Fish diversity on tropical coral reefs

Comparing shallow and deep-water communities

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Abstract

Tropical coral reefs are among the most biologically diverse ecosystems, supporting essential ecological functions while providing income and food security for coastal populations. Reef fish communities are shaped by environmental factors such as depth, habitat structure, and trophic interactions. Tanzania's coral reefs, including those around Unguja Island, Zanzibar, are vital to local fisheries, but fishing pressure may impact fish communities across depth strata. This study examines variations in fish communities across two depth strata (shallow: ≤ 10 m and deep: > 10 m) on coral reefs around Unguja Island. It focuses on species richness, the relative abundance of the entire fish community, commercially important species, and trophic groups. Fish communities were sampled at six urban areas using baited remote underwater video systems. Depth significantly influenced fish community structure, including commercial species and trophic groups, with species contributing to these dissimilarities exhibiting greater abundance in shallow strata. Habitat factors, such as hard live coral and habitat complexity, significantly contributed to dissimilarities in fish communities across strata, although these factors themselves differed significantly between depth strata. Contrary to previous studies suggesting depth refuges for fish, this study found no evidence supporting this phenomenon. The findings highlight that depth and habitat significantly influence fish communities on coral reefs. Future studies should evaluate biomass and investigate fish communities of locally important commercial species to gain a deeper understanding of their structures. This knowledge is critical for developing sustainable management strategies to safeguard this vital resource for the communities that depend on it.

Keywords: Coral reefs, fish community structure, Baited remote underwater video (BRUV), fish diversity.

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Abbreviations

ANOSIM	Analysis of similarities
BRUV	Baited remote underwater video
LOESS	Locally estimated scatterplot smoothing
NMDS	Non-metric MultiDimensional Scaling
PERMANOVA	Permutational multivariate analysis of variance
SCUBA	Self-contained underwater breathing apparatus
SIMPER	Similarity percentage
Sp.	Species

1 Introduction

Tropical coral reefs are among the most biologically diverse ecosystems. They support a vast array of marine life and include organisms from nearly all marine phyla (Paulay 1997). In addition to their ecological importance, coral reefs provide ecosystem services such as coastal protection and food security. Many people living in regions with coral reefs are directly or indirectly dependent on these ecosystems for their livelihoods. The high productivity of coral reefs supports fishing industries, offering both food and economic benefits to local communities and nations (Burke et al. 2011). Coral reefs, as an ecosystem, depend on their inhabitants that sustain the ecosystems functional processes. There are indications that suggest biodiversity and key species are the drivers of reef functions and productivity (Brandl et al. 2019). For instance, predators on coral reefs contribute to the balance of productivity across different trophic levels and help maintain essential ecosystem functions (Grigg et al. 1984).

1.1 Drivers of marine biodiversity with focus on depth

Marine biodiversity is influenced by a complex interplay of factors, including biogeography, depth, water temperature, habitat productivity and habitat type (Costello & Chaudhary 2017). Among these, habitat type and depth play significant roles in influencing community structure and species richness. In shallow waters, phototrophic primary producers such as epilithic algae and symbiotic algae within hard coral tissues contribute to higher productivity as sunlight penetrates the water column, supporting a biodiverse community (Klumpp & McKinnon, 1989; LaJeunesse, 2020). However, species richness tends to decline with increasing depth (Costello & Chaudhary, 2017; Pinheiro et al., 2023).

Variations in depth and regional physical factors give rise to distinct habitat types, which are partly characterized by the dominance of different biological substratum covers (Ceccarelli et al. 2023; Walker et al. 2024). Interactions between species and their environment result in ecosystems where species are closely associated with specific habitat types, contributing to differences in relative abundances, biodiversity, and population densities (Ceccarelli et al. 2023; Bell & Galzin 1984; Houk & Musburger 2013). Another factor that characterizes a habitat is habitat complexity, which arises from both physical structures, such as rock formations, and biological traits, like coral growth. These complex structures create microhabitats that provide refuge for fish, offering protection from predators and environmental stressors (Friedlander et al. 2003; Hall & Kingsford 2021), and significantly enhance species richness and fish abundance on coral reefs (Bell & Galzin 1984; Darling et al. 2017).

Abiotic factors such as temperature, oxygen levels, salinity, pressure, wave exposure, visibility, water quality, and anthropogenic disturbances vary with depth and directly influence fish communities (Friedlander et al. 2003; Fulton et al. 2001; Nhat et al. 2024; Takarina et al. 2022). Depth can influence fish both directly and indirectly, with indirect effects involving an interplay of physical and biological factors that are themselves influenced by depth. An example of an indirect effect is when temperature affects aerobic metabolic processes that depend on oxygen. Near the surface, higher water temperatures reduce oxygen availability, impacting the metabolic functions of coral reef fish (Rummer et al. 2013). Consequently, temperature influences growth and body size, as larger individuals expend more energy to sustain their body mass, leaving less energy for growth or reproduction (Morais & Bellwood 2018). When reproduction is affected, fish community structures may also be altered (Morais & Bellwood 2020). This study tested the effects of temperature, wave height, weather, tide, and visibility, but did not include the other factors mentioned. Instead, it focused on depth as a grouping factor.

1.2 Trophic level interactions

A species' placement within the food web of an ecosystem, compared to other species, conveys information about its ecological interactions within that system. Species that occupy relatively similar positions in the food web can be grouped together to represent different levels of interaction, known as trophic levels (Elton 1927). In Christensen and Pauly's (1993) book *Trophic Models of Aquatic Ecosystems* this relationship is modeled by analyzing the diets of species to assign ranks within the food web. Primary producers are ranked as one, primary consumers as rank two, and species higher up in the food web receive higher ranks. Estimation of a species' rank is performed by calculating the mean trophic level of its diet and adding one to the result.

Examining trophic levels and food webs on a reef provides valuable insights into fish community structures and their functional groups. Populations of lower trophic level species are often regulated by predation pressure from higher trophic levels. Conversely, populations of higher trophic level species can be limited by the availability of lower trophic level organisms, including primary producers (Bierwagen et al. 2018). These dynamics influence fish size, biomass, and behavior on coral reefs (Catano et al. 2015). Additionally, human pressure on coral reefs exerts significant influence on trophic interactions, affecting abundances, fish size and fish community structure (Houk et al. 2013; Ferretti et al. 2010; Williams et al. 2010).

1.3 Fisheries and previous research on Unguja Island

1.3.1 Coastal fishieries in Tanzania

Tanzania has one of the highest fish species diversities on coral reefs in the Western Indian Ocean (Samoilys et al. 2022), with a total of 961 marine fish species recorded on FishBase at the time of this study (Froese & Pauly 2024). Coastal communities in Tanzania mainland rely on fishing as their main source of income, and it also provides resources for household consumption (Ulega et al. 2022). A fifth of Zanzibar's populations income is dependent on fisheries (ZIPA n.d.). Majority of fishing in Tanzania takes place in the coastal seascape, e.g. coral reefs (Ulega et al. 2022). There's an increasing demand for fish from tourism which adds pressure on the local ecosystems (ZIPA n.d.).

1.3.2 Depth as a refuge from fishing in East Africa

Previous research in East Africa has indicated fishing as a stressor on fish communities and emphasized the importance of healthy fish communities for people reliant on them (McClanahan 2019; Staehr et al. 2018). A study by Tyler et al. (2009) on Unguja and Pemba Island, Tanzania, indicated that deeper depths (> 7 m) provide a refuge for coral reef fish impacted by fishing. The study classified fish as either commercial or non-commercial species. On fished reefs, commercial species showed increased relative abundance and species richness with depth. However, when all fish were included in the analysis, overall species richness decreased with depth, suggesting effects of fishing pressure on commercial species. Although the study by Tyler et al. (2009) was limited to a maximum depth of 15 m, Osuka et al. (2022) observed a similar depth refuge effect among predatory reef species on Pemba Island. Their study focused exclusively on predatory fish, noting that this category is under fishing pressure. Using a different approach and sampling down to 47 meters, Osuka et al. found that most predatory reef fish species were observed at depths greater than 20 meters, suggesting fishing pressure and ontogenetic shift as the explanation for their results. Depth refuge may contribute to variations across depth gradients, but these patterns can differ between reefs and among species, with some species exhibiting higher abundances in shallow habitats (Jankowski et al. 2015). Similarly, a study from the Red Sea documented a decline in abundance with increasing depth, alongside a peak in species richness at 30 m

(Brokovich et al. 2008). A more detailed examination of fish communities across depths is needed to assess differences in relative abundance and better understand the factors driving these patterns.

1.4 Objective

The aim of this study is to explore variations in fish communities on coral reefs across different depths, focusing on species richness, relative abundance, trophic groups and commercial species. Building on the work of Tyler et al. (2009), this research examines fish communities around Unguja Island. While Tyler et al. limited their study to depths of 15 m, this research extends the depth range by employing the same sampling method as Osuka et al. (2022), to determine if similar patterns emerge at greater depths. Furthermore, this study investigates the potential influence of depth on the distribution of trophic groups, specifically testing whether species at higher trophic levels are more abundant in deeper habitats, as suggested by Osuka et al. (2022). I hypothesize that fish communities will vary between shallow and deep strata. Building on the findings of Tyler et al. and Osuka et al., I expect species richness and relative abundance to be lower in deeper habitats compared to shallow ones, except for commercial species and those at higher trophic levels, which are likely to show greater richness and abundance in deeper habitats. Finally, this study also examines environmental variables, such as live hard coral cover and habitat complexity, to assess their impact on species richness and fish abundance.

2 Materials and methods

2.1 Baited remote underwater video

Baited Remote Underwater Video (BRUV) was employed to investigate fish communities at various depths around Unguja Island. It is a non-invasive method for sampling fish community data and can be applied in a standardized way to ensure comparability across studies. Moreover, BRUV sampling is not limited by depth and can be deployed for extended periods of time to examine both shallow and deep sites (Langlois et al. 2020). Use of bait attracts fish within higher trophic classes but does not reduce the abundance of species in lower trophic classes (Harvey et al. 2007). Although bait can bias the presence of predatory fish, BRUV has shown promising results for statistical analyses compared to other methods (Harvey et al. 2007; Schramm, 2020). Additionally, larger individuals attracted by the bait do not significantly influence the abundance in the fish community (Coghlan et al. 2017). To asses potential bait bias in my study, I conducted seven paired control samples to examine the influence of bait on the relative abundance of fish communities and trophic groups.

Stereo BRUV (collapsible system from SeaGIS) was used with GoPro Hero 9 Black cameras. Settings used for recording were following: Wide angle lens with a resoulution of 1080p and 24 frames per second. Cameras were calibrated before and after the sample period using the software CAL. Different camera rig frames were built to attach and place the BRUV in the water. The first frame (Figure 1a) was used for 37 samples and built of rebar with black paint. Its dimensions were 125x70x40 cm, and it had an estimated weight of 60-70 kg, which made it difficult to handle. A secondary frame was designed to ease the sample collection process. The second frame (Figure 1b) was used for 15 samples, built of steel, with an estimated weight of 5 kg and dimensions of 125x70x30 cm. A rope, marked with a knot every meter, was attached to the frames and connected to a buoy to mark the drop location. A secondary buoy was tied to the end of the rope to minimize the risk of losing sight of the initial buoy during tidal change. A steel bait stick was placed at the center of each frame, extending 1 m from the midpoint between the cameras on the first frame and 1.1 m on the second frame. A meshed bait bag was attached in the end of the bait stick. Approximately 20 kg of rebar weights were attached to the second frame before deployment to ensure stability in the water. Additionally, both frames were equipped with a water temperature data logger (Onset MX2203 HOBO TidbiT MX 400) and with an additional bottom-facing GoPro Hero Session camera to film the deployment site.

(a) First frame

(b) Second frame

Figure 1: Baited remote underwater video (BRUV) frames used for sampling. Figure a) showing the first heavier frame and figure b) showing the second lighter frame

2.2 Study area

Data collection was conducted on Unguja Island, Tanzania, across six urban areas to provide a comprehensive representation of fish communities (Figure 2). The selected urban areas were Stone Town (6°09'54.2"S 39°11'51.0"E), Nungwi (5°43'32.8"S 39°17'52.4"E), Uroa (6°05'52.8"S 39°25'30.8"E), Jambiani (6°19'11.5"S 39°32'50.5"E), Kizimkazi (6°27'01.6"S 39°28'14.2"E) and Fumba (6°18'57.9"S 39°17'11.1"E). Sampling locations within these areas were strategically selected based on the presence of coral reefs in both deep and shallow waters, as well as accessibility and logistical feasibility.

In Stone Town, sampling was conducted at Changu Island, Bawe Island, and Chumbe Island. In Fumba, locations included Ukombe Island, Kwale Island, