Thus, there are a few corals that are restricted to zones such as very shallow areas, protected areas, deep water, shaded niches, soft bottoms, or exposed areas. However, many corals can be found over a relatively wide range of exposure and light intensity. Corals are primarily autotrophic, relying on the products of the photosynthesis of their symbiotic algae, supplemented by plankton caught by filter-feeding and suspension feeding. Most require hard substrate for attachment, but a few grow well on soft substrates.

The reefs at Volivoli have a near vertical wall from very shallow to around 10-20 m depth. Below that, a rubble plain or slope extends. The near vertical wall has some hard corals on it, and many soft corals and black corals. The Canyons site is particularly rich in soft corals and black corals, with one wall covered with orange soft corals that are particularly striking. Soft corals can only be identified to genus level in the water, and the author is not an expert on this group. The rubble bottom has clumps of corals on it, more at some sites than others. The reef crest was not explored in this study, but is likely to have some species not found deeper on the slope. Some of the most luxuriant hard coral gardens in Fiji are on the tops of reefs.

Species of special interest

Four species where found that are uncommon to rare, which are listed in Table 4.

Table 4

Uncommonly Reported Corals

1. *Acanthastrea ishigakiensis*
2. *Cantharellus jebbi*
3. *Echinomorpha nishihirai*
4. *Symphyllia hassi*

In addition, several species were found that were first found in Fiji in the author's study of the Mamanucas in 2005. They are:

1. *Acropora lokani*
2. *Acropora lovelli*
3. *Acropora yongei*
4. *Caulastrea tumida*
5. *Ctenactis albitentaculata*
6. *Ctenactis crassa*
7. *Distichopora violacea*
8. *Echinopora hirsutissima*
9. *Fungia spinifer*
10. *Goniopora somaliensis*
11. *Hydnophora grandis*
12. *Hydnophora rigida*
13. *Millepora dichotoma*
14. *Montastrea annuligera*
15. *Montipora capitata*
16. *Montipora undata*
17. *Mycedum robokakai*
18. *Oxypora crassispinosa*
19. *Pachyseris gemmae*
20. *Porites horizontallata*
21. *Stylophora subseriata*
22. *Symphyllia hassi*

Two species were found which have not previously been reported from Fiji. These are *Pavona bipartita* and *Echinophyllia echinoporoides.*

The second of these two, *E. echinoporoides*, was known only as far east as the Great Barrier Reef in Australia previously, so this represents a significant extension in its known biogeographic range.

It should be noted that all of these identifications are visual identifications in the field. In order to verify these, specimens will need to be collected (not necessarily at Volivoli) and voucher specimens deposited in the USP coral collection.

Acropora pharaonis

One species deserves special mention. This is a species of staghorn (*Acropora*), that the author first recognized in the Mamanucas in 2005. It was referred to as "*Acropora* sp. 1" in Fenner (2006). When the author saw it in Volivoli, he asked permission to collect it to find out if it was a new species. Two small pieces were collected. They were a small part of each colony, and the colonies will be unaffected and grow these branches back. This species is not uncommon. The two pieces were taken by the author to the University of the South Pacific, where they were examined and notes taken. Another sample of it, collected in 1972, was already present in the collection. Notes on the details of the skeletons were taken. The samples were contributed to the USP coral collection. Back in American Samoa, a technical treatise on staghorns (Wallace, 1999), was consulted. It turned out to be a known species, *Acropora pharaonis*. This species was described from the Red Sea, where it is most common (and hence the name). It has subsequently been found in several sites in the Indian Ocean, with the easternmost known site being Cocos-Keeling Islands, west of Australia. It is not heretofore known from the Pacific Ocean anywhere. This is a most surprising find, which expands the known range of this species greatly. It was subsequently also found in Great Astrolabe Reef lagoon.

This species produces a vertical stock from which branches radiate. In the Mamanucas and Volivoli, the branches radiate nearly horizontally from the top of the vertical stock. The branches are about 1 inch thick, and taper little, and have few side branches. They do not radiate in one plane, rather some are above others and some below, so they form a thick band of radiating branches. The branches are rough with small projecting tubes, which are called "corallites" which is where the polyps are. The corallites on this species are long and tubular, and away from the tip of the branch are highly variable in length, giving branches a rough appearance. In Great Astrolabe Reef lagoon, the branches grow upward from the basal stock, but again they do not fuse or have many sub-branches. They may curve and they grow at a variety of angles from vertical to about 45 degrees from vertical. Under the microscope, the tubular corallites can be seen to be nearly hollow, unlike most *Acropora* but as is typical for *A. pharaonis*. The branches look exactly like those in a couple photos of Veron (2002) taken in the Indian Ocean, but colonies in the Red Sea are often fused into horizontal tables that have fused branchlets and little space between branches. The surface on corallites has tiny ridges called costae, and the surface between corallites on the branch is the same as in *A. pharaonis*.

Possible new species

Fiji has the Organ Pipe Coral, *Tubipora*, with several different shaped sets of tentacles. These may well be new species, but will have to be collected and sent to a specialist to have this verified and the species named. Two of these tentacle variations were seen on the Volivoli reefs.

Overview of the Volivoli reefs

The reefs the author saw near Volivoli appear to be in relatively good shape. Cyanobacteria and macroalgae were not noticed, whereas cyanobacteria are noticeable in the Mamanucas (and macroalgae in some locations) and macroalgae dominate the reef flat on the Coral Coast. The low level of these two types of algae at Volivoli is a good sign. Algae blooms may occur when nutrient runoff from land is too great and flushing inadequate, and/or when herbivorous fish such as surgeons and parrotfish are overfished. Algae compete for space with corals. Divers like to see hard corals, they are generally uninterested in seeing algae. Divers usually cannot assess the diversity of corals, as long as they see several kinds, they are usually happy. They may, however, notice abundance. The abundance of colorful soft corals at some locations is a particular tourist attraction; divers like bright colors. The author did not see any large fish, such as sharks, Bumphead Parrotfish or Humphead Wrasse, though he was not looking for these and the sample was quite small. Large fish are also a big attraction for divers. Where they are present in low numbers, it is likely that they have been removed by fishing, as has been documented in Fiji for Bumphead Parrotfish by Dulvy and Polunin (2004). Protection can allow these species to recover their populations, though recovery may be slow if the populations are very low. It is possible to have protection of just the species that have been depleted by fishing, and allow fishing for other species, and thus a minimal impact on fishermen and their families. Once they have recovered, more can actually be taken than when they are rare, so their recovery can actually help fishermen. The value to the local economy of dive tourism far outstrips that of fishing for a few rare large fish. The large fish, once caught, can be sold in the market for less than the cost of taking a single diver to see the large fish, or certainly for taking a boatload of divers to see the one big fish. Further, diving is non-consumptive, you can return the next day to make money taking divers to see the big fish. If you can take a boatload of divers every day for a year, the fish is made of solid gold. It is important that the financial benefits be spread to the local people, as is done in Volivoli with the dive operation personnel and hotel staff being Fijian. Fishermen need an alternative source of income if they are asked to stop fishing. Through dive tourism, the coral reefs of Fiji can provide more benefits to the Fijian people than through fishing the large fish. This works, of course, only if you can attract the dive tourists, which good coral, low algae, colorful reefs, large fish, and friendly staff all contribute to. The author congratulates the Volivoli resort.

Acknowledgements

The author wishes to thank the Volivoli Resort for hosting me during this study, and to thank Bill Aalbersberg and Coral Cay Conservation for inviting me and arranging the trip.

2. Reef corals of the Great Astrolabe Reef and Dravuni Island, Kadavu Island, Fiji

Executive Summary

- A list of corals was compiled for 13 sites on the Great Astrolabe Reef and near Dravuni Island, Kadavu, Fiji. The survey involved about 7 hours of scuba diving in 10 dives by D. Fenner to a maximum depth of 28.8 meters, and three snorkels of about 1 hour each.

- The reefs of the Great Astrolabe Reef and near Dravuni Island have a diverse coral fauna. A total of 179 species in 58 genera of hard corals (169 species and 51 genera of zooxanthellate Scleractinia) were recorded during the present survey. This is lower than the number (253) found in the Mamanucas and Coral Coast by the author in a previous study. However, additional species are found with additional search dives, and the previous study had 21 sites compared to 13 in the present study.

