# WCS-Fiji Marine Biological Monitoring Handbook



WILDLIFE
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SOCIETY

Version 3.0
January 2010

This document to be cited as:
WCS (2010) WCS-Fiji marine biological handbook. Version 3.0. Wildlife Conservation Society-Fiji. Suva, Fiji, 34 pp.

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# Contents

# Introduction

This handbook describes the marine biological monitoring techniques that the Wildlife Conservation Society (WCS) Fiji Country Program is currently using to monitor reef resources inside traditional Fijian fishing grounds (*qoliqoli*) where networks of marine protected areas (MPAs) have been established. The protocols have built on existing methodologies and have evolved over time to meet the needs of the WCS-Fiji program. In this section, we describe the rationale behind the monitoring approaches and how they have been optimized to fit our staffing capability and cost constraints. As the goals of the Fijian MPA networks surveyed are primarily to increase stock of food fish, we concentrate on methods for surveying relevant coral reef fish communities. We then describe several methods to collect benthic data which we predominantly use to exclude differences in reef fish communities specifically related to habitat. These data also provide valuable baseline information which could be used to monitor recovery in the event of large-scale disturbance to the reef systems.

## *Coral Reef Fish Monitoring*

### Fish survey methods

Coral reef fish populations exhibit high natural variability which makes it challenging to detect changes in population size or density that are related to management measures (McClanahan et al. 2007). Variation can be caused by natural factors associated with: diurnal and tidal movements (Thompson and Mapstone 2002); population processes such as reproduction, recruitment and mortality (Williams 1983; Hixon and Carr 1997); habitat complexity and habitat utilization preferences (Friedlander and Parrish 1998; Friedlander et al. 2003); speed of fish movement and difficulty of detecting cryptic species (Green and Alevizon 1989; Willis 2001). Variation may be further introduced in fish size and abundance estimates by varying abilities and swimming speeds of observers or the presence of divers in the vicinity, particularly where fishing pressure is high (Fowler 1987; Lincoln Smith 1988; Samoilys and Carlos 2000; Gotanda et al. 2009).

Underwater visual census (UVC) monitoring has become a mainstay of programs assessing the effects of protected areas on reef fish population recovery. Several types of UVC monitoring are most commonly utilized, including belt transects and stationary point counts (Saimolys and Carlos 2000). Samoilys and Carlos (2000) found few significant differences between the methods, but noted that the data obtained by either were characterised by "high variability, low precision and low power". For belt transects, they recommend a size of 50 m x 5 m, replicated at least 10 times, with low swimming speeds (33 $m^2$ $min^{-1}$).

To reduce variability in fish estimates, several authors have recommended limiting the number of species surveyed (Williams 1986; Lincoln Smith 1989). In addition, different taxa can be surveyed on multiple passes of the same transect and within the same tidal regime with good (> 7 m) visibility (McClanahan and Kaunda-Arara 1996; McClanahan 2008). However, the number of sites and transects utilized (and passes along transects) will ultimately require a trade-off between obtaining enough statistical power to detect differences among factors influencing reef fish population density and size and practical constraints of time, money, staff capacity and feasibility (Bros and Cowell 1987, Samoilys and Carlos 2000). WCS-Fiji has chosen to limit the fish counted to targeted food fish families and families with important ecological functions (see Belt transects for

Fish Size and Abundance) that are easily recognizable (e.g. Chaetodontidae). Given the large number of MPAs requiring monitoring in each qoliqoli where WCS-Fiji presently works, the monitoring teams limit their surveys to 1 pass per transect in order to be able to cover more sites per monitoring period.

Optimal experimental designs for assessing differences in fish populations related to management can be assessed through a priori power analyses. However, power analysis calculations are typically not robust when using non-normally distributed data (Zar 1999), such as most fish survey data. New developments in statistics and statistical software have addressed this issue: permutational analysis of variance (PERMANOVA) allows for the calculation of pseudo-F ratios on the basis of any distance measure from non-parametric data for balanced, multi-factorial ANOVA designs (Anderson 2001). WCS-Fiji has modified our experimental design over time through an adaptive process when new information has become available to reduce variability in the data and increase the power to detect differences related to the factors of the survey design.

WCS-Fiji monitoring designs of fish abundance and size in 2007-2008 included three factors: management (open, closed), exposure (forereef, backreef), and depth (top, shallow, deep). In general, two forereef and two backreef sites were surveyed within each management treatment, with 5 replicate transects nested within depth categories and depth nested within sites. In late 2008, exploratory data analysis revealed high variability in fish abundance and biomass recorded from backreef sites which made it difficult to detect differences related to management effects from data collected between October 2005 and October 2008, even when data were pooled across exposure gradients (forereef, backreef). A power analysis using PERMANOVA+ within PRIMER-E software (Anderson et al. 2008) indicated that changing the sampling design to increased sample size of *forereef-only* sites would improve the ability to detect differences related to management (Appendix 1). Therefore, monitoring was conducted in 2009 on forereefs only to improve our power to detect differences related to protection.

Further power analyses conducted in 2010 show that changing the number of transects surveyed has minimal effect on our ability to detect differences related to management, but would greatly change costs (Appendix 2). However, the power to detect difference related to management is improved by nesting sites within depth categories using the same sampling effort (# of transects). The 2010 monitoring design will be modified based on these results so that depth categories are surveyed at different sites instead of evaluating multiple depths at each site.

## Data cleaning and biomass calculation

Observer bias is investigated by assessing the mean number of fish species counted per transect by each observer. Fish biomass is calculated from size class estimates of length (L) and existing published values from Fishbase (Froese and Pauly 2009) used in the standard length-weight (L-W) expression $W = aL^b$, with *a* and *b* parameter values preferentially selected from sites closest to Fiji (e.g. New Caledonia). If no L-W parameters is available for the species, the factors for the species with the most similar morphology in the same genus are used (Jennings and Polunin 1996). If a suitable similar species cannot be determined, averages for the genera are used. As many of the L-W conversions require fork length (FL), a length-length (L-L) conversion factor can be obtained from Fishbase where necessary to convert from total length (TL) recorded during the surveys to FL before biomass estimation.

## *Coral Reef Benthic Habitat Monitoring*

There are many reasons to survey coral reef benthic communities. Many studies are done to understand ecological drivers of natural differences in community structure. Population processes such as recruitment, competition, predation and mortality fluctuate naturally in response to environmental conditions and levels of disturbance (Connell et al. 1997; Connell et al. 2004) and can produce very different benthic communities that support different fish assemblages.

Other types of monitoring are done to observe direct and indirect shifts in benthic community composition related to major disturbance, which may include: tropical storms, floods, overfishing, coral bleaching or combined response of several of the above categories. Overfishing of reef grazers in particular may lead to shifts from coral to algal dominance following large disturbances resulting in mass coral mortality (e.g. bleaching, tropical cyclones; Hughes 1994). Management through no-take protected areas can result in differential changes to benthic cover (McClahanan et al. 2002), in particular by promoting recovery of reef grazers who promote reef resilience by limiting algal cover (Mumby et al. 2006; Green et al. 2009).

There has been much debate over the preferred methods for monitoring benthic habitats, with many management agencies using point intercept transects (PIT), line intercept transects (LIT) or photo/video transects. PIT is easy to learn and implement and has been a recommended tool of Reef Check, though it is not good for picking up rare species on the reef and gives no indication of coral colony sizes (Hill and Wilkinson 2004). LIT, recommended by the Global Coral Reef Monitoring Network (GCRMN), gives additional information on coral colony size, which may indicate disturbance frequency (Meesters et al. 1996), but the size estimates are only accurate if the line passes over the entire width of the colony (Jupiter, pers. obs.) and may be time consuming to implement (Hill and Wilkinson 2004). When combined with photoquadrats across fixed, permanent transects, however, it can provide reliable estimates of benthic cover, coral diversity and change over time.

As with the methods for monitoring reef fish populations, the WCS-Fiji protocols for monitoring benthic habitats have evolved over time with additional staff training. Initially, all surveys were conducted using PIT where modified GCRMN life forms of benthic cover were measured at 0.5 m intervals along the same replicate 50 m transects used for counting fish. In order to add an additional layer of information to be able to assess differential response to and recovery from disturbance, observers began recording coral genera in 2007 in addition to life form. In 2008, WCS-Fiji also established permanent transects for period monitoring using LIT plus photoquadrats which are analysed for benthic cover using Coral Point Count with Excel extension (CPCe) software (Kohler and Gill 2006).

Because reef topography and complexity has been shown to be a major driver of fish assemblages across several spatial scales (Wilson et al. 2007; Purkis et al. 2008; Pittman et al. 2009), WCS-Fiji began measuring rugosity of the 10 m replicate LITs in 2008 using a fine chain. Beginning in 2009, along PIT transects, WCS-Fiji additionally started giving a complexity score to each 0.25 m$^2$ surrounding every 0.5 m point where: 1 = minimal relief; 2 = some vertical relief (e.g. boulder corals); 3 = high vertical relief (e.g. branching corals, reef crevices).

For data analysis to date, percent cover of lifeforms have been combined into 7 functional strata: unconsolidated substrate (US: rubble, sand, silt); reef matrix (RM: dead coral, reef pavement,

crustose coralline algae, coralline algae); macroalgae (MA: all fleshy macroalgae > 2 cm, including cyanobacteria); live hard coral (LC: all hard coral classes including *Millepora* and *Tubipora*); other soft substrate (OT: including soft corals, sponges, ascidians, anemones); turf algae (TA: ≤ 2 cm height on reef pavement)p; and upright coralline algae (UC: e.g. *Halimeda* spp). This information is combined with fish biomass and abundance data to evaluate whether benthic cover and complexity influences fish assemblages. Only studies that take into account multiple stressors across spatial and temporal scales and their potential synergistic reactions will be able to tease apart the main factors structuring current day reef community composition (e.g. Done et al. 2007) and be able to assess whether management measures have influence over other factors.

## *Handbook Format*

In the following section, the specific protocols used by the WCS-Fiji program are described for carrying out belt transects for fish sureys and PIT and LIT for benthic cover surveys. Datasheets in support of the fish surveys and PIT surveys are found in Appendix 3. LIT datasheets are the same as the PIT datasheets with the exception that the distance field is blank and filled in by observers. The complete list of known fish found in Fiji for each of the WCS-Fiji target families is in Appendix 4. The list has been compiled through confirmed sightings by local experts (A. Jenkins, H. Sykes) and compared with museum collections. The complete list of known scleractinian coral genera is found in Appendix 5, based on compilation of Fiji records by Lovell and McLardy (2008).

# Belt Transects for Fish Size and Abundance

## *Scientific Questions*

- **Are food fish bigger and more abundant inside protected areas?**
- **What are the natural differences in food fish size and abundance due to habitat?**
- **Are there different types of fish communities inside protected areas? (i.e. Has fishing altered fish community structure?)**
- **What are the natural differences in fish communities due to habitat?**

## Protocol

1. Diver will descend to required depth (shallow: 5-8 m; deep: 12-15 m) and randomly select a section of reef to begin surveying. At high tide, diver will descend to the lower depth limit (shallow: 7-8 m; deep: 14-15 m). At low tide, diver will descend to the upper depth limit (shallow: 5-6 m; deep: 12-13 m)

2. Diver will wait 3 minutes for fish to settle

3. Diver will attach end of transect tape to appropriate substrate (**not live coral**) and ensure that it is firmly attached

4. Diver will record: Site name, Recorder Name, Transect #, Depth Class (Deep/Shallow), Date, Water Temperature, Tide, Start Time, and Actual Depth (m)

5. Diver will swim forward, releasing transect tape behind him/her, and record all fish sighted within a 5 m cube of the transect (2.5 m to each side of the tape and 5 m perpendicular to tape, **Figure 1**). Transects should follow a depth contour on the reef, attempting to stay on reef substrate as much as possible.

6. All species of fish are to be recorded from the following families:

| | | |
|---|---|---|
| **Acanthuridae (Surgeonfish)** | **Labridae (Wrasses)** | **Serranidae (Groupers** minus Athias**)** |
| **Balistidae (Triggerfish)** | **Lethrinidae (Emperors)** | **Siganidae (Rabbitfish)** |
| **Caesionidae (Fusiliers)** | **Lutjanidae (Snappers)** | **Scombridae (Mackerel & Tuna)** |
| **Carangidae (Jacks and Trevallies)** | **Mullidae (Goatfish)** | **Sphyraenidae (Barracuda)** |
| **Chaetodonotidae (Butterflyfish)** | **Nemipteridae (Breams)** | **Sharks (all families)** |
| **Ephippidae (Spadefish aka Batfish)** | **Pomacanthidae (Angelfish)** | |
| **Haemulidae (Sweetlips)** | **Priacathidae (Bigeyes)** | |
| **Kyphosidae (Chubs and Rudderfish)** | **Scaridae (Parrotfish)** | |

**Refer to the WCS updated Fish list for Fiji for most current records of fish within the above groups expected to be found in Fiji**

7. Fish are to be recorded to Genus and species where possible and to genus only if there is uncertainty. Refer to the Fiji Fish List (Appendix 4) for all fish found in Fiji for each family. Fill in the degree of certainty of your identification:

        1 – Not sure (guess)
        2 – Genus sure, species uncertain
        3 – Genus sure, 50% sure of species
        4 – Genus sure, could be one of two or three similar species
        5 – Certain of both genus and species

8. If the species is not known, record the genera followed by U/I #1, U/I #2, etc., and record notes about appearance at bottom of page.

9. Size of fish are to be recorded in the following classes (to nearest cm): 2-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, and >40. For fish >40 cm, note the # of large fish in the box on the data sheet and the size of **each** of the fish in the margin

10. Diver should maintain a slow, even pace. Transects should take **at least 20 minutes**!

11. Only **3 transects maximum** should be completed on **one tank** of compressed air

12. Diver should leave at least **5 m** of space between each transect

13. At the end of the final transect, diver will wind up the tapes and return to the boat

14. For each site, **five x 50 m** transects should be completed for each depth category (e.g. deep, shallow).
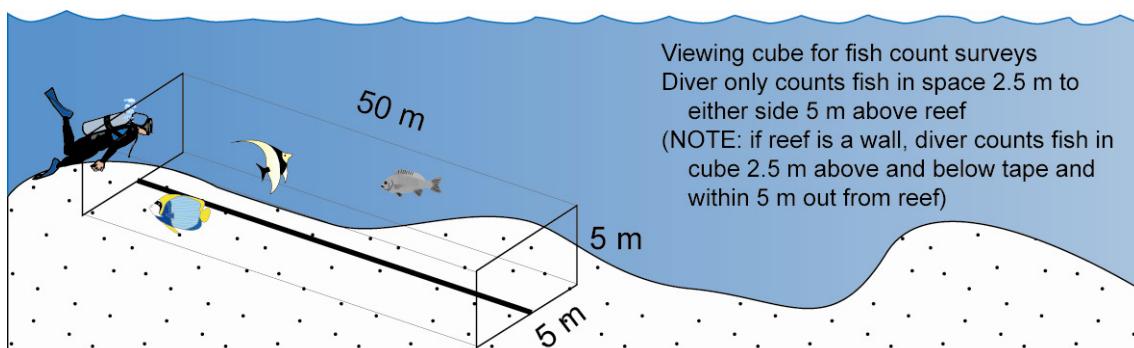


**Figure 1. Schematic of diver counting fish within 5 m x 5 m cube along reef.**

# Point Intercept Transects for Benthic Cover

## *Scientific Questions*

- Are there significant differences in benthic cover between sites and habitats within sites that may influence fish and invertebrate abundance?
- Are there any significant differences in benthic cover that could be related to indirect effects of management?

## *Protocol*

1. Diver will wait 2-3 minutes after fish recorder begins laying transect tape before starting survey and after invertebrate recorder begins, starting at same point as fish survey

2. Diver will record: Site name, Recorder Name, Transect #, Depth Class (Deep/Shallow), Date, Water Temperature, Tide, Start Time, and Actual Depth (m)

3. Starting at the 0.5 m mark on the transect tape, diver will record benthic substrate directly below the tape (at each 0.5 m) to the GCRMN category listed below:

| Abbreviation | Category Description | Abbreviation | Category Description |
|---|---|---|---|
| RC | Rock (non-carbonate) | CM | Coral massive |
| RB | Rubble | CS | Coral submassive |
| SD | Sand (<0.5 cm) | CC | Coral corymbose |
| SI | Silt (very fine) | SC | Soft coral |
| DA | Dead coral with fleshy algae | CMR | Coral mushroom |
| CCA | Crustose coralline algae | CME | Coral *Millepora* |
| ACB | *Acropora* branching | SP | Sponge |
| ACD | *Acropora* digitate | ZO | Zooanthid |
| ACT | *Acropora* table | OT | Other biota |
| ACS | *Acropora* submassive | AA | Algal assemblage |
| ACE | *Acropora* encrusting | CA | Coralline algae (w/ structure) |
| ACC | *Acropora* corymbose | HA | *Halimeda* |
| CB | Coral branching | MA | Macroalgae |
| CE | Coral encrusting | TA | Turf algae |
| CF | Coral foliose | | |

4. For **OT** category, diver should note what the other biota is (e.g. black coral, anemone)

5. In the column labelled complexity, diver should record the general reef complexity with a ½ m$^2$ around the point on the tape as either: 1 – flat/rubbly (no vertical structure; 2 – mounding or submassive (medium amount of horizontal and vertical structure; or 3 – branching and complex (high horizontal and vertical structure). (**TIP:** Diver should imagine that he/she is a 5 cm damsel fish. If there would be nowhere for the fish to hide, the point should be categorized as 1. If the fish could shield itself behind a mound, but not tuck itself

into a crevice, the point should be categorized as 2. If the fish could safely hide itself from predators, the point should be categorized as 3.

6.  In the live/dead category, the diver should record whether the entire coral colony is: L: live; D: dead: PD: part-dead; B: bleached; PB: part-bleached; DS: diseased. If the point is not on a coral colony, the diver should record whether the **REEF SUBSTRATE** below that point is live or dead.

7.  For live hard corals, macroalgae and soft corals, diver will record the genus (if known), in addition to GCRMN life form. See list on p. 34 for all genera of reef-building corals likely to be found in Fiji.

8.  Diver will fill in the degree of certainty of coral identification:
    1 – Not sure (guess)
    2 – Family sure, genus uncertain
    3 – Family sure, 50% sure of genus
    4 – Family sure, could be one of two or three similar genera
    5 – Certain of both family and genus

9.  Diver should maintain a slow, even pace. Transects should take **at least 20 minutes**!

10.  Only **3 transects maximum** should be completed on **one tank** of compressed air

11.  For each site, **five x 50 m** transects should be completed for each depth category (e.g. deep, shallow). The requirements for sampling at each depth category will vary by site and weather conditions.

# Line Intercept Transects for Benthic Cover

## *Scientific Questions*

- **Are there significant differences in coral community composition between sites and habitats within sites that may influence fish and invertebrate abundance?**
- **How do the coral communities reflect environmental conditions and potential prior histories of disturbance?**
- **Are the current coral communities resilient to disturbance?** *(NOTE: multiple years of monitoring along the SAME transects are required to answer this question)*

## *Protocol*

1. **Four x 10 m PERMANENT** transects will be established along shallow (6 m) reef foreslopes *where coral is present*. Divers should leave **5 m** of space between each transect

2. Diver will attach end of transect tape to appropriate substrate (**not live coral**) and ensure that it is firmly attached. Diver will pull the tape **taut** to 10 m

3. **[Initial set-up of transects only]** Diver will cable tie **TWO** permanent marker floats at the start and **ONE** float at the end of the 10 m. Diver will add additional cable ties along the transect as visual markers to relocate the site during future monitoring events

4. A chain to measure rugosity will be attached to the beginning of the transect and carefully laid over the coral until the 10 m mark. The chain will be marked at every metre. The diver will put his/her hand over the part of the chain which falls on the 10 m mark, and measure the distance from the last metre mark along the transect tape. The total rugosity measurement will equal the total number of metre marks on the chain plus the additional distance from the last mark.

5. Diver will record: Site name, Recorder Name, Transect #, Rugosity, Date, Water Temperature, Tide, Start Time, Actual Depth (m)

6. Diver will record GCRMN categories (see Point Intercept methods section for table) to the nearest **1 cm** along the transect

7. For **OT** category, diver should note what the other biota is (e.g. black coral, anemone)

8. In the column labelled complexity, diver should record the general reef complexity with a ½ m$^2$ around the point on the tape as either: 1 – flat/rubbly (no vertical structure; 2 – mounding or submassive (medium amount of horizontal and vertical structure; or 3 – branching and complex (high horizontal and vertical structure). (**TIP:** Diver should imagine that he/she is a 5 cm damsel fish. If there would be nowhere for the fish to hide, the point

should be categorized as 1. If the fish could shield itself behind a mound, but not tuck itself into a crevice, the point should be categorized as 2. If the fish could safely hide itself from predators, the point should be categorized as 3.

9. In the live/dead category, the diver should record whether the entire coral colony is: L: live; D: dead: PD: part-dead; B: bleached; PB: part-bleached; DS: diseased. If the point is not on a coral colony, the diver should record whether the **REEF SUBSTRATE** below that point is live or dead.

10. For live hard corals, macroalgae and soft corals, diver will record the genus (if known), in addition to GCRMN life form. See list on p. 34 for all genera of reef-building corals likely to be found in Fiji.

11. Diver should draw a line in the margin linking together all records going across a single colony. For example, if there was a massive Porites with several dead patches, the diver should connect all life form categories that cover the length of the colony.

12. Diver will fill in the degree of certainty of coral identification:
    1 – Not sure (guess)
    2 – Family sure, genus uncertain
    3 – Family sure, 50% sure of genus
    4 – Family sure, could be one of two or three similar genera
    5 – Certain of both family and genus

13. **Photographs** over **½ m x ½ m quadrats** will be taken over every other metre along each of the four x 10 m transects (e.g. with the edge of the quadrat positioned along metre 0, 2, 4, 6, 8 on the tape = **five total photographs per transect, Figure 2**). One diver should move the quadrats while a second diver takes the photographs, maintaining a constant height above the reef. Before each photograph, take a photo of either the metre tape or the second diver's hands showing the position along the metre tape.

14. At the end of the final transect, divers will wind up the tapes and return to the boat
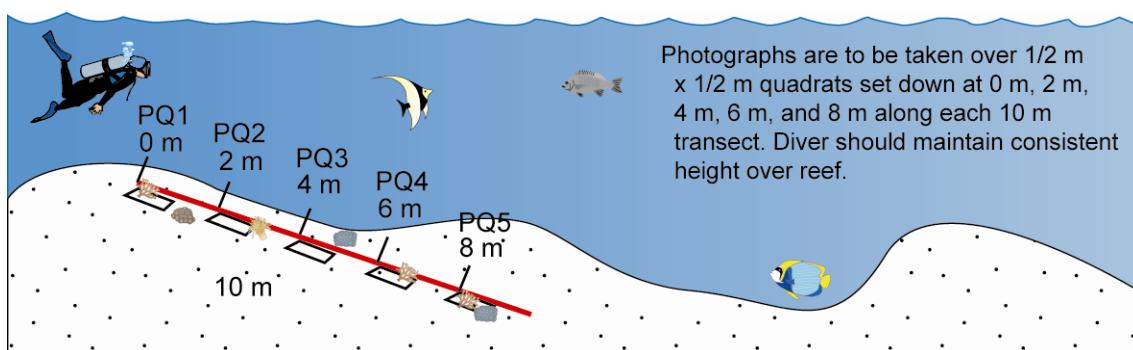


**Figure 2. Schematic diagram of how quadrats should be placed along each LIT transect to take photographs from above.**

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# Appendix 1. Power analysis to assess limitations of including exposure as a factor

**Table 1.** Critical F-statistics needed to conclude significant differences at p < 0.05 level for experimental design of Kubulau 2007 and 2008 surveys where (a) exposure, site and depth are considered as separate factors; and (b) sites are pooled across exposure categories.

| Factor | Levels | Nesting | Fixed/ Random | Numerator | Denominator | Critical F-statistic |
|--------|--------|---------|---------------|-----------|-------------|----------------------|
| **(a) Exposure, Site and Depth as factors** | | | | | | |
| Status | 2 (open, closed) | | fixed | 1 | 4 | 12.2 |
| Exposure | 2 (back-, forereef) | | fixed | 1 | 4 | 12.2 |
| Site | 2 | status x exposure | random | 4 | 96 | 2.93 |
| Depth | 3 (top, shallow, deep) | status x exposure x site | fixed | 2 | 8 | 6.06 |
| N | 5 | | | | | |
| Sample size | 120 | | | | | |
| **(b) Site and Depth as factors** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 6 | 8.81 |
| Site | 4 | status | random | 6 | 96 | 2.55 |
| Depth | 3 (top, shallow, deep) | status x site | fixed | 2 | 12 | 5.1 |
| N | 5 | | | | | |
| Sample size | 120 | | | | | |

**Table 2.** Critical F-statistics needed to conclude significant differences at p < 0.05 level for experimental design of Kubulau 2009 surveys for (a) Namena MPA with 5 closed sites and 5 open sites surveyed; and (b) Namuri and Nasue MPAs with 4 closed sites and 4 open sites each surveyed.

| Factor | Levels | Nesting | Fixed/ Random | Numerator | Denominator | Critical F-statistic |
|--------|--------|---------|---------------|-----------|-------------|----------------------|
| **(a) Namena MPA (n = 10 sites total)** | | | | | | |
| Status | 2 (open, closed) | | fixed | 1 | 8 | 7.57 |
| Site | 5 | status | random | 8 | 80 | 2.35 |
| Depth | 2 | status & site | fixed | 1 | 8 | 7.57 |
| N | 5 | | | | | |
| Sample size | 100 | | | | | |
| **(b) Namuri/Nasue MPA (n = 8 sites total)** | | | | | | |
| Status | 2 (open, closed) | | fixed | 1 | 6 | 8.81 |
| Site | 4 | status | random | 6 | 64 | 2.63 |
| Depth | 2 | status & site | fixed | 1 | 6 | 8.81 |
| N | 5 | | | | | |
| Sample size | 80 | | | | | |

Power analysis of experimental design showed a reduction in critical F-statistic values when sites are pooled across exposure (Table 1a,b) and when higher replicates of forereef only sites are surveyed (Table 2a,b). The main improvements were an expected increase of power to detect an effect of status (crit F reduced from 12.2 to 7.57), which was the main question addressed by the original experimental design.

Based on the results of the above sets of analyses, a decision was made to survey forereef sites only in Kubulau in April-May 2009 and to increase the number of sites surveyed in closed and open areas to improve the statistical power to detect differences related to management and depth. Results from pre-2009 are reported from forereef sites only in the body text.

# Appendix 2. Power analysis to assess cost-effectiveness of experimental design

| Factor | Levels | Nesting | Fixed/ Random | Numerator | Denominator | Critical F-statistic* |
|---|---|---|---|---|---|---|
| **(a) Site and Depth as factors: Site=5 & transects=5** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 8 | 7.57 |
| Site | 5 | status | random | 8 | 80 | 2.35 |
| Depth | 2 (shallow, deep) | status x site | fixed | 10 | 80 | 2.21 |
| N | 5 | | | | | |
| Sample size | 100 | | | | | |
| **(b) Site and Depth as factors: Site=5 & transects=3** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 8 | 7.57 |
| Site | 5 | status | random | 8 | 40 | 2.53 |
| Depth | 2 (shallow, deep) | status x site | fixed | 10 | 40 | 2.39 |
| N | 3 | | | | | |
| Sample size | 60 | | | | | |
| **(c) Site and Depth as factors: Site=5 & transects=7** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 8 | 7.57 |
| Site | 5 | status | random | 8 | 120 | 2.30 |
| Depth | 2 (shallow, deep) | status x site | fixed | 10 | 120 | 2.16 |
| N | 7 | | | | | |
| Sample size | 140 | | | | | |
| **(d) Site and Depth as factors: Site=3 & transects=5** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 4 | 12.2 |
| Site | 3 | status | random | 4 | 48 | 3.05 |
| Depth | 2 (shallow, deep) | status x site | fixed | 6 | 48 | 2.67 |
| N | 5 | | | | | |
| Sample size | 60 | | | | | |
| **(e) Site and Depth as factors: Site=7 & transects=5** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 12 | 6.55 |
| Site | 7 | status | random | 12 | 112 | 2.08 |
| Depth | 2 (shallow, deep) | status x site | fixed | 14 | 112 | 2.00 |
| N | 5 | | | | | |
| Sample size | 140 | | | | | |
| **(f) Depth and Site as factors: site nested within depth** | | | | | | |
| Status | 2 (open/closed) | | fixed | 1 | 16 | 6.12 |
| Depth | 2 (shallow, deep) | status | fixed | 1 | 16 | 6.12 |
| Site | 5 | depth x site | random | 16 | 80 | 1.97 |
| N | 5 | | | | | |
| Sample size | 100 | | | | | |

* Critical F-statistic for α = 0.05

Rough survey cost estimates based on fixed daily costs for fieldwork and total number of sites can be calculated from the power design table above with the following equation:

$$SC = N / TPD * CPD + TC$$

SC: Survey costs; N: sample size (total number of transects); TPD: transects per day (can vary depending on the number of teams and boats doing the surveys); CPD: cost per day (total daily costs for the whole survey team); TC: Travel cost (total costs for the survey team to get to the study area and back).

Increasing the number of transects done per depth at each site only results in a small increase in power to detect differences related to protection while dramatically increasing costs. Increasing the number of sites surveyed with two depths surveyed at each site will improve power, however will also increase costs. Meanwhile, nesting sites within depth categories (5 transects per site at 5 sites per depth category (x2)) results in the most improved power to detect management differences without increasing costs or manpower over current sampling design (5 transects per depth, 2 depths per site (x5)).

# Appendix 3. Datasheets for Fish and Benthic (PIT) Monitoring

| FISH ABUNDANCE AND SIZE To Genera / Species | | | | | | | | | | | | | SIDE 1 | WCS 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Five 50 x 5 m transects per site. Each transect should take at least 20 minutes to survey.**

| Site Name: | | | Transect number: | | Deep/Shallow: | |
|---|---|---|---|---|---|---|
| Data recorded by: | | | Date: | | Water Temp (°C): | |
| Tide: (Rising / Full/ Falling/ Low) | | | Time Start/End: | / | Depth (m): | |

Record fish to Genera level as minimum, Species where confident.     Count all seen, in size classes.
Where species unknown record Genera "U/I # 1", "U/I # 2" etc., record identifying characteristics in notes by number.

| Degrees Certainty of Species Identification | 1: Not sure (guess)          2: Genus sure, Species uncertain          3: Genus sure, 50% sure of Species<br>4: Genus sure, could be one of two or three similar Species          5: Certain of both Genus and Species |
|---|---|

| # | Genus | Species | Degree Cert | 2 - 5 cm | 6 - 10 cm | 11 - 15 cm | 16 - 20 cm | 21 - 25 cm | 26 - 30 cm | 31 - 35 cm | 36 - 40 cm | >40 cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

| Notes on U/I species | | | | |
|---|---|---|---|---|
| # | Genera | U/I Species # | Most resembles | Characteristics / Sketch |
| | | | | |
| | | | | |
| | | | | |

## FISH ABUNDANCE AND SIZE TO GENERA / SPECIES   SIDE 2   WCS 2009

| Degrees Certainty of Species Identification | 1: Not sure (guess)   2: Genus sure, Species uncertain   3: Genus sure, 50% sure of Species | | | | | | | | | | | |
| | 4: Genus sure, could be one of two or three similar Species   5: Certain of both Genus and Species | | | | | | | | | | | |

| # | Genus | Species | Degree Cert | 2 - 5 cm | 6 - 10 cm | 11 - 15 cm | 16 - 20 cm | 21 - 25 cm | 26 - 30 cm | 31 - 35 cm | 36 - 40 cm | >40 cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | |
| 38 | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 41 | | | | | | | | | | | | |
| 42 | | | | | | | | | | | | |
| 43 | | | | | | | | | | | | |
| 44 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 46 | | | | | | | | | | | | |
| 47 | | | | | | | | | | | | |
| 48 | | | | | | | | | | | | |
| 49 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 51 | | | | | | | | | | | | |
| 52 | | | | | | | | | | | | |
| 53 | | | | | | | | | | | | |
| 54 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |

### Notes on U/I species

| # | Genera | U/I Species # | Most resembles | Characteristics / Sketch |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## BENTHIC COVER PIT LIFEFORM To Family / Genus     SIDE 1    WCS 2009

| Site Name: | | | | Transect number: | | | Deep/Shallow: | |
|---|---|---|---|---|---|---|---|---|

| Data recorded by: | | | Date: | | | Water Temp (°C): | |
|---|---|---|---|---|---|---|---|

| Tide: (Rising / Full/ Falling/ Low) | | | Time Start/End: | | / | Depth (m): | |
|---|---|---|---|---|---|---|---|

| Life-Form Categories | RC Rock (non-carbonate) | RB Rubble (0.5 – 15cm) | SD Sand (<0.5cm) | SI Silt (Very fine) | DA Dead Coral w/ Fleshy Algae | CCA Crustose Coralline Algae |
|---|---|---|---|---|---|---|

| ACB Acropora branching | ACD Acropora digitate | ACT Acropora table | ACS Acropora submassive | ACE Acropora encrusting |
|---|---|---|---|---|
| CB Coral branching | CE Coral encrusting | CF Coral foliose | CM Coral massive | CS Coral submassive | SC Soft coral |
| CMR Coral mushroom | ACC Acropora corymbose | CME Coral Millepora | CC Coral corymbose | SP Sponge | ZO Zooanthids |
| OT Other biota | AA Algal Assemblage | CA Coralline algae | HA Halimeda | MA Macroalgae | TA Turf algae |

| Complexity | 1: flat, rubbly (no vertical structure) | 2: mounding or submassive (medium amount of structure) | 3: branching and complex (high vertical and horizontal structure) |
|---|---|---|---|

| Live/Dead | L: live | D: dead | PD: part-dead | B: bleached | PB: part-bleached | DS: diseased |
|---|---|---|---|---|---|---|

| Degrees Certainty of Genus Identification | 1: Not sure (guess)   2: Family sure, Genus uncertain   3: Family sure, 50% sure of Genus <br> 4: Family sure, could be one of two or three similar Genera   5: Certain of both Family and Genus |
|---|---|

| | 0.5m – 12.5m | | | | | | 13.0m – 25.0m | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PIT (m) | Life Form | Com-plexity | Live/ Dead | Degree Cert | Genus | PIT (m) | Life Form | Com-plexity | Live/ Dead | Degree Cert | Genus |
| 0.5 | | | | | | 13.0 | | | | | |
| 1.0 | | | | | | 13.5 | | | | | |
| 1.5 | | | | | | 14.0 | | | | | |
| 2.0 | | | | | | 14.5 | | | | | |
| 2.5 | | | | | | 15.0 | | | | | |
| 3.0 | | | | | | 15.5 | | | | | |
| 3.5 | | | | | | 16.0 | | | | | |
| 4.0 | | | | | | 16.5 | | | | | |
| 4.5 | | | | | | 17.0 | | | | | |
| 5.0 | | | | | | 17.5 | | | | | |
| 5.5 | | | | | | 18.0 | | | | | |
| 6.0 | | | | | | 18.5 | | | | | |
| 6.5 | | | | | | 19.0 | | | | | |
| 7.0 | | | | | | 19.5 | | | | | |
| 7.5 | | | | | | 20.0 | | | | | |
| 8.0 | | | | | | 20.5 | | | | | |
| 8.5 | | | | | | 21.0 | | | | | |
| 9.0 | | | | | | 21.5 | | | | | |
| 9.5 | | | | | | 22.0 | | | | | |
| 10.0 | | | | | | 22.5 | | | | | |
| 10.5 | | | | | | 23.0 | | | | | |
| 11.0 | | | | | | 23.5 | | | | | |
| 11.5 | | | | | | 24.0 | | | | | |
| 12.0 | | | | | | 24.5 | | | | | |
| 12.5 | | | | | | 25.0 | | | | | |

NOTES:

| BENTHIC COVER PIT | | | | SIDE 2 | | | | | WCS 2009 |
|---|---|---|---|---|---|---|---|---|---|

| Life-Form Categories | RC Rock (non-carbonate) | | RB Rubble (0.5 – 15cm) | | SD Sand (<0.5cm) | | SI Silt (Very fine) | DA Dead Coral w/ Fleshy Algae | CCA Crustose Coralline Algae |
|---|---|---|---|---|---|---|---|---|---|
| ACB Acropora branching | | ACD Acropora digitate | | ACT Acropora table | | ACS Acropora submassive | | | ACE Acropora encrusting |
| CB Coral branching | | CE Coral encrusting | | CF Coral foliose | | CM Coral massive | CS Coral submassive | | SC Soft coral |
| CMR Coral mushroom | | ACC Acropora corymbose | | CME Coral Millepora | | CC Coral corymbose | | SP Sponge | ZO Zooanthids |
| OT Other biota | | AA Algal Assemblage | | CA Coralline algae | | HA Halimeda | | MA Macroalgae | TA Turf algae |

| Complexity | | 1: flat, rubbly (no vertical structure) | | 2: mounding or submassive (medium amount of structure) | | | 3: branching and complex (high vertical and horizontal structure) | | |
|---|---|---|---|---|---|---|---|---|---|
| Live/Dead | | L: live | D: dead | PD: part-dead | | B: bleached | PB: part-bleached | | DS: diseased |

| Degrees Certainty of Genus Identification | 1: Not sure (guess)  2: Family sure, Genus uncertain  3: Family sure, 50% sure of Genus<br>4: Family sure, could be one of two or three similar Genera  5: Certain of both Family and Genus |
|---|---|

| 25.5m – 37.5m | | | | | | 38.0m – 50.0m | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PIT (m) | Life Form | Com-plexity | Live/ Dead | Degree Cert | Genus | PIT (m) | Life Form | Com-plexity | Live/ Dead | Degree Cert | Genus |
| 25.5 | | | | | | 38.0 | | | | | |
| 26.0 | | | | | | 38.5 | | | | | |
| 26.5 | | | | | | 39.0 | | | | | |
| 27.0 | | | | | | 39.5 | | | | | |
| 27.5 | | | | | | 40.0 | | | | | |
| 28.0 | | | | | | 40.5 | | | | | |
| 28.5 | | | | | | 41.0 | | | | | |
| 29.0 | | | | | | 41.5 | | | | | |
| 29.5 | | | | | | 42.0 | | | | | |
| 30.0 | | | | | | 42.5 | | | | | |
| 30.5 | | | | | | 43.0 | | | | | |
| 31.0 | | | | | | 43.5 | | | | | |
| 31.5 | | | | | | 44.0 | | | | | |
| 32.0 | | | | | | 44.5 | | | | | |
| 32.5 | | | | | | 45.0 | | | | | |
| 33.0 | | | | | | 45.5 | | | | | |
| 33.5 | | | | | | 46.0 | | | | | |
| 34.0 | | | | | | 46.5 | | | | | |
| 34.5 | | | | | | 47.0 | | | | | |
| 35.0 | | | | | | 47.5 | | | | | |
| 35.5 | | | | | | 48.0 | | | | | |
| 36.0 | | | | | | 48.5 | | | | | |
| 36.5 | | | | | | 49.0 | | | | | |
| 37.0 | | | | | | 49.5 | | | | | |
| 37.5 | | | | | | 50.0 | | | | | |

Notes:

# Appendix 4. Fiji Fish List for Targeted Families

| Family | Genus | Species | CommonName |
|---|---|---|---|
| Acanthuridae | Acanthurus | albipectoralis | Whitefin Surgeonfish |
| Acanthuridae | Acanthurus | auranticavus | Orange Socket Surgeonfish |
| Acanthuridae | Acanthurus | bariene | Roundspot Surgeonfish |
| Acanthuridae | Acanthurus | blochii | Ringtail Surgeonfish |
| Acanthuridae | Acanthurus | dussumieri | Eyestripe Surgenfish |
| Acanthuridae | Acanthurus | fowleri | Blackspine/Fowlers Surgeonfish |
| Acanthuridae | Acanthurus | grammoptilus | Fined-lined Surgeonfish |
| Acanthuridae | Acanthurus | guttatus | Whitespotted Surgeonfish |
| Acanthuridae | Acanthurus | leucopareius | Whitebar Surgeonfish |
| Acanthuridae | Acanthurus | lineatus | Striped Surgeonfish |
| Acanthuridae | Acanthurus | maculiceps | White-freckeld Surgeonfish |
| Acanthuridae | Acanthurus | mata | Yellowmask Surgeonfish |
| Acanthuridae | Acanthurus | nigricans | Whitecheek Surgeonfish |
| Acanthuridae | Acanthurus | nigricauda | Epaulette Surgeonfish |
| Acanthuridae | Acanthurus | nigrofuscus | Brown Surgeonfish |
| Acanthuridae | Acanthurus | nigroris | Bluelined Surgeonfish |
| Acanthuridae | Acanthurus | nubilus | Dark Surgeonfish |
| Acanthuridae | Acanthurus | olivaceus | Orangeband Surgenofish |
| Acanthuridae | Acanthurus | pyroferus | Mimic Surgeonfish |
| Acanthuridae | Acanthurus | sp. | Unknown Species Surgeonfish |
| Acanthuridae | Acanthurus | thompsoni | Whitetail Surgeonfish |
| Acanthuridae | Acanthurus | triostegus | Convict Tang |
| Acanthuridae | Acanthurus | xanthopterus | Yellowfin Surgeonfish |
| Acanthuridae | Ctenochaetus | binotatus | Twospot Surgeonfish |
| Acanthuridae | Ctenochaetus | cyanocheilus | Bluelipped Bristletooth |
| Acanthuridae | Ctenochaetus | sp. | Unknown Ctenochaetus species |
| Acanthuridae | Ctenochaetus | striatus | Lined Bristletooth |
| Acanthuridae | Ctenochaetus | tominiensis | Tomini Surgeonfish |
| Acanthuridae | Naso | annulatus | Whitemargin Unicornfish |
| Acanthuridae | Naso | brachycentron | Humpback Unicornfish |
| Acanthuridae | Naso | brevirostris | Spotted Unicornfish |
| Acanthuridae | Naso | caesius | Gray Unicornfish |
| Acanthuridae | Naso | hexacanthus | Sleek Unicornfish |
| Acanthuridae | Naso | lituratus | Orangespine Unicornfish |
| Acanthuridae | Naso | lopezi | Slender Unicornfish |
| Acanthuridae | Naso | minor | Blackspine Unicornfish |
| Acanthuridae | Naso | sp. | Unknown Naso species |
| Acanthuridae | Naso | thynnoides | Barred Unicornfish |
| Acanthuridae | Naso | tonganus | Humpnose Unicornfish |
| Acanthuridae | Naso | unicornis | Bluespine Unicornfish |
| Acanthuridae | Naso | vlamingii | Bignose Unicronfish |
| Acanthuridae | Paracanthurus | hepatus | Palette Surgeonfish |
| Acanthuridae | Zebrasoma | flavescens | Yellow Tang |
| Acanthuridae | Zebrasoma | scopas | Brushtail Tang |
| Acanthuridae | Zebrasoma | sp. | Unknown Zebrasoma species |
| Acanthuridae | Zebrasoma | veliferum | Pacific Sailfin Tnag |
| Balistidae | Balistapus | sp. | Unknown Balistapus species |
| Balistidae | Balistapus | undulatus | Orange-lined triggerfish |
| Balistidae | Balistoides | conspicillum | Clown Triggerfish |
| Balistidae | Balistoides | sp. | Unknown triggerfish |

| Balistidae | Balistoides | viridescens | Titan Triggerfish |
|---|---|---|---|
| Balistidae | Canthidermis | maculatus | Spotted oceanic triggerfish |
| Balistidae | Canthidermis | sp. | Unknown Canthidermis species |
| Balistidae | Melichthys | niger | Indian Triggerfish |
| Balistidae | Melichthys | sp. | Unknown Melichthys species |
| Balistidae | Melichthys | vidua | Pinktail Triggerfish |
| Balistidae | Odonus | niger | Redtooth Triggerfish |
| Balistidae | Pseudobalistes | flavimarginatus | Yellow margin Triggerfish |
| Balistidae | Pseudobalistes | fuscus | Yellow-spotted triggerfish |
| Balistidae | Pseudobalistes | sp. | Unknown Pseudobalistes species |
| Balistidae | Rhinecanthus | aculeatus | Picasso Triggerfish |
| Balistidae | Rhinecanthus | rectangulus | Wedge-tail Triggerfish |
| Balistidae | Rhinecanthus | sp. | Unknown Rhinecanthus species |
| Balistidae | Sufflamen | bursa | Scythe Triggerfish |
| Balistidae | Sufflamen | chrysopterum | Flagtail Triggerfish |
| Balistidae | Sufflamen | fraenatum | Bridled Triggerfish |
| Balistidae | Sufflamen | sp. | Unknown Sufflamen species |
| Caesionidae | Caesio | caerulaurea | Blue and gold fusilier |
| Caesionidae | Caesio | lunaris | Lunar Fusilier |
| Caesionidae | Caesio | sp. | Unknown Caesio species |
| Caesionidae | Caesio | teres | Yellow and blueback Fusilier |
| Caesionidae | Gymnocaesio | gymnoptera | Slender fusilier |
| Caesionidae | Pterocaesio | lativittata | Wide-band Fusilier |
| Caesionidae | Pterocaesio | marri | Twinstripe Fusilier |
| Caesionidae | Pterocaesio | pisang | Ruddy Fusilier |
| Caesionidae | Pterocaesio | sp. | Unknown Pterocaesio species |
| Caesionidae | Pterocaesio | tile | Bluestreak Fusilier |
| Caesionidae | Pterocaesio | trilineata | Threestripe Fusilier |
| Carangidae | Alectis | ciliaris | African Pompano |
| Carangidae | Alectis | sp. | Unknown Alectis species |
| Carangidae | Atule | mate | Yellowtail Scad |
| Carangidae | Atule | sp. | Unknown Atule species |
| Carangidae | Carangoides | bajad | Orangespotted trevally |
| Carangidae | Carangoides | caeruleopinnatus | Coastal trevally |
| Carangidae | Carangoides | chrysophrys | Longnose trevally |
| Carangidae | Carangoides | dinema | Shadow Trevally |
| Carangidae | Carangoides | ferdau | Blue Trevally |
| Carangidae | Carangoides | fulvoguttatus | Gold-spotted Trevally |
| Carangidae | Carangoides | gymnostethus | Bludger Trevally |
| Carangidae | Carangoides | oblongus | Coachwhip Trevally |
| Carangidae | Carangoides | orthogrammus | Yellow-spotted Trevally |
| Carangidae | Carangoides | plagiotaenia | Barcheek Trevally |
| Carangidae | Carangoides | sp. | Unknown Carangoides species |
| Carangidae | Caranx | ignobilis | Giant Trevally |
| Carangidae | Caranx | melampygus | Bluefin Trevally |
| Carangidae | Caranx | papuensis | Brassy Trevally |
| Carangidae | Caranx | sexfasciatus | Bigeye Trevally |
| Carangidae | Caranx | sp. | Unknown Caranx species |
| Carangidae | Caranx | tille | Tille Trevvally |
| Carangidae | Decapterus | kurroides | Redtail Scad |
| Carangidae | Decapterus | macarellus | Mackerel Scad |
| Carangidae | Decapterus | russelli | Russell's Mackerel Scad |
| Carangidae | Decapterus | sp. | Unknown Decapterus species |
| Carangidae | Elagatis | bipinnulata | Rainbow Runner |

| Carangidae | Gnathanodon | speciosus | Golden Trevally |
|---|---|---|---|
| Carangidae | Pseudocaranx | dentex | Silver Trevally |
| Carangidae | Pseudocaranx | sp. | Unknown Pseudocaranx species |
| Carangidae | Scomberoides | lysan | Doublespotted Queenfish |
| Carangidae | Scomberoides | sp. | Unknown Scomberoides species |
| Carangidae | Scomberoides | tol | Needlescaled Queenfish |
| Carangidae | Selar | crumenophthalmus | Scads |
| Carangidae | Selar | sp. | Unknown Selar species |
| Carangidae | Seriola | rivoliana | Almaco Jack |
| Carangidae | Trachinotus | bailloni | Small spotted Dart |
| Carangidae | Trachinotus | blochii | Snubnose Pompano |
| Carangidae | Trachinotus | sp. | Unknown Trachinotus species |
| Carangidae | Uraspis | helovola | Whitetongue Jack |
| Carangidae | Uraspis | sp. | Unknown Uraspis species |
| Carcharhinidae | Carcharhinus | albimarginatus | Silvertip Shark |
| Carcharhinidae | Carcharhinus | amblyrhynchos | Gray Reef Shark |
| Carcharhinidae | Carcharhinus | leucas | Bull Shark |
| Carcharhinidae | Carcharhinus | limbatus | Blacktip Reef Shark |
| Carcharhinidae | Carcharhinus | melanopterus | Blacktip Reef Shark |
| Carcharhinidae | Carcharhinus | sp. | Unknown Carcharhinus species |
| Carcharhinidae | Galeocerdo | cuvier | Tiger Shark |
| Carcharhinidae | Negaprion | acutidens | Sicklefin lemon Shark |
| Carcharhinidae | Triaenodon | obesus | Whitetip Reef Shark |
| Chaetodontidae | Chaetodon | auriga | Threadfin Butterflyfish |
| Chaetodontidae | Chaetodon | baronessa | Eastern Triangular Butterflyfish |
| Chaetodontidae | Chaetodon | bennetti | Eclipse/Bennet's Butterflyfish |
| Chaetodontidae | Chaetodon | citrinellus | Speckled Butterflyfish |
| Chaetodontidae | Chaetodon | ephippium | Saddled Butterflyfish |
| Chaetodontidae | Chaetodon | flavirostris | Black Butterflyfish |
| Chaetodontidae | Chaetodon | kleinii | Blcklip Butterflyfish |
| Chaetodontidae | Chaetodon | lineolatus | Lined Butterflyfish |
| Chaetodontidae | Chaetodon | lunula | Raccon Butterflyfish |
| Chaetodontidae | Chaetodon | lunulatus | Oval Butterflyfish |
| Chaetodontidae | Chaetodon | melannotus | Blackback Butterflyfish |
| Chaetodontidae | Chaetodon | mertensii | Yellowback butterflyfish |
| Chaetodontidae | Chaetodon | ornatissimus | Ornate Butterflyfish |
| Chaetodontidae | Chaetodon | oxycephalus | Spot-nape Butterflyfish |
| Chaetodontidae | Chaetodon | pelewensis | Dot & Dash Butterflyfish |
| Chaetodontidae | Chaetodon | plebius | Blue-spot Butterflyfish |
| Chaetodontidae | Chaetodon | punctatofasciatus | Spot-banded Butterflyfish |
| Chaetodontidae | Chaetodon | quadrimaculatus | Four-spot Butterflyfish |
| Chaetodontidae | Chaetodon | rafflesi | Latticed Butterflyfish |
| Chaetodontidae | Chaetodon | reticulatus | Reticulated Butterflyfish |
| Chaetodontidae | Chaetodon | semeion | Dotted Butterflyfish |
| Chaetodontidae | Chaetodon | sp. | Unknown Chaetodon species |
| Chaetodontidae | Chaetodon | speculum | Mirror Butterflyfish |
| Chaetodontidae | Chaetodon | trifascialis | Chevroned Butterflyfish |
| Chaetodontidae | Chaetodon | ulietensis | Pacific Double-saddled Butterflyfish |
| Chaetodontidae | Chaetodon | unimaculatus | Teardrop Butterflyfish |
| Chaetodontidae | Chaetodon | vagabundus | Vagabond Butterflyfish |
| Chaetodontidae | Forcipiger | flavissimus | Longnose Butterflyfish |
| Chaetodontidae | Forcipiger | longirostris | Big Longnose Butterflyfish |
| Chaetodontidae | Forcipiger | sp. | Unknown Forcipiger species |
| Chaetodontidae | Hemitaurichthys | polylepis | Pyramid Butterflyfish |

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|---|---|---|---|
| Chaetodontidae | Heniochus | acuminatus | Longfin Bannerfish |
| Chaetodontidae | Heniochus | chrysostomus | Pennant Bannerfish |
| Chaetodontidae | Heniochus | monoceros | Masked Bannerfish |
| Chaetodontidae | Heniochus | singularis | Singular Bannerfish |
| Chaetodontidae | Heniochus | sp. | Unknown Heniochus species |
| Chaetodontidae | Heniochus | varius | Humphead Bannerfish |
| Chaetodontidae | Parachaetodon | ocellatus | Sixspine Butterflyfish |
| Chanidae | Chanos | chanos | Milkfish |
| Ephippidae | Platax | orbicularis | Circular Spadefish |
| Ephippidae | Platax | sp. | Unknown Platax species |
| Ephippidae | Platax | teira | Teira Batfish |
| Haemulidae | Diagramma | pictum | Painted Sweetlips |
| Haemulidae | Diagramma | sp. | Unknown Diagramma species |
| Haemulidae | Plectorhinchus | albovittatus | Giant Sweetlips |
| Haemulidae | Plectorhinchus | chaetodonoides | Many-spotted Sweetlips |
| Haemulidae | Plectorhinchus | gibbosus | Blubberlip |
| Haemulidae | Plectorhinchus | picus | Dotted Sweetlips |
| Haemulidae | Plectorhinchus | sp. | Unknown Plectorhinchus species |
| Haemulidae | Plectorhinchus | vittatus | Oriental Sweetlips |
| Kyphosidae | Kyphosus | cinerascens | Blue Seachub |
| Kyphosidae | Kyphosus | sp. | Unknown Kyphosus species |
| Kyphosidae | Kyphosus | vaigiensis | Brassy Chub |
| Labridae | Anampses | caeruleopunctatus | Bluespotted Wrasse |
| Labridae | Anampses | geographicus | Geographic Wrasse |
| Labridae | Anampses | melanurus | White-spotted Wrasse |
| Labridae | Anampses | meleagrides | Yellowtail Wrasse |
| Labridae | Anampses | neoguinaicus | New Guinea Wrasse |
| Labridae | Anampses | sp. | Unknown Anampses species |
| Labridae | Anampses | twistii | Yellow-breasted Wrasse |
| Labridae | Bodianus | anthioides | Lyretail Hogfish |
| Labridae | Bodianus | axillaris | Axilspot Hogfish |
| Labridae | Bodianus | bimaculatus | Twospot Hogfish |
| Labridae | Bodianus | diana | Diana's Hogfish |
| Labridae | Bodianus | loxozonus | Blackfin Hogfish |
| Labridae | Bodianus | mesothorax | Splitlevel Hogfish |
| Labridae | Bodianus | sp. | Unknown Bodianus species |
| Labridae | Cheilinus | chlorourus | Floral Wrasse |
| Labridae | Cheilinus | fasciatus | Redbreast Wrasse |
| Labridae | Cheilinus | oxycephalus | Snooty Wrasse |
| Labridae | Cheilinus | sp. | Unknown Cheilinus species |
| Labridae | Cheilinus | trilobatus | Tripletail Wrasse |
| Labridae | Cheilinus | undulatus | Humphead Wrasse |
| Labridae | Cheilio | inermis | Cigar Wrasse |
| Labridae | Choerodon | cyanodus | Blue Tuskfish |
| Labridae | Choerodon | jordani | Blackwedge Tuskfish |
| Labridae | Choerodon | sp. | Unknown Choerodon species |
| Labridae | Cirrhilabrus | exquisitus | Exquisite Wrasse |
| Labridae | Cirrhilabrus | marjorie | Marjorie's Wrasse |
| Labridae | Cirrhilabrus | punctatus | Dotted Wrasse |
| Labridae | Cirrhilabrus | rubrimarginatus | Redfin Wrasse |
| Labridae | Cirrhilabrus | scottorum | Redtailed Wrasse |
| Labridae | Cirrhilabrus | sp. | Unknown Cirrhilabrus species |
| Labridae | Coris | aygula | Clown coris |
| Labridae | Coris | batuensis | Batu Coris |

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|---|---|---|---|
| Labridae | Coris | dorsomacula | Spottail Coris |
| Labridae | Coris | gaimard | Yellowtail coris |
| Labridae | Coris | sp. | Unknown Coris species |
| Labridae | Cymolutes | praetextatus | Knife Razorfish |
| Labridae | Cymolutes | sp. | Unknown Cymolutes species |
| Labridae | Diproctacanthus | xanthurus | Yellowtail Tubelip |
| Labridae | Epibulus | insidiator | Slingjaw Wrasses |
| Labridae | Epibulus | sp. | Unknown Epibulus species |
| Labridae | Gomphosus | varius | Bird Wrasse |
| Labridae | Halichoeres | argus | Argus Wrasse |
| Labridae | Halichoeres | biocellatus | Red-lined Wrasse |
| Labridae | Halichoeres | hortulanus | Checkerboard Wrasse |
| Labridae | Halichoeres | margaritaceus | Pink-belly Wrasse |
| Labridae | Halichoeres | marginatus | Dusky Wrasse |
| Labridae | Halichoeres | melanurus | Tailspot Wrasse |
| Labridae | Halichoeres | nebulosus | Nebulous Wrasse |
| Labridae | Halichoeres | ornatissimus | Ornate Wrasse |
| Labridae | Halichoeres | prosopeion | Twotone Wrasse |
| Labridae | Halichoeres | scapularis | Zigzag Wrasse |
| Labridae | Halichoeres | sp. | Unknown Halichoeres species |
| Labridae | Halichoeres | trimaculatus | Threespot Wrasse |
| Labridae | Hemigymnus | fasciatus | Barred Thicklip |
| Labridae | Hemigymnus | melapterus | Blackeye Thicklip |
| Labridae | Hemigymnus | sp. | Unknown Hemigymnus species |
| Labridae | Hologymnosus | annulatus | Ring Wrasse |
| Labridae | Hologymnosus | doliatus | Pastel Ringwrasse |
| Labridae | Hologymnosus | sp. | Unknown Hologymnosus species |
| Labridae | Iniistius | pavo | Peacock Wrasse |
| Labridae | Iniistius | sp. | Unknown Iniistius species |
| Labridae | Labrichthys | unilineatus | Tubelip Wrasse |
| Labridae | Labroides | bicolor | Bicolor Cleaner Wrasse |
| Labridae | Labroides | dimidiatus | Bluestreak Cleaner Wrasse |
| Labridae | Labroides | sp. | Unknown Labroides species |
| Labridae | Labropsis | alleni | Allen's Tubelip |
| Labridae | Labropsis | australis | Micronesian Tubelip |
| Labridae | Labropsis | sp. | Unknown Labropsis species |
| Labridae | Labropsis | xanthonota | Wedge-tail Wrasse |
| Labridae | Macropharyngodon | meleagris | Blackspotted Wrasse |
| Labridae | Macropharyngodon | negrosensis | Black Wrasse |
| Labridae | Macropharyngodon | sp. | Unknown Macropharyngodon species |
| Labridae | Novaculichthys | macrolepidotus | Seagrass Wrasse |
| Labridae | Novaculichthys | sp. | Unknown Novaculichthys species |
| Labridae | Novaculichthys | taeniourus | Rockmover Wrasse |
| Labridae | Oxycheilinus | bimaculatus | Two-spot Wrasse |
| Labridae | Oxycheilinus | digrammus | Linedcheeked Wrasse |
| Labridae | Oxycheilinus | orientalis | Oriental Maori Wrasse |
| Labridae | Oxycheilinus | sp. | Unknown Oxycheilinus species |
| Labridae | Oxycheilinus | unifasciatus | Ringtail Maori Wrasse |
| Labridae | Paracheilinus | rubricaudalis | Redtail Flasherwrasse |
| Labridae | Paracheilinus | sp. | Unknown Paracheilinus species |
| Labridae | Pseudocheilinus | evanidus | Striated Wrasse |
| Labridae | Pseudocheilinus | hexataenia | Sixline Wrasse |
| Labridae | Pseudocheilinus | octotaenia | Eightstripe Wrasse |
| Labridae | Pseudocheilinus | sp. | Unknown Pseudocheilinus species |

| Labridae | Pseudocheilinus | tetrataenia | Four-Lined Wrasse |
|---|---|---|---|
| Labridae | Pseudocoris | sp. | Unknown Pseudocoris species |
| Labridae | Pseudocoris | yamashiroi | Redspot Wrasse |
| Labridae | Pseudodax | mollucanus | Chiseltooth Wrasse |
| Labridae | Pseudojuloides | cerasinus | Smalltail Wrasse |
| Labridae | Pseudojuloides | sp. | Unknown Pseudojuloides species |
| Labridae | Pteragogus | cryptus | Cryptic Wrasse |
| Labridae | Pteragogus | sp. | Unknown Pteragogus species |
| Labridae | Stethojulis | bandanensis | Redshoulder Wrasse |
| Labridae | Stethojulis | notialis | South Pacific Wrasse |
| Labridae | Stethojulis | sp. | Unknown Stethojulis |
| Labridae | Stethojulis | strigiventer | Three-line Wrasse |
| Labridae | Stethojulis | trilineata | Three-lined rainbow fish |
| Labridae | Thalassoma | amblycephalum | Two-tone Wrasse |
| Labridae | Thalassoma | hardwicke | Sixbar Wrasse |
| Labridae | Thalassoma | jansenii | Jansen's Wrasse |
| Labridae | Thalassoma | lunare | Crescent Wrasse |
| Labridae | Thalassoma | lutescens | Yellow brown Wrasse |
| Labridae | Thalassoma | purpureum | Surge Wrasse |
| Labridae | Thalassoma | quinquevittatum | Fivestripe Wrasse |
| Labridae | Thalassoma | sp. | Unknown Thalassoma species |
| Labridae | Wetmorella | albofasciata | Whitebanded Sharpnose Wrasse |
| Labridae | Wetmorella | nigropinnata | Sharpnose Wrasse |
| Labridae | Wetmorella | sp. | Unknown Wetmorella species |
| Lethrinidae | Gnathodentex | aureolineatus | Striped Large-eye Bream |
| Lethrinidae | Gnathodentex | sp. | Unknown Gnathodentex species |
| Lethrinidae | Gymnocranius | euanus | Japanese Large-eye Bream |
| Lethrinidae | Gymnocranius | grandoculis | Blue-lined large-eye Bream |
| Lethrinidae | Gymnocranius | microdon | Blue-spotted Large Eye Bream |
| Lethrinidae | Gymnocranius | sp. | Undescribed Gymnocranius species |
| Lethrinidae | Lethrinus | atkinsoni | Yellowtail Emperor |
| Lethrinidae | Lethrinus | erythracanthus | Orange-spotted Emperor |
| Lethrinidae | Lethrinus | erythropterus | Longfin Emperor |
| Lethrinidae | Lethrinus | harak | Thumbprint Emperor |
| Lethrinidae | Lethrinus | laticaudis | Grass emperor |
| Lethrinidae | Lethrinus | lentjan | Pink ear Emperor |
| Lethrinidae | Lethrinus | microdon | Smalltooth Emperor |
| Lethrinidae | Lethrinus | miniatus | Sweetlip Emperor |
| Lethrinidae | Lethrinus | nebulosus | Spangled Emperor |
| Lethrinidae | Lethrinus | obsoletus | Orange-striped Emperor |
| Lethrinidae | Lethrinus | olivaceus | Longface Emperor |
| Lethrinidae | Lethrinus | semicinctus | Black blotch Emperor |
| Lethrinidae | Lethrinus | sp. | Unknown Lethrinus species |
| Lethrinidae | Lethrinus | xanthochilus | Yellowlip Emperor |
| Lethrinidae | Monotaxis | grandoculis | Humpnose Bigeye Bream |
| Lutjanidae | Aphareus | furca | Smalltooth Jobfish |
| Lutjanidae | Aprion | virescens | Green Jobfish |
| Lutjanidae | Lutjanus | argentimaculatus | Mangrove Red Snapper |
| Lutjanidae | Lutjanus | biguttatus | Two-spot Snapper |
| Lutjanidae | Lutjanus | bohar | Red Snapper |
| Lutjanidae | Lutjanus | ehrenbergii | Blackspot Snapper |
| Lutjanidae | Lutjanus | fulviflamma | Longspot Snapper |
| Lutjanidae | Lutjanus | fulvus | Blacktail Snapper |
| Lutjanidae | Lutjanus | gibbus | Humpback Snapper |

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|---|---|---|---|
| Lutjanidae | Lutjanus | kasmira | Bluestripe Snapper |
| Lutjanidae | Lutjanus | malabaricus | Malabar blood Snapper |
| Lutjanidae | Lutjanus | monostigma | Onespot Snapper |
| Lutjanidae | Lutjanus | quinquelineatus | Five-lined Snapper |
| Lutjanidae | Lutjanus | rivulatus | Blubberlip Snapper |
| Lutjanidae | Lutjanus | russeli | Russell's Snapper |
| Lutjanidae | Lutjanus | semicinctus | Black-banded Snapper |
| Lutjanidae | Lutjanus | sp. | Unknown Lutjanus species |
| Lutjanidae | Lutjanus | timorensis | Timor Snapper |
| Lutjanidae | Macolor | macularis | Midnight Snapper |
| Lutjanidae | Macolor | niger | Black Snapper |
| Lutjanidae | Macolor | sp. | Unknown Macolor species |
| Lutjanidae | Paracaesio | sordidus | Dirty odure Snapper |
| Lutjanidae | Paracaesio | sp. | Unknown Paracaesio species |
| Lutjanidae | Paracaesio | xanthura | Yellowtail Blue Snapper |
| Lutjanidae | Pinjalo | lewisi | Slender Pinjalo |
| Lutjanidae | Pinjalo | sp. | Unknown Pinjalo species |
| Lutjanidae | Symphorichthys | spilurus | Sailfin Snapper |
| Lutjanidae | Symphorus | nematophorus | Chinamanfish |
| Mullidae | Mulloidichthys | flavolineatus | Yellowstripe Goatfish |
| Mullidae | Mulloidichthys | sp. | Unknown Mulloidichthys |
| Mullidae | Mulloidichthys | vanicolensis | Yellowfin Goatfish |
| Mullidae | Parupeneus | barberinoides | Bicolor Goatfish |
| Mullidae | Parupeneus | barberinus | Dash-dot Goatfish |
| Mullidae | Parupeneus | ciliatus | Whitesaddle Goatfish |
| Mullidae | Parupeneus | crassilabris | Doublebar Goatfish |
| Mullidae | Parupeneus | cyclostomus | Golden Goatfish |
| Mullidae | Parupeneus | heptacanthus | Cinnabar Goatfish |
| Mullidae | Parupeneus | indicus | Indian Goatfish |
| Mullidae | Parupeneus | multifasciatus | Many Bar Goatfish |
| Mullidae | Parupeneus | pleurostigma | Sidespot Goatfish |
| Mullidae | Parupeneus | sp. | Unknown Parupeneus species |
| Mullidae | Upeneus | arge | Band-tail Goatfish |
| Mullidae | Upeneus | sp. | Unknown Upeneus species |
| Mullidae | Upeneus | sulphureus | Sulphur Goatfish |
| Mullidae | Upeneus | vittatus | Yellowstriped Goatfish |
| Nemipteridae | Nemipterus | sp. | Unknown Nemipterus species |
| Nemipteridae | Nemipterus | zysron | Slender Bream |
| Nemipteridae | Pentapodus | aureofasciatus | Goldstripe Bream |
| Nemipteridae | Pentapodus | sp. | Unknown Pentapodus species |
| Nemipteridae | Scolopsis | bilineatus | Two-lined Monocle Bream |
| Nemipteridae | Scolopsis | sp. | Unknown Scolopsis species |
| Nemipteridae | Scolopsis | temporalis | Bald-spot Monocle Bream |
| Nemipteridae | Scolopsis | trilineatus | Three-lined Monocle Bream |
| Pomacanthidae | Apolemichthys | sp. | Unknown Apolemichthys species |
| Pomacanthidae | Apolemichthys | trimaculatus | Threespot Angelfish |
| Pomacanthidae | Centropyge | aurantia | Golden Angelfish |
| Pomacanthidae | Centropyge | bicolor | Bicolor Angelfish |
| Pomacanthidae | Centropyge | bispinosus | Twospine Angelfish |
| Pomacanthidae | Centropyge | flavicauda | Whitetail Angelfish |
| Pomacanthidae | Centropyge | flavissima | Lemonpeel Angelfish |
| Pomacanthidae | Centropyge | heraldi | Yellow Pygmy Angelfish |
| Pomacanthidae | Centropyge | multifaciata | Barred Angelfish |
| Pomacanthidae | Centropyge | nox | Midnight Angelfish |

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|---|---|---|---|
| Pomacanthidae | Centropyge | sp. | Unknown Centropyge species |
| Pomacanthidae | Genicanthus | melanospilos | Blackspot Angelfish |
| Pomacanthidae | Genicanthus | sp. | Unknown Genicanthus species |
| Pomacanthidae | Genicanthus | watanabei | Pinstriped Angelfish |
| Pomacanthidae | Pomacanthus | imperator | Emperor Angelfish |
| Pomacanthidae | Pomacanthus | semicirculatus | Semicircle Angelfish |
| Pomacanthidae | Pomacanthus | sp. | Unknown Pomacanthus species |
| Pomacanthidae | Pygoplites | diacanthus | Regal Angelfish |
| Priacanthidae | Heteropriacanthus | cruentatus | Glass eye |
| Priacanthidae | Priacanthus | hamrur | Moontail Bullseye |
| Priacanthidae | Priacanthus | sp. | Unknown Priacanthus species |
| Scaridae | Bolbometopon | muricatum | Bumphead Parootfish |
| Scaridae | Calotomus | sp. | Unknown Calotomus species |
| Scaridae | Calotomus | spinidens | Raggedtooth Paarotfish |
| Scaridae | Cetoscarus | bicolor | Bicolor Parrotfish |
| Scaridae | Chlorurus | bleekeri | Bleeker's Parrotfish |
| Scaridae | Chlorurus | frontalis | Tan-face Parrotfish |
| Scaridae | Chlorurus | microrhinos | Steephead Parrotfish |
| Scaridae | Chlorurus | sordidus | Bullethead Parrotfish |
| Scaridae | Chlorurus | sp. | Unknown Chlorurus species |
| Scaridae | Hipposcarus | longiceps | Pacific nose Parrotfish |
| Scaridae | Hipposcarus | sp. | Unknown Hipposcarus species |
| Scaridae | Leptoscarus | vaigiensis | Marbled Parrotfish |
| Scaridae | Scarus | altipinnis | Filament-fin Parrotfish |
| Scaridae | Scarus | chameleon | Chameleon Parrotfish |
| Scaridae | Scarus | dimidiatus | Yellow-barred Parrotfish |
| Scaridae | Scarus | forsteni | Bluepatch Parrotfish |
| Scaridae | Scarus | frenatus | Bridled Parrotfish |
| Scaridae | Scarus | ghobban | Blue-barred Parrotfish |
| Scaridae | Scarus | globiceps | Violet-lined Parrotfish |
| Scaridae | Scarus | longipinnis | Highfin Parrotfiswh |
| Scaridae | Scarus | niger | Swarthy Parrotfish |
| Scaridae | Scarus | oviceps | Dark-capped Parrotfish |
| Scaridae | Scarus | prasiognathos | Greenthroat Parrotfish |
| Scaridae | Scarus | psittacus | Palenose Parrotfish |
| Scaridae | Scarus | rivulatus | Surf Parrotfish |
| Scaridae | Scarus | rubroviolaceus | Redlip Parrotfish |
| Scaridae | Scarus | schlegeli | Yellowbar Parrotfish |
| Scaridae | Scarus | sp. | Unknown Parrotfish Species |
| Scaridae | Scarus | spinus | Greensnout Parrotfish |
| Scombridae | Acanthocybium | solandri | Wahoo |
| Scombridae | Grammatorcynus | bilineatus | Double-lined Macakerel |
| Scombridae | Grammatorcynus | sp. | Unknown Grammatorcynus species |
| Scombridae | Gymnosarda | unicolor | Dogtooth Tuna |
| Scombridae | Rastrelliger | brachysoma | Short Mackerel |
| Scombridae | Rastrelliger | kanagurta | Long-Jawed Macakerel |
| Scombridae | Rastrelliger | sp. | Unknown Rastrelliger species |
| Scombridae | Scomberomorus | commerson | Narrow Barred Spanish Macakerel |
| Scombridae | Scomberomorus | sp. | Unknown Scomberomorus species |
| Scombridae | Thunnus | albacares | Yellowfinn Tuna |
| Scombridae | Thunnus | sp. | Unknown Thunnus species |
| Serranidae | Aethaloperca | rogaa | Redmouth Grouper |
| Serranidae | Aethaloperca | sp. | Unknown Aethaloperca species |
| Serranidae | Anyperodon | leucogrammicus | Slender Grouper |

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|---|---|---|---|
| Serranidae | Cephalopholis | argus | Peacock Grouper |
| Serranidae | Cephalopholis | aurantia | Golden hind |
| Serranidae | Cephalopholis | boenak | Chocolate Hind |
| Serranidae | Cephalopholis | leopardus | Leopard Hind/ Rockcod |
| Serranidae | Cephalopholis | miniata | Coral Grouper |
| Serranidae | Cephalopholis | sexmaculata | Saddle Grouper |
| Serranidae | Cephalopholis | sonnerati | Tomato Grouper |
| Serranidae | Cephalopholis | sp. | Unknown Cephalopholis species |
| Serranidae | Cephalopholis | spiloparaea | Strawberry hind |
| Serranidae | Cephalopholis | urodeta | Flagtail Grouper |
| Serranidae | Epinephelus | areolatus | Areolate Grouper |
| Serranidae | Epinephelus | caeruleopunctatus | Whitespotted Grouper |
| Serranidae | Epinephelus | chlorostigma | Brown-spotted Grouper |
| Serranidae | Epinephelus | coioides | Orange-spotted Grouper |
| Serranidae | Epinephelus | cyanopodus | Speckled blue Grouper |
| Serranidae | Epinephelus | fasciatus | Blacktip Grouper |
| Serranidae | Epinephelus | fuscoguttatus | Brown-marbeled Grouper |
| Serranidae | Epinephelus | hexagonatus | Starspotted Grouper |
| Serranidae | Epinephelus | howlandi | Blacksaddled Grouper |
| Serranidae | Epinephelus | lanceolatus | Giant Grouper |
| Serranidae | Epinephelus | macrospilos | Snubnose Grouper |
| Serranidae | Epinephelus | maculatus | Highfin Grouper |
| Serranidae | Epinephelus | malabaricus | Malabar Grouper |
| Serranidae | Epinephelus | melanostigma | One-Blotch Grouper |
| Serranidae | Epinephelus | merra | Honeycomb Grouper |
| Serranidae | Epinephelus | miliaris | Netfin Grouper |
| Serranidae | Epinephelus | ongus | Whitestreaked Grouper |
| Serranidae | Epinephelus | polyphekadion | Camouflage Grouper |
| Serranidae | Epinephelus | socialis | Surge Grouper |
| Serranidae | Epinephelus | sp. | Unknown Epinephelus species |
| Serranidae | Epinephelus | spilotoceps | Foursaddle Grouper |
| Serranidae | Epinephelus | tauvina | Greasy Grouper |
| Serranidae | Gracila | albomarginata | Masked Grouper |
| Serranidae | Plectropomus | areolatus | Squaretail Coral Grouper |
| Serranidae | Plectropomus | laevis | Blacksaddle Coral Grouper |
| Serranidae | Plectropomus | leopardus | Leopard Coral Grouper |
| Serranidae | Plectropomus | maculatus | Spotted Coral Grouper |
| Serranidae | Plectropomus | pessuliferus | Roving Coral Grouper |
| Serranidae | Plectropomus | sp. | Unknown Plectropomus species |
| Serranidae | Variola | albimarginata | White-edged Lyretail |
| Serranidae | Variola | louti | Yellow-edged Lyretail |
| Serranidae | Variola | sp. | Unknown Variola species |
| Siganidae | Siganus | argenteus | Forktail Rabbitfish |
| Siganidae | Siganus | doliatus | Barred Rabbitfish |
| Siganidae | Siganus | guttatus | Golden Rabbitfish |
| Siganidae | Siganus | punctatissimus | Peppered spinefoot Rabbitfish |
| Siganidae | Siganus | punctatus | Gold-spotted Rabbitfish |
| Siganidae | Siganus | sp. | Unknown Siganus species |
| Siganidae | Siganus | spinus | Scribbled Rabbitfish |
| Siganidae | Siganus | stellatus | Honeycomb Rabbitfish |
| Siganidae | Siganus | uspi | Bicolor Rabbitfish |
| Siganidae | Siganus | vermiculatus | Vermiculate Rabbitfish |
| Sphyraenidae | Sphyraena | barracuda | Great Barracuda |
| Sphyraenidae | Sphyraena | flavicauda | Yellowtail Barracuda |

| Sphyraenidae | Sphyraena | forsteni | Bigeye Barracuda |
|---|---|---|---|
| Sphyraenidae | Sphyraena | jello | Pickhandle Barracuda |
| Sphyraenidae | Sphyraena | qenie | Blackfin Barracuda |
| Sphyraenidae | Sphyraena | sp. | Unknown Sphyraena species |
| Sphyrnidae | Sphyrna | lewini | Scalloped Hammerhead |
| Sphyrnidae | Sphyrna | mokarran | Great Hammerhead |
| Sphyrnidae | Sphyrna | sp. | Unknown Sphyrna species |
| Stegostomatidae | Stegastoma | fasciatum | Zebra Shark |
| Zanclidae | Zanclus | cornutus | Moorish Idol |

# Appendix 5. Coral Genera Found in Fiji

| Family | Genus | Family | Genus |
|---|---|---|---|
| Acroporidae | *Acropora* | Fungiidae (cont.) | *Heliofungia* |
| | *Anacropora* | | *Herpolitha* |
| | *Astreopora* | | *Polyphyllia* |
| | *Montipora* | | *Sandolitha* |
| | *Isopora* | | *Zoopilus* |
| | | | |
| Agariciidae | *Coeloseris* | Merulinidae | *Hydnophora* |
| | *Gardinoseris* | | *Merulina* |
| | *Leptoseris* | | *Paraclavarina* |
| | *Pachyseris* | | *Scaphophyllia* |
| | *Pavona* | | |
| | | Mussidae | *Acanthastrea* |
| Astrocoeniidae | *Stylocoeniella* | | *Blastomussa* |
| | | | *Lobophyllia* |
| Dendrophyllidae | *Turbinaria* | | *Scolmya* |
| | *Tubastrea* | | *Symphyllia* |
| | | | |
| Euphyllidae | *Euphyllia* | Oculinidae | *Galaxea* |
| | *Physogyra* | | |
| | *Plerogyra* | Pectiniidae | *Echinophyllia* |
| | | | *Mycedium* |
| Faviidae | *Barabattoia* | | *Oxypora* |
| | *Caulastrea* | | *Pectinia* |
| | *Cyphastrea* | | |
| | *Diploastrea* | Pocilloporidae | *Pocillopora* |
| | *Echinopora* | | *Seriatopora* |
| | *Favia* | | *Stylophora* |
| | *Favites* | | |
| | *Goniastrea* | Poritidae | *Alveopora* |
| | *Leptastrea* | | *Goniopora* |
| | *Leptoria* | | *Porites* |
| | *Montastrea* | | |
| | *Oulophyllia* | Siderastreidae | *Coscinaraea* |
| | *Platygyra* | | *Psammocora* |
| | *Pleisiastrea* | | |
| | | Trachyphylidae | *Trachyphyllia* |
| Fungiidae | *Podobacia* | | |
| | *Lithophyllon* | | |
| | *Cantharellus* | | |
| | *Ctenactis* | | |
| | *Cycloseris* | | |
| | *Diaseris* | | |
| | *Fungia* | | |
| | *Halomitra* | | |

List based on Lovell and McLardy (2008)