- The number of species found after 13 dives and snorkels (179) is less than that found in the Mamanucas in the same number of dives (195). However, the number of species found after 7 hours of diving (179) is higher than that found after the same number of hours of diving in the Mamanucas (150). The number of hours spent searching is a far better way to compare these numbers than the number of dives, since additional time spent searching reveals additional species. These numbers indicate that the diversity of corals at the Great Astrolabe Reef and Dravuni Island area are high for Fiji.

- This brief study found 53.8% of the (333) species of hard corals reported so far from all of Fiji by all studies. Additional study would find many more. This high diversity supports the value of efforts to use these reefs sustainably.

- Species numbers at visually sampled sites ranged from 37 to 79, with an average of 49 per site. Sites in the Mamanucas produced an average of 70 species per site, and Volivoli 69 per site. Reefs in the Philippines produce about 90 species per site, American Samoa produces about 71 per site, and Hawaii produces about 17 per site. However, the data produced for the Mamanucas, Volivoli, and the other sites are based on 60 minutes per dive, and additional search time reveals additional species. The Philippines is in the area of highest coral diversity in the world, called the "Coral Triangle." Hawaii is in the eastern Pacific, a species-depauperate area. The best measure (hours of diving) indicates that Great Astrolabe Reef has a high diversity for Fiji.

- The overwhelming majority (94%) of corals on these reefs are zooxanthellate Scleractinia, with only a few non-sclearctinian and azooxanthellate species, as is typical of Indo-Pacific reefs.

- Ten rare species were found.

- Six species that have not been reported from Fiji in published reports were found, two of which represent extensions of the known ranges for those species.

- One species was originally described from the Red Sea, and known from the Indian Ocean but not known anywhere in the Pacific Ocean before the author's studies in Fiji. The nearest it was known was from Cocos-Keeling Island, west of Australia in the Indian Ocean. This was a very surprising and exciting find, even though it is not a new species. It was also found in the Mamanucas and Volivoli. It is not uncommon.

- In a few hours of study, several species were found in the School of Marine Studies, University of the South Pacific coral collection which had not been reported from Fiji before the author's studies. The collection is likely to have more such corals in it, and study of the collection is a high priority for the author's next visit. Collection of voucher specimens of the species which the author has reported from Fiji for the first time is also a high priority for the future.

- These reefs support a very high coral diversity, typical of the best reef sites in Fiji, and should be used sustainably. The Great Astrolabe Reef has good coral cover, good coralline algae, little macroalgae, and a fair population of large reef fish such as sharks. These are very attractive features for divers and give this reef high tourism potential.

Introduction

The following is a report of the reef coral fauna of 13 dive and snorkel sites, on the Great Astrolabe Reef and near Dravuni Island, Kadavu, Fiji, found in September, 2006.

The principle aim of the coral survey was to provide an inventory of the coral species growing on reefs and associated habitats and compare the coral fauna on different sites. This includes species growing on sand or other soft sediments within and around reefs. The primary group of corals is the zooxanthellate scleractinian corals, that is, those that contain single-cell algae and which contribute to building the reef. Also included are a small number of zooxanthellate non-scleractinian corals which also produce sufficiently large skeletons to contribute to reef building (e.g., *Millepora*, *Tubipora, Distichopora* and *Stylaser*: fire coral, organ-pipe coral, thick lace coral, and lace coral, respectively), and a small number of azooxanthellate scleractinian corals (*Dendrophyllia*, *Rhizopsammia* and *Tubastrea*). All produce calcium carbonate skeletons that contribute to reef building to some degree.

The results of this survey facilitate a comparison of the faunal richness of these Great Astrolabe and Dravuni coral reefs with other reefs in Fiji and other regional reefs. However, the list of corals presented below is very incomplete, due to the limited number of dives and snorkels in the survey (7 hours total), the highly patchy distribution of corals and the difficulty in identifying some species in the water.

Corals are sufficiently difficult to identify that there are significant differences between leading experts on some identifications.

Methods

Corals were surveyed in 10 scuba dives and 3 snorkels by D. Fenner to a maximum depth of 28.8 m. A list of coral species was recorded at each site. The basic method consisted of underwater observations. The name of each species identified was marked on a plastic sheet on which species names were printed. Sample areas of all habitats encountered were surveyed. Many corals can be identified to species with certainty in the water and a few must be identified alive since they cannot be identified without living tissues. Also, there are some that are easier to identify alive than from skeletons. Field guides assisted identification (Veron and Stafford-Smith, 2002; Veron, 2000; Wallace, 1999ab). Corals were also studied in the University of the South Pacific's School of Marine Studies coral collection for about 2 hours, and the results of that study are also included. Additional references supporting identification are listed in references (Best & Suharsono, 1991; Boschma, 1959; Cairns & Zibrowius, 1997; Claereboudt, M. 1990; Dai, 1989; Dai & Lin 1992; Dineson, 1980; Fenner, in preparation; Hodgson, 1985; Hodgson & Ross, 1981; Hoeksema, 1989; Hoeksema & Best, 1991; Hoeksema & Best 1992; Moll & Best, 1984; Nemenzo 1986; Nishihira, 1986; Ogawa & Takamashi, 1993, 1995; Randall & Cheng, 1984: Sheppard & Sheppard, 1991; Suharsono, 1996; Veron, 1985, 1986, 1990, 2000; Veron & Nishihira, 1995; Veron & Pichon 1976, 1980, 1982; Veron, Pichon & Wijman-Best, 1977; Wallace 1994, 1997a, Wallace & Wolstenholme 1998).

Dive sites are listed in Table 2.

Results

A total of 179 species in 58 genera of stony corals (169 species and 51 genera of zooxanthellate Scleractinia) were found in the survey of these reefs, (Appendix A). All of these species are illustrated in Veron (2000) and Veron and Stafford-Smith (2002). This is lower than the number (253) found in the Mamanucas and Coral Coast by the author in a previous study. However, additional species are found with additional search dives, and the previous study had 21 sites compared to 13 in the present study, and dive durations were less in this study.

The number of species found after 13 dives and snorkels (179) is less than that found in the Mamanucas in the same number of dives (195). These numbers might suggest that the diversity of corals at the Great Astrolabe Reef and Dravuni Island is a bit low for Fiji. However, the duration of dives was less than in the Mamanuca study. If the number of species found after 7 hours of diving and snorkeling (179) is compared to the number found after 7 hours of diving in the Mamanucas (150), then the diversity found in this study can be seen to be high for Fiji. Because there are differences in what corals are present at each site, having a higher number of sites within 7 hours of searching could increase the number of corals found compared to the same 7 hours spent in a smaller number of sites. Thus, although the number found in this study (179) appears high, it may not actually be much higher than other Fiji sites, and is likely to be within the range of common diversity values for Fiji.

This brief study found 53.8% of the (333) species of hard corals reported so far from all of Fiji by all studies. Additional study would find many more. This high diversity supports the value of efforts to use these reefs sustainably.

Species numbers at visually sampled sites ranged from 37 to 79, with an average of 49 per site. Sites in the Mamanucas produced an average of 70 species per site, and Volivoli had 69 per site. Reefs in the Philippines produce about 90 species per site, American Samoa produces about 71 per site, and Hawaii produces about 17 per site. However, these counts were all produced from dives averaging 60 minutes, while dives in the present study averaged about 40 minutes. Additional species are found with additional searching, so these numbers are not really comparable. The Philippines is in the area of highest coral diversity in the world, called the "Coral Triangle." Hawaii is in the eastern Pacific, a species-depauperate area. The most reliable comparison between areas within Fiji for this study is based on the same number of hours of searching, which shows that this area had higher diversity than the Mamanucas.

General faunal composition

The coral fauna consists mainly of Scleractinia. The genera with the largest numbers of species found were *Acropora, Pavona, Fungia, Porites, Montipora, Goniastrea, Pocillopora, Acanthastrea, Leptastrea, Leptoseris, Hydnophora, and Turbinaria.* These 12 genera account for about 55% of the total observed species (Table 1). (Families are less stable and useful in corals than genera, and thus were not used.)

Table 1

Genera with the greatest number of species

Rank	Genus	No. species
1	*Acropora*	39
2	*Pavona*	8
3	*Fungia*	8
4	*Porites*	7
5	*Montipora*	6
6.5	*Goniastrea*	5
6.5	*Pocillopora*	5
8	*Acanthastrea*	4
8	*Leptastrea*	4
8	*Leptoseris*	4
8	*Hydnophora*	4
8	*Turbinaria*	4

Acropora, Montipora, and *Porites* are usually the three most species-rich genera on rich Indo-Pacific reefs, in that order. The farther down the list one moves, the more variable the order becomes, with both the number of species and the differences between genera decreasing. *Montipora* and *Porites* had surprisingly few species seen in this study, as in Volivoli. In the Mamanucas, the genera followed the usual order, *Acropora, Montipora, Porites, Pavona, Fungia.*

Most of the corals were zooxanthellate (algae-containing, reef-building) Scleractinian corals, with 94% of the corals in this group. There were 3 species that are azooxanthellate (lacking algae) Scleractinia for 1.7% of the total, and there were 7 corals that were not Scleractinia, for 3.9% of the total.

Zoogeographic affinities of the coral fauna

The reef corals of Fijian reefs belong to the overall Indo-west Pacific faunal province. A few species span the entire range of the province, but most do not. The area of highest biodiversity in corals appears to be an area enclosing the Philippines, central and eastern Indonesia, and northern (Hoeksema, 1992), eastern Papua New Guinea and perhaps the Solomon Islands (Karlson et al 2004). Areas of somewhat lower diversity include Eastern Australia's Great Barrier Reef, Southern New Guinea, and the Ryukyu Islands of Southern Japan. Some evidence (Best et al 1989) indicates western Indonesia may not be included in the area of highest diversity.

The biodiversity of corals falls off from the Coral Triangle in all directions, reaching 80 species at an island near Tokyo, 65 species at Lord Howe Island southeast of Australia, about 56 species in Hawaii, and about 20 species at Pacific Panama. Species fall-off is significantly less to the west in the Indian Ocean and Red Sea. About 300 species may currently be known in the Red Sea, though this area, like many others, is insufficiently studied to provide accurate figures.

Most coral species found in this area have fairly wide distributions within the Indo-Pacific. A majority of corals have a pelagic larval stage, with a minimum of a few days pelagic development for broadcast spawners (a majority of species), and larval settling competency lasting for at least a few weeks. A minority of species release brooded larvae that may be capable of anything from immediate settlement to a long pelagic dispersal period. Most of the corals found in these reefs have ranges that extend both east and west of the Fiji, some ranging from the Red Sea to Tahiti. Some species have ranges that extend just to the west of Fiji, that is, Fiji is at the eastern boundary of their range. None known extend just to the east of Fiji, and none are known to be endemic to just Fiji.

Diversity at individual sites

The number of species for each dive is presented in Table 2.

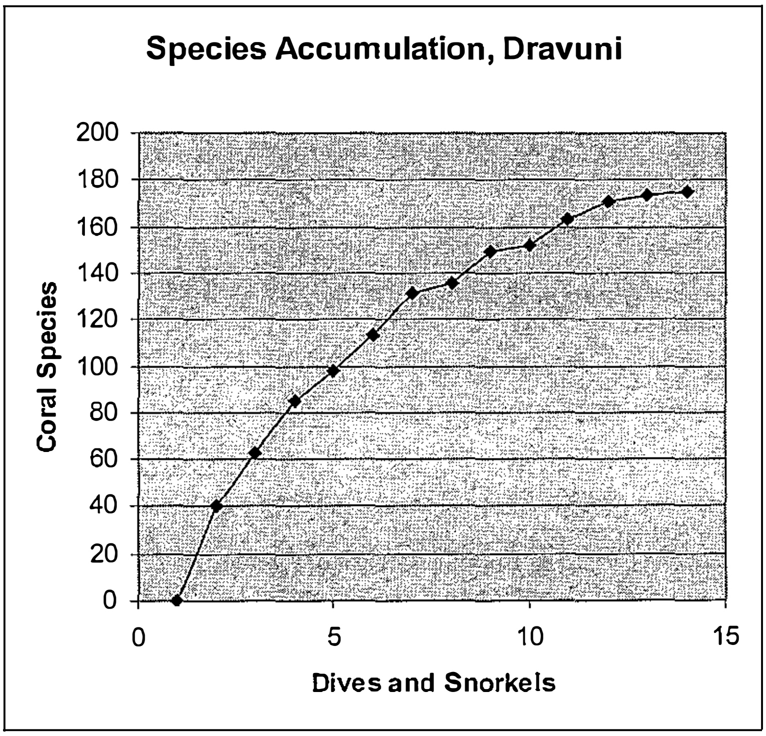
Table 2

Number of coral species for each dive and snorkel
(Dives 1-4 were at Volivoli)

Dive	Site		No. species	Duration	Latitude	Longitude
5.	Last Resort	Dive	39	42 min		
6.	Site 1098	Dive	44	41	18° 48' 54.28"	178° 28' 37.93"
7.	Dravuni	Snorkel	28	30		
8.	Dravuni	Snorkel	37	60		
9.	Labyrinth	Snorkel	46	40		
10.	Party Ring	Dive	52	40	18° 48' 54.28"	178° 28' 37.93"
11.	in lagoon	Dive	48	43		
12.	Site 0044	Dive	50	41	18° 44' 2.95"	178° 32' 59.88"
13.	Site 0048	Dive	57	41	18° 42' 57.89"	178° 32' 57.00"
14.	Black Magic	Dive	37	22	18° 43' 12.16"	178° 29' 13.59"
15.	Labyrinth	Dive	63	38	18° 41' 30.76"	178° 31' 25.07"
16.	Labyrinth	Dive	79	41	18° 41' 30.76"	178° 31' 25.07"
17.	Site 052	Dive	50	42	18° 41' 54.61"	178° 31' 43.92"

Species are typically added to the list rapidly at first and then at a slower rate near the end of the surveys. This is because additional searching always finds more species, but the more searching that has already been done the fewer additional species will be found. This study was so brief that many more species are left in the area to find, though a good measure of the overall diversity was obtained in this very short study. The species accumulation curve can be seen in Figure 1.

Figure 1



Habitats and Reefs

Corals are habitat-builders and appear to have less niche-specialization than some other groups. Some zonation occurs by depth and exposure to waves or currents. Thus, there are a few corals that are restricted to zones such as very shallow areas, protected areas, deep water, shaded niches, soft bottoms, or exposed areas. However, many corals can be found over a relatively wide range of exposure and light intensity. Corals are primarily autotrophic, relying on the products of the photosynthesis of their symbiotic algae, supplemented by plankton caught by filter-feeding and suspension feeding. Most require hard substrate for attachment, but a few grow well on soft substrates.

There were several very different types of reef sites that were studied. The first dive sites were around small high islands within the Great Astrolabe Reef lagoon. Most of these sites had very low coral cover, and very low appeal. Two snorkels were on the NE side of Dravuni Island, and had a good shallow coral community, with several species not seen elsewhere. Some dives were on the outside of the Great Astrolabe Barrier Reef. On the east side of the reef, these sites had very good coral cover at about 10-15 m depth. Surprisingly, there were many rolling hills on the seaward reef slope. Interestingly, the tops of the hills commonly had damselfish territories that were black due to filamentous algae growing on the rock, and little coralline algae. On the slopes, there was high coralline algae cover between the corals. There appeared to be less corals on the tops of the hills than slopes. In shallower water, the reef became nearly flat with a very gradual slope, and modest coral coverage. In deep water, a relatively steep dropoff at one site went from about 10 m to 28 m, and below that could be seen a second dropoff to perhaps 40 m where another gradual slope could be seen. On the NW side of the barrier reef, an area called Labyrinth has a maze of steep sided canyons ending in a nearly flat rubble bottom at perhaps 10-15 m depth.

Sites were divided into three categories, barrier reef, reefs in the lagoon, and the fringing reef at Dravuni Island. The barrier reef sites averaged 57 coral species per dive, the lagoon reefs averaged 42 species per dive, and the Dravuni fringing reef averaged 32 species per snorkel. Thus, the barrier reef is the most diverse, followed by the lagoon reefs, with the fringing reef the least diverse.

Species of special interest

Ten species where found that are uncommon to rare, which are listed in Table 3.

Table 3

Uncommonly Reported Corals

5. *Acanthastrea brevis*
6. *Acanthastrea ishigakiensis*
7. *Acropora batunai*

8. *Astreopora eliptica*
9. *Cantharellus jebbi*
10. *Dendrophyllia* cf. *coccinea*
11. *Echinomorpha nishihirai*
12. *Pocillopora setichelli*
13. *Polyphyllia novohibernae*
14. *Rhizopsammia verrilli*

Six species were found that have not been reported previously from Fiji. The record of *Cyphastrea agassizi* is an extension of the known range for this species. It was previously known from eastern Australia and Hawaii, but not in between these two (Veron, 2000). The record for *Acropora batunai* is also an extension of the known range for that species. It was previously known from Indonesia to northern Papua New Guinea (Veron, 2000).

Table 4

1. *Dendrophyllia cf. coccinea*
2. *Cyphastrea agassizi*
3. *Leptoseris incrustans*
4. *Pocillopora setichelli*
5. *Acropora accuminata*
6. *Acropora batunai*

In addition, several species were found that were first found in Fiji in the author's study of the Mamanucas in 2005 (Fenner, 2006). They are:

Table 5

1. *Acanthastrea brevis*
2. *Acanthastrea hemprichii*
3. *Acanthastrea ishigakiensis*
4. *Acropora yongei*
5. *Astreopora eliptica*
6. *Ctenactis albitentaculata*
7. *Ctenactis crassa*
8. *Cycloseris tenuis*
9. *Distichopora violacea*
10. *Echinopora hirsutissima*
11. *Goniopora somaliensis*
12. *Herpolitha weberi*
13. *Hydnophora grandis*
14. *Hydnophora rigida*
15. *Leptastrea pruinosa*
16. *Lobophyllia robusta*
17. *Millepora dichotoma*
18. *Millerpora intricate*
19. *Montastrea annuligera*

20. *Montipora capitata*
21. *Montipora nodosa*
22. *Mycedum robokakai*
23. *Oxypora crassispinosa*
24. *Pachyseris gemmae*
25. *Polyphyllia novohibernae*
26. *Porites monticulosa*
27. *Porites vaughani*
28. *Rhizopsammia verrilli*
29. *Scolymia vitiensis*
30. *Stylaster sp.*
31. *Stylophora subseriata*

It should be noted that all of these identifications are visual identifications in the field. In order to verify these, specimens will need to be collected (not necessarily at Dravuni) and voucher specimens deposited in the USP coral collection.

Acropora pharaonis

One species deserves special mention. This is a species of staghom (*Acropora*), that the author first recognized in the Mamanucas in 2005. It was referred to as "*Acropora* sp. 1" in Fenner (2006). When the author saw it in Volivoli, he asked permission to collect it to find out if it was a new species. Two small pieces were collected. They were a small part of each colony, and the colonies will be unaffected and grow these branches back. This species is not uncommon. The two pieces were taken by the author to the University of the South Pacific, where they were examined and notes taken. Another sample of it, collected in 1972, was already present in the collection. Notes on the details of the skeletons were taken. The samples were contributed to the USP coral collection. Back in American Samoa, a technical treatise on staghoms (Wallace, 1999), was consulted. It turned out to be a known species, *Acropora pharaonis*. This species was described from the Red Sea, where it is most common (and hence the name). It has subsequently been found in several sites in the Indian Ocean, with the easternmost known site being Cocos-Keeling Islands, west of Australia. It is not heretofore known from the Pacific Ocean anywhere. This is a most surprising find, which expands the known range of this species greatly. It was subsequently also found in Great Astrolabe Reef lagoon.

This species produces a vertical stock from which branches radiate. In the Mamanucas and Volivoli, the branches radiate nearly horizontally from the top of the vertical stock. The branches are about 1 inch thick, and taper little, and have few side branches. They do not radiate in one plane, rather some are above others and some below, so they form a thick band of radiating branches. The branches are rough with small projecting tubes, which are called "corallites" which is where the polyps are. The corallites on this species are long and tubular, and away from the tip of the branch are highly variable in length, giving branches a rough appearance. In Great Astrolabe Reef lagoon, the branches grow upward from the basal stock, but again they do not fuse or have many sub-branches. They may curve and they grow at a variety of angles from vertical to about 45 degrees from vertical. Under the microscope, the tubular corallites can be seen to be nearly hollow, unlike most *Acropora* but as is typical for *A. pharaonis*. The branches look exactly like those in a couple photos of Veron (2002) taken in the Indian Ocean, but colonies in the Red Sea are often fused into horizontal tables that have fused branchlets and little space between branches. The surface on corallites has tiny ridges called costae, and the surface between corallites on the branch is the same as in *A. pharaonis*.

Possible new species

Fiji has the Organ Pipe Coral, *Tubipora*, with several different shaped sets of tentacles. These may well be new species, but will have to be collected and sent to a specialist to have this verified and the species named. Two of these tentacle variations were seen on the Dravuni reefs.

School of Marine Sciences (SMS), University of the South Pacific Coral Collection

In the very brief study of the SMS coral collection, several species were found that have not been previously been reported from Fiji. Several of these were specimens which were not identified correctly according to the current taxonomy. A list of these additional species, with names previously given some, is given below.

1. *Sandalolitha dentata*
2. *Seriatopora aculeata* (possibly)
3. *Euphyllia cristata* (instead of *E. glabrescens*)
4. *Anacropora matthai* or *pillai*
5. *Acropora pharaonis*
6. *Oxypora crassispinosa*
7. *Rhizopsammia verrilli* or *Dendrophyllia* sp.
8. *Plerogyra simplex*
9. *Cantharellus jebbi* (not *Lithophyllon lobata*)
10. *Polyphyllia novohibernae* (not *P. talpina*)
11. *Fungia fralinae* (possibly)
12. *Cycloseris tenuis*
13. *Cyphastrea decadea*

Several days of additional study of the collection is needed, and is likely to pay off in additional corrections. Further, there is a need to collect those species which the author reports visual sightings of but which are not present in the collection, to verify the sightings. It is likely that after these two steps, the differences in the list of species previously recorded from Fiji and the author's reports will be considerably reduced.

Overview of the Great Astrolabe and Dravuni reefs

The Great Astrolabe barrier reef sites seen in this study appeared to be in good shape. Macroalgae was nearly non-existent, and coral cover good. On slopes, coralline algae was common. On some reef tops black filamentous algae was common within damsel territories, but this may be natural. It is seen in American Samoa as well. The fringing reef on the NW side of Dravuni island appears to be in good shape as well, with little macroalgae and plentiful healthy hard coral. The reefs within the Great

Astrolabe lagoon that were seen, however, were in very sad shape, with little live coral, and the rock covered with a variety of small algae, with little or no coralline algae. It is not entirely clear why this should be so. It may well be that coral on these reefs were killed by mass coral bleaching. Perhaps the lagoon got hotter than the water on the outer slope of the barrier reef. However, the fringing reef on Dravuni Island is in good shape, which is also within the lagoon.

Littler and Littler (1995; 1997) reported that Coralline Lethal Orange Disease (CLOD) had become very common on Great Astrolabe Reef and had caused a sharp decline in coralline algae. In this survey, coralline algae were abundant in some areas on the barrier reef, where wave surge makes the reef good habitat for coralline algae. Very small anounts of CLOD were seen. It appears that the coralline algae have largely recovered from the CLOD outbreak which the Littlers' documented. It might be well worth Coral Cay's time to repeat their measurements and document this quantitatively.

On the outer Great Astrolabe barrier reef slope, the Coral Cay divers fairly frequently reported seeing large fish such as sharks, rays and humphead wrasse. They reported these large fish much more often than in the Mamanucas. Although the author saw only a few of these due to the fact he was studying coral on the bottom, the presence of these large fish is a good sign, indicating that the outer barrier reef has not been fished as intensively as many, but certainly not all, reefs. Reefs in locations such as the Northwestern Hawaiian Islands, Phoenix Islands, Line Islands, and northern Great Barrier Reef, have many more large reef fish than most divers have ever seen in their lives (e.g., Friedlander and DeMartini, 2002). These locations have few if any people or fishing pressure, and only now are we realizing that these pristine reefs have amazing concentrations of these megafauna. These high populations of large fish are the natural situation for coral reefs, and we must now begin to realize that almost all reefs that we see are degraded in this respect, and that our acceptance of this situation is a prime example of shifting baselines. The populations at Great Astrolabe Reef of large fish are clearly intermediate, much better than on many reefs, but still far from the swarms of big fish on unfished reefs. For example, the author is told that an average dive in the Phoenix Islands produces sightings of about 15 sharks, 7 Humphead Wrasse, and 2 Bumphead Parrots (G. Allen, personal comm.). Bumphead Parrotfish on the northern Great Barrier Reef travel in schools of 30-50, though some schools can reach 100 individuals. This sort of breathtaking sight is rarely if ever seen on fished reefs, as these large fish are very easily fished out (e.g., Bellwood et al 2002; Sadovy et al 2003). Their removal constitutes a major ecological experiment, with major effects on the food web and bioerosion. Dulvy and Polunin (2004) have documented the loss of Bumphead Parrotfish in parts of Fiji. An important goal for the future is to do stock assessments for these species, comparing with unfished reefs, to generate the best available evidence on whether they are overfished or not, and then to take measures such as closing overfished areas to these species until they recover to the Biomass at Maximum Sustainable Yield (Bmsy). Since entire archipelagos and countries are likely to be overfished for these large species, entire archipelagos or countries may be the best scale for closures, as has been done in Niue for Humphead Wrasse. Ault et al (2005) and Friedlander et al (in preparation) provide examples of such stock assessments. It is likely that most or all of the Fijian archipelago is overfished for most of these species. The loss of large reef fish may be one of the most universal effects of humans on coral reefs around the world, as they are highly depleted on nearly every reef near humans. If management can restore stocks, fishermen can actually take more at the level of maximum sustainable yield; failing to restore these stocks does the fishermen no favors.

The Great Astrolabe Reef has significant tourist potential. The healthy coral reefs on the outer reef slopes with good coral cover, clear water, steep dropoffs and good quantities of large reef fish are extremely valuable attractions for dive tourists. The reefs the authors saw in the lagoon should not be dived by tourists, the tourists are much better never to have seen them. The small fringing reefs on the far side of Dravuni Island are good for snorkel tourism, though not good enough to draw tourists just for them.

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References

Ault, J.S., Bohnsack, J.A., Smith, S.G., and J. Luo. 2005. Towards sustainable multispecies fisheries in the Florida, USA, coral reef ecosystem. Bulletin of Marine Science 76: 595-622.

Bellwood, D.R., Hoey, A.S., and Choat, J.H. 2003. Limited functional redundancy in high diversity systems: resilience and ecosystem function on coral reefs. Ecology Letters 6: 281-285.

Best, M.B. and B.W. Hoeksema. 1987. New observations on Scleractinian corals from Indonesia: 1. Free-living species belonging to the Faviina. Zoologishe Mededelingen Leiden. 61: 387-403.

Best, M.B. and Suharsono. 1991. New observations on Scleractinian corals from Indonesia: 3. Species belonging to the Merulinidae with new records of *Merulina* and *Boninastrea*. Zoologishe Mededelingen Leiden 65: 333-342.

Best, M.B., Hoeksema, W., Moka, W., Moll, H., Suharsono and I. Nyoman Sutarna. 1989. Recent scleractinian coral species collected during the Snellius-II Expedition in eastern Indonesia. Netherlands J. Sea Res. 23: 107-115.

Boschma, H. 1959. Revision of the Indo-Pacific species of the genus *Distichopora*. Bijdragen tot de Dierkunde 29: 121-171.

Claereboudt, M. 1990. *Galaxea paucisepta* nom. nov. (for *G. pauciradiata*), rediscovery and redescription of a poorly known scleractinian species (Oculinidae). Galaxea 9: 1-8.

Dai, C-F. 1989. Scleractinia of Taiwan. I. Families Astrocoeniidae and Pocilloporiidae. Acta Oceanographica Taiwanica 22: 83-101.

Dai, C-F. and C-H. Lin. 1992. Scleractinia of Taiwan III. Family Agariciidae. Acta Oceanographica Taiwanica 28: 80-101.

Dineson, Z.D. 1980. A revision of the coral genus *Leptoseris* (Scleractinia: Fungiina: Agariciidae). Memoires of the Queensland Museum 20: 181-235.

Dulvy, N.K. and Polunin, N.V.C. 2004. Using informal knowledge to infer human-induced rarity of a conspicuous reef fish. Animal Conservation 7: 365-374.

Fenner, D. 2006. Coral diversity survey Mamanuca Islands and Coral Coast, Fiji, 2005. IAS Technical Report No. 2005/10.

Friedlander, A.M. and E.E. DeMartini. 2002. Contrasts in density, size, and biomass of reef fishes between the northwestern and main Hawaiian Islands: the effects of fishing down apex predators. Marine Ecology Progress Series 230: 253-264.

Friedlander, A.M., Nowlis, J.S., DeMartini, E.E., and E.K. Brown. In preparation. Assessing shallow water Hawaiian reef fish stocks through the use of a spatially heterogeneous management regime.

Hodgson, G. 1985. A new species of *Montastrea* (Cnidaria, Scleractinia) from the Philippines. Pacific Science 39: 283-290.

Hodgson, G. and M.A. Ross. 1981. Unreported scleractinian corals from the Philippines. Proceedings of the Fourth International Coral Reef Symposium, 2: 171-175.

Hoeksema, B.W. 1989. Taxonomy, phylogeny and biogeography of mushroom corals (Scleractinia: Fungiidae). Zoologishe Verhandelingen 254: 1-295.

Hoeksema, B.W. 1992. The position of northern New Guinea in the center of marine benthic diversity: a reef coral perspective. 7th International Coral Reef Symposium 2: 710-717.

Hoeksema, B.W. and M.B. Best. 1991. New observations on scleractinian corals from Indonesia: 2. Sipunculan-associated species belonging to the genera *Heterocyathus* and *Heteropsammia*. Zoologishe Mededelingen 65: 221-245.

Hoeksema, B. and C-F. Dai. 1992. Scleractinia of Taiwan. II. Family Fungiidae (including a new species). Bulletin of the Institute of Zoology Academia Sinica 30: 201-226.

Karlson, R.H., Connell, H.V. and T.P. Hughes. 2004. Coral communities are regionally enriched along an oceanic biodiversity gradient. Nature 429: 867-870.

Littler, M.M. and Littler, D.S. (1995) Impact of CLOD pathogen on Pacific coral reefs. Science 267: 1356-1360.

Littler, M.M. and Littler, D.S. (1997) Disease-induced mass mortality of crustose coralline algae on coral reefs provides rationale for the conservation of herbivorous fish stocks. Proceedings of the 8th International Coral Reef Symposium 1: 719-724.

Moll, H. and M.B. Best. 1984. New scleractinian corals (Anthozoa: Scleractinia) from the Spermonde Archipelago, south Sulawesi, Indonesia. Zoologische Mededelingen 58: 47-58.

Nemenzo, F. Sr. 1986. Guide to Philippine Flora and Fauna: Corals. Natural Resources Management Center and the University of the Philippines. 273 pp.

Nishihira, M. 1991. Field Guide to Hermatypic Corals of Japan. Tokai University Press, Tokyo. 264 pp. (in Japanese)

Nishihira, M. and J.E.N. Veron. 1995. Corals of Japan. Kaiyusha Publishers Co., Ltd, Tokyo. (in Japanese) 439 pp.

Ogawa, K., and K. Takamashi. 1993. A revision of Japanese ahermatypic corals around the coastal region with guide to identification- I. Genus *Tubastraea.* Nankiseibutu: The Nanki Biological Society 35: 95-109. (in Japanese)

Ogawa, K. and K. Takamashi. 1995. A revision of Japanese ahermatypic corals around the coastal region with guide to identification- II. Genus *Dendrophyllia.* Nankiseibutu: The Nanki Biological Society 37: 15-33. (in Japanese)

Randall, R.H. and Y-M. Cheng. 1984. Recent corals of Taiwan. Part III. Shallow water Hydrozoan Corals. Acta Geologica Taiwanica 22: 35-99.

Sadovy, Y., Kulbicki, M., Labrosse, P., Letourneur, Y., Lokani, P., and Donaldson, T. J. 2003. The humphead wrasse, *Cheilinus undulatus*: synopsis of a threatened and poorly known giant coral reef fish. Reviews in Fish Biology and Fisheries 13: 327-364.

Sheppard, C.R.C. and A.L.S. Sheppard. 1991. Corals and coral communities of Arabia. Fauna of Saudi Arabia 12: 3-170.

Veron, J.E.N. 1985. New scleractinia from Australian reefs. Records of the Western Australian Museum 12: 147-183.

Veron, J.E.N. 1986. Corals of Australia and the Indo-Pacific. Univ. Hawaii Press. 644 pp.

Veron, J.E.N. 1990. New scleractinia from Japan and other Indo-West Pacific countries. Galaxea 9: 95-173.

Veron, J.E.N. 1993. A Biogeographic Database of Hermatypic Corals. AIMS Monograph 10: 1-433.

Veron, J.E.N. 2000. Corals of the World. Volumes 1-3. AIMS.

Veron, J.E.N. and G. Hodgson. 1989. Annotated checklist of the hermatypic corals of the Philippines. Pacific Science 43: 234-287.

Veron, J.E.N. and M. Pichon. 1976. Scleractinia of Eastern Australia. I. Families Thanmasteriidae, Astrocoeniidae, Pocilloporidae. Australian Institute of Marine Science Monograph Series 1: 1-86.

Veron, J.E.N. and M. Pichon. 1980. Scleractinia of Eastern Australia. III. Families Agariciidae, Siderastreidae, Fungiidae, Oculilnidae, Merulinidae, Mussidae, Pectiniidae, Caryophyllidae, Dendrophyllidae. Australian Institute of Marine Science Monograph Series 4: 1-422.

Veron, J.E.N. and M. Pichon. 1982. Scleractinia of Eastern Australia. IV. Family Poritidae. Australian Institute of Marine Science Monograph Series 5: 1-210.

Veron, J.E.N., M. Pichon, and M. Wijsman-Best. 1977. Scleractinia of Eastern Australia. II. Families Faviidae, Trachyphyllidae. Australian Institute of Marine Science Monograph Series 3: 1-233.

Veron, J.E.N. and Stafford-Smith, M. 2002. Coral ID, CD-ROM. Australian Institute of Marine Science.

Veron, J.E.N. and C. Wallace. 1984. Scleractinia of Eastern Australia. V. Family Acroporidae. Australian Institute of Marine Science Monograph Series 6: 1-485.

Wallace, C.C. 1994. New species and a new species-group of the coral genus *Acropora* (Scleractinia: Astrocoeniina: Acroporidae) from Indo-Pacific locations. Invertebrate Taxonomy 8: 961-88.

Wallace, C.C. 1997a. New species of the coral genus *Acropora* and new records of recently described species from Indonesia. Zoological Journal of the Linnean Society 120: 27-50.

Wallace, C.C. 1997b. The Indo-Pacific centre of coral diversity re-examined at species level. Proceedings of the 8th International Coral Reef Symposium 1: 365-370.

Wallace, C.C. 1999a. Staghorn corals of the world, a revision of the genus *Acropora*. CSIRO Publ., Collingwood, Australia. 422 pages.

Wallace, C.C. 1999b. Staghorn corals of the world: a key to species of Acropora. CD-ROM. CSIRO Publ., Collingwood, Australia

Wallace, C.C. and J. Wolstenholme. 1998. Revision of the coral genus *Acropora* in Indonesia. Zoological Journal of the Linnean Society 123: 199-384.

Dive sites: Volivoli Beach:

1. Junction

2. Canyons
3. Sally
4. Mani

Dravuni Island:

5. Last Resort
6. 1098
7. snorkel far side of Dravuni
8. same
9. snorkel Labyrinth
10. Party Ring
11. in lagoon
12. 0044
13. 0048
14. Black Magic
15. Labyrinth
16. Labyrinth
17. Site 052

R = rare; U = uncommon; C = common; A = abundant; D = dominant

genera	Volivoli species	Dravuni species	SPECIES	VOLIVOLI SITE RECORDS	DRAVUNI SITE RECORDS
			Family Astrocoeniidae		
1	1	1	*Stylocoeniella guentheri* Bassett-Smith, 1890	1R,3R,4R	5U
			Family Pocilloporidae		
2	2	2	*Pocillopora damicornis* (Linnaeus, 1758)	1U,2U,3U,4U	5U, 6R, 7R, 8U, 9U, 10U, 11U, 12U, 14R, 16R
	3	3	*Pocillopora eydouxi* Milne Edwards & Haime, 1860	1R	6R, 9U, 10R, 11R, 12U, 13R, 14R, 15R, 16R, 17U
		4	*Pocillopora meandrina* Dana, 1846		9U, 12U, 13U
		5	*Pocillopora setichelli* Hoffmeister, 1929		9U
	4	6	*Pocillopora verrucosa* (Ellis & Solander, 1786)	2R	6R, 9U, 10U, 11R, 12C, 13C, 14R, 15R, 16R, 17U
3		7	*Seriatopora hystrix* Dana, 1846		17U
4	5	8	*Stylophora pistillata* Esper, 1797	1R	9U, 10R, 13U, 15R, 16R, 17R
	6	9	*Stylophora subseriata* Ehrenberg, 1834	1U,2U	5R, 14U, 15R, 16R
			Family Acroporidae		
5		10	*Acropora abrotanoides* (Lamarck, 1816)		8R, 9R, 13U
	7		*Acropora aculeus* (Dana, 1846)	1U	
		11	*Acropora acuminata* (Verrill, 1846)		12U, 16R
		12	*Acropora austera* (Dana, 1846)		15R, 16R,17U
		13	*Acropora batunai* Wallace, 1997		14R
	8		*Acropora carduus* (Dana, 1846)	1U,3U,4U	
	9	14	*Acropora carolineana* Nemenzo, 1976	1U,2U	14R
	10	15	*Acropora cerealis* (Dana, 1846)	1U,2U	6U, 10U, 13U,16U
	11	16	*Acropora clathrata* (Brook, 1891)	2R	10U, 12U, 13U,16U
		17	*Acropora crateriformis* (Gardiner, 1898)		14R,15R, 16U, 17U
		18	*Acropora cuneata* (Dana, 1846)		8R, 9U, 15R, 17R
	12	19	*Acropora cytherea* (Dana, 1846)	1R,3R,4R	6U, 10U, 11U, 13R, 15R, 16U, 17U
	13	20	*Acropora digitifera* (Dana, 1846)	1R	7C, 8U, 9C, 16R

	21	*Acropora divaricata* (Dana, 1846)		10R, 12U
14		*Acropora echinata* (Dana, 1846)	1R,3R	
15	22	*Acropora florida* (Dana, 1846)	1C,3C,4C	5U,9R, 11R, 15R, 16R
16	23	*Acropora gemmifera* (Brook, 1892)	1U	7C, 8C, 9C, 11U, 12U
17	24	*Acropora granulosa* (Milne Edwards & Haime, 1860)	1U,3C	14R
18	25	*Acropora humilis* (Dana, 1846)	1R	8U
19	26	*Acropora hyacinthus* (Dana, 1846)	1U,4R	6R, 7U, 8U, 9C, 10U, 12U, 13U, 15R, 17U
20		*Acropora latistella* (Brook, 1891)	1U	
21		*Acropora lokani* Wallace, 1994	4R	
22		*Acropora longicyathus* (Milne Edwards & Haime, 1860)	3R,4R	
23	27	*Acropora loripes* (Brook, 1892)	1A,2C,3C,4U	5U, 6U, 11U, 14R, 16U
24		*Acropora lovelli* Veron and Wallace, 1984	4R	
25	28	*Acropora microphthalma* (Verrill, 1859)	1U,2U,4U	9U, 12U
26	29	*Acropora millepora* (Ehrenberg, 1834)	1U,3U,4U	7R, 8U, 9U, 10R
	30	*Acropora monticulosa* (Brüggemann, 1879)		9R, 12R, 13R
27	31	*Acropora muricata* (Linnaeus, 1758) (=*formosa*)	1R,2R,3R	8R, 9R, 11R, 13R, 16R, 17R
	32	*Acropora nana* (Studer, 1878)		12R
	33	*Acropora nasuta* (Dana, 1846)		8R, 9R
28	34	*Acropora nobilis* (Dana, 1846)	1R	12U, 15R
29	35	*Acropora palifera* (Lamarck, 1816)	3R	7R, 10U, 12U, 16U, 17R
30	36	*Acropora paniculata* Verrill, 1902	1C,2U,3R	5R, 6U, 12U, 15U
	37	*Acropora pharaonis* (Milne Edwards & Haime, 1860)	2U, 3U	15R
	38	*Acropora polystoma* Brook, 1891		17R
	39	*Acropora prostrata* Dana, 1846		10R
31	40	*Acropora robusta* (Dana, 1846)	1U	7R, 9C
	41	*Acropora rosaria* (Dana, 1846)		6R, 15U
32	42	*Acropora samoensis* (Brook, 1891)	1R,4R	6R, 7R, 10R
33	43	*Acropora sarmentosa* Brook, 1892	1C,2U,3U,4U	6U, 10R, 11R, 16U
34		*Acropora subglabra* (Brook, 1891)	4R	
	44	*Acropora tenuis* (Dana, 1846)		12U, 13R
35		*Acropora valenciennesi* (Milne Edwards & Haime, 1860)	2U,3U,4U	

	36	45	*Acropora valida* (Dana, 1846)	1R	9U
	37	46	*Acropora vaughani* Wells, 1954	1U,3U,4U	10U, 11R, 13R, 16R, 17U
		47	*Acropora verweyi* Veron & Wallace, 1984		13R
	38	48	*Acropora yongei* Veron & Wallace, 1984	1U,3U	8R, 9R, 10R, 11R, 13R, 16U, 17R
6		49	*Astreopora eliptica* Yabe & Sugiyama 1941		13R
	39	50	*Astreopora listeri* Bernard, 1896	4R	11R, 13R
	40	51	*Astreopora myriophthalma* (Lamarck, 1816)	1R,2U,3R	5R, 7C, 9R, 10R, 13U, 17R
	41	52	*Astreopora randalli* Lamberts, 1980	1U,2U,3R	10R
	42	53	*Astreopora suggesta* Wells, 1954	1U,3R	5C, 6C, 16R
7		54	*Montipora aequituberculata* Bernard, 1897		12R
	43	55	*Montipora capitata* Dana, 1846	1U,3U,4U	10R, 14R, 16U
		56	*Montipora digitata* Dana, 1846		7C, 8U
		57	*Montipora foveolata* (Dana, 1846)		9U, 10R, 11R, 12R, 13U, 15R, 16R, 17R
		58	*Montipora nodosa* (Dana, 1846)		6R, 15R, 16R
	44		*Montipora undata* Bernard, 1897	1R	
	45	59	*Montipora verrucosa* (Lamarck, 1816)	1R,4R	5R, 6R, 15R
			Family Poritidae		
8	46	60	*Goniopora somaliensis* Vaughan, 1907	1U,2U	12R, 14R, 16R
9		61	*Porites annae* Crossland, 1952		8U
		62	*Porites cylindrica* Dana, 1846		8U, 11R
	47		*Porites horizontalata* Hoffmeister, 1925	1R,3R	
		63	*Porites lichen* Dana, 1846		7R?, 8R?
		64	*Porites monticulosa* Dana, 1846		14C
		65	*Porites nigrescens* Dana, 1846		12C, 13U, 16R, 17U
	48	66	*Porites rus* (Forskål, 1775)	1R,2R,3R,4R	9R, 16U, 17R
		67	*Porites vaughani* Crossland, 1952		11R, 12U, 15U, 16U, 17R
			Family Siderasteridae		
10	49	68	*Coscinaraea columna* (Dana, 1846)	1R,2R,3R,4R	5R, 6R, 7U, 8U, 9U, 10R, 11U, 12U, 13U, 15R, 16U, 17U
	50	69	*Coscinaraea exesa* (Dana, 1846)	2R	5R, 13R
	51		*Coscinaraea monile* (Forskål, 1775)	1R	

11	52	70	*Psammocora digitata* Milne Edwards & Haime, 1851	1U,2U	8U, 9R, 11R, 13R, 17R
	53	71	*Psammocora nierstraszi* van der Horst, 1921	3R	7R, 12R, 13R, 15R, 16R, 17R
	54	72	*Psammocora profundacella* Gardiner, 1898	2R	12R, 15R, 16R, 17R
	55		*Psammocora superficialis* Gardiner, 1898	2R	
			Family Agariciidae		
12	56	73	*Gardineroseris planulata* Dana, 1846	1R	12R, 13R, 14R, 15R, 16R, 17R
13		74	*Leptoseris explanata* Yabe & Sugiyama, 1941		14R
	57		*Leptoseris hawaiiensis* Vaughan, 1907	2R	
		75	*Leptoseris incrustans* (Quelch, 1886)		15R, 16U
		76	*Leptoseris mycetoseroides* Wells, 1954		6U, 10U, 11U, 12R, 15C, 16U, 17R
	58		*Leptoseris scabra* Vaughan, 1907	1U,2U	
	59	77	*Leptoseris yabei* (Pillai & Scheer, 1976)	1U,2U,3R	14U
14	60	78	*Pachyseris gemmae* Nemenzo, 1955	1R,2R,3R,4R	10R
	61	79	*Pachyseris rugosa* (Lamarck, 1801)	1R,2R,3R,4R	14R
		80	*Pachyseris speciosa* (Dana, 1846)		5R, 10U, 14R, 15R, 16R
15	62		*Pavona bipartita* Nemenzo, 1980	1U,2U,3U	
	63		*Pavona cactus* (Forskål, 1775)	1R	
		81	*Pavona chiriquiensis* Glynn, Mate & Stemann, 2001		5R, 8R, 10R, 11R, 13R, 15R, 16R
	64		*Pavona clavus* (Dana, 1846)	3C,4U	
	65	82	*Pavona duerdeni* Vaughan, 1907	1R	9R, 11R, 12R, 13R, 15U, 16R, 17R
	66	83	*Pavona explanulata* (Lamarck, 1816)	1U,2U,3R,4R	10R, 15U, 16R, 17R
		84	*Pavona frondifera* (Lamarck, 1816)		8U
		85	*Pavona gigantea* Verrill, 1896		16R
	67	86	*Pavona maldivensis* (Gardiner, 1905)	1R,2R	6U, 10U, 12R, 15U, 16U, 17R
		87	*Pavona minuta* Wells, 1954		16U
	68	88	*Pavona varians* Verrill, 1864	1R,2U,3U	5R, 6R, 10R, 15U, 16U, 17U
			Family Fungiidae		
16	69	89	*Cantharellus jebbi* Hoekesema, 1993	3R	11R
17	70	90	*Ctenactis albitentaculata* Hoeksema, 1989	2R	6R, 11R, 15R
	71	91	*Ctenactis crassa* (Dana, 1846)	1R,2R,3R	5U, 14R, 15R
	72	92	*Ctenactis echinata* (Pallas, 1766)	1R,4R	6U

18		93	*Cycloseris tenuis* (Dana, 1846)		15R, 16R
		94	*Cycloseris vaughani* (Boschma, 1923)		10R
19		95	*Fungia concinna* Verrill, 1864		5R, 6R, 15R, 16R
	73	96	*Fungia fungites* (Linneaus, 1758)	1U,3U	12R, 15R, 16R
	74	97	*Fungia granulosa* Klunzinger, 1879	1R,2U,3R,4R	5R, 16R
		98	*Fungia horrida* Dana, 1846		15R, 16R
		99	*Fungia moluccensis* Horst, 1919		15R
	75	100	*Fungia paumotensis* Stutchbury, 1833	1R,2R,3R	15R, 16R, 17R
	76	101	*Fungia scruposa* Klunzinger, 1816	3U	6R, 12R, 15U, 17R
		102	*Fungia scutaria* Lamarck, 1816		6R, 9R, 12U, 13R, 15U, 16U, 17U
	77		*Fungia spinifer* Claereboudt & Hoeksema 1987	4R	
20	78	103	*Herpolitha limax* (Houttuyn, 1772)	1R,2R	12U, 14R, 16U,
		104	*Herpolitha weberi* Horst, 1921		5U, 12R, 15U
21	79	105	*Podabacia motuporensis* Veron, 1990	1U,2U,3R	10U, 15U, 16U
22		106	*Polyphyllia novohibernae* (Lesson, 1831)		5C
	80	107	*Polyphyllia talpina* Lamarck, 1801	1U,2U,3R	5U, 6R, 10R
23		108	*Sandalolitha dentata* Quelch, 1884		14R, 16R
		109	*Sandalolitha robusta* Quelch, 1886		10R
24	81	110	*Zoopilus echinatus* Dana, 1846	4U	15U
			Family Oculinidae		
25	82	111	*Galaxea astreata* (Lamarck,. 1816)	1R,2R,3R	5R, 6R, 11R, 15R, 16R, 17R
	83	112	*Galaxea fascicularis* (Linnaeus, 1767)	1R,2R,3R	7U, 8R, 9R, 10R, 11R, 13R, 14R, 15R, 16R
	84		***Galaxea horrescens* (Dana, 1846)**	4C	
			Family Pectinidae		
26	85	113	*Echinomorpha nishihirai* (Veron 1990)	1R,3R,4R	14R
	86	114	*Echinophyllia aspera* (Ellis & Solander, 1788)	1R,2U,4R	6U
	87		*Echinophyllia echinoporoides* Veron & Pichon, 1979	2R	
27	88	115	*Mycedium elephantotus* (Pallas, 1766)	1R,2U,3R	5U, 6R, 11R
	89		*Mycedium robokaki* Moll & Borel-Best, 1984	3R	

28	90		*Oxypora crassispinosa* Nemenzo, 1979	3R	
	91	116	*Oxypora lacera* Verrill, 1864	1R,2U,4U	7R, 14R, 15R, 16R, 17R
29	92	117	*Pectinia alcicornis* (Saville-Kent, 1871)	3U,4U	5U
		118	*Pectinia paeonia* (Dana, 1846)		6R
			Family Mussidae		
30		119	*Acanthastrea brevis* Milne Edwards & Haime, 1849		6R, 8R, 11R, 16R, 17U
	93	120	*Acanthastrea echinata* (Dana, 1846)	3R,4R	13U, 16R
		121	*Acanthastrea hemprichii* (Ehrenberg, 1834)		7U, 8U, 10R, 13U
		122	*Acanthastrea ishigakiensis* Veron, 1990		12U, 13U, 15R
31	94	123	*Lobophyllia corymbosa* Forskål, 1775	4R	9U, 11R
	95	124	*Lobophyllia hemprichii* (Ehrenberg, 1834)	2R,3U,4U	5C, 6U, 7C, 8C, 9R, 10R, 11R, 12C, 13U, 14R, 15R, 16U, 17R
		125	*Lobophyllia robusta* Yabe & Sugiyama, 1936		8R, 10R, 12R, 16R
32		126	*Scolymia vitiensis* Brüggemann, 1877		5R
33		127	*Symphyllia agaricia* Milne Edwards & Haime, 1849		7U
	96		*Symphyllia hassi* Pillai & Scheer, 1976	3R	
		128	*Symphyllia radians* Milne Edwards & Haime, 1849		7U, 9U, 13R
		129	*Symphyllia recta* (Dana, 1846)		7U, 13R
			Family Merulinidae		
34	97	130	*Hydnophora exesa* (Pallas, 1766)	1R,2R	5R, 13R, 16R
	98	131	*Hydnophora grandis* Gardiner, 1904	3R,4R	7U, 8A
	99	132	*Hydnophora microconos* (Lamarck, 1816)	1R,2R	7C, 8U, 9U, 11R, 13R, 16R
	100	133	*Hydnophora rigida* (Dana, 1846)	1R,4R	9U, 12R, 13R, 15R, 16U, 17U
35	101	134	*Merulina ampliata* (Ellis & Solander, 1786)	1U,2U,3U,4U	5U, 6R, 11R, 14R, 16R
	102	135	*Merulina scabricula* Dana, 1846	1R,2R,3U	6R, 10U, 11U, 13R, 14U, 16U
36	103	136	*Scapophyllia cylindrica* Milne Edwards & Haime, 1848	3R	9R, 10R, 12R
			Family Faviidae		

37		138	*Caulastrea echinulata* (Milne Edwards & Haime, 1849)		11R
		139	*Caulastrea furcata* Dana, 1846		8R
	104		*Caulastrea tumida* Matthai, 1928	1R,2R,4R	
38		140	*Cyphastrea agassizi* (Vaughan, 1907)		12R
	105		*Cyphastrea decadia* Moll & Borel-Best, 1984	4U	
39	106	141	*Diploastrea heliopora* (Lamarck, 1816)	1U,2C,3C,4U	5U, 6U, 9C, 10C, 11C, 12U, 13R, 14U, 15U, 16U
40	107	142	*Echinopora hirsuitissima* Milne Edwards & Haime, 1849	3R	7U, 8U, 9R, 11R, 12R, 13R, 15R, 16U, 17R
	108		*Echinopora horrida* Dana, 1846	4R	
		143	*Echinopora lamellosa* Esper, 1795		6R, 8U, 11U, 12U, 13U, 15R, 17R
	109		*Echinopora mammiformis* (Nemenzo, 1959)	2U,3U,4U	
41	110	144	*Favia pallida* (Dana, 1846)	4R	7R, 8R, 9R, 11R, 13U, 16R, 17R
		145	*Favia rotundata* Veron & Pichon, 1977		11U, 12R, 15R, 16R
	111	146	*Favia stelligera* (Dana, 1846)	1R	7R, 8R, 10R, 11R, 12R, 13U, 15R, 16U, 17U
42		147	*Favites abdita* (Ellis & Solander, 1786)		9R, 13R,
	112	148	*Favites halicora* (Ehrenberg, 1834)	2R	8R, 9R, 10R, 11R, 17R
43	113	149	*Goniastrea edwardsi* Chevalier, 1971	2R	5U, 6U, 10U, 11U, 13U, 15R, 16U, 17U
		150	*Goniastrea favulus* (Dana, 1846)		10R, 14R
		151	*Goniastrea minuta* Veron, 2002		7C, 8C, 9R, 11R, 12U, 13U, 15U, 16U, 17C
	114	152	*Goniastrea pectinata* (Ehrenberg, 1834)	2R,3U,4U	5U, 6U, 10R, 11R, 13R, 14R, 17R
		153	*Goniastrea retiformis* (Lamarck, 1816)		9R
44		154	*Leptastrea bewickensis* Veron & Pichon, 1977		8R
		155	*Leptastrea pruinosa* Crossland, 1952		16R
	115	156	*Leptastrea purpurea* (Dana, 1846)	4R	5R, 6R, 7U, 9U, 14R, 15U, 16R
		157	*Leptastrea transversa* Klunzinger, 1879		10R, 11R, 12R, 13R, 14R
45	116	158	*Leptoria phrygia* (Ellis & Solander)	1U,2U,3R,4R	5R, 7C, 8C, 9R, 10R, 11R, 12U, 13U, 14R, 15R, 16R, 17U

46	117	159	*Montastrea annuligera* (Milne Edwards & Haime, 1849)	1R	5R, 6R, 8R, 11R, 12R, 13R, 14R, 16R, 17R
	118	160	*Montastrea curta* (Dana, 1846)	1R,3R	5R, 7R, 9R, 10R, 11R, 12R, 13R, 16R, 17R
	119	161	*Montastrea magnistellata* Chevalier, 1971	1R,2U,3U,4U	6R
47		162	*Oulophyllia crispa* (Lamarck, 1816)		5R, 6R
48	120	163	*Platygyra daedalea* (Ellis & Solander, 1786)	3U	6R, 7C, 8A, 9R, 11R, 13U, 15R, 16R
49		164	*Plesiastrea versipora* (Lamarck, 1816)		6R
			Family Euphilliidae		
50	121		*Euphyllia cristata* Chevalier, 1971	4R	
		165	*Plerogyra simplex* Rehberg, 1892		5R
			Family Dendrophylliidae		
51		166	*Dendrophyllia* cf. *coccinea* (Ehrenberg, 1834)		10R
52		167	*Rhizopsammia verrilli* van der Horst, 1922		10R
53	122		*Tubastraea coccinea* Lesson, 1829	3R	
	123	168	*Tubastraea micranthus* Ehrenberg, 1834	1U,2U,3U	10U, 14R
54	124		*Turbinaria frondens* Dana, 1846	4R	
	125	169	*Turbinaria mesenterina* (Lamarck, 1816)	1R,4R	7C, 16R
	126		*Turbinaria peltata* (Esper, 1794)	1R,2R,3R,4R	
		170	*Turbinaria radicalis* Bernard, 1896		5R, 15R
	127	171	*Turbinaria reniformis* Bernard, 1896	1R,2R	17R
	128	172	*Turbinaria stellulata* (Lamarck, 1816)	4R	5R, 8R
			Family Clavulariidae		
55		173	*Tubipora musica* Linnaeus, 1758		12R, 13R, 14R, 15R
	129	174	*Tubipora* sp. 2 "green center"	1R,2R,3U	5R, 8U
	130		*Tubipora* sp. 3 "raggedy"	4R	
			Family Milleporidae		
56	131	175	*Millepora dichotoma* Forskål, 1775	1U,3U	10R, 14U 16R
	132	176	*Millepora exaesa* Forskål, 1775	1R,3R,4R	5U, 6R, 9U, 10U, 11U, 12A, 13C, 14U, 15U, 16U, 17U
		177	*Millepora intricata* Milne-Edwards & Haime, 1857		9R, 13U
			Family Stylasteridae		

57		178	*Stylaster* sp. 1 orange or pink		10U, 15R, 16R, 17R
58	133	179	*Distichopora violacea* (Pallas, 1766)	2U,3R,4R	9R, 12R, 13R, 16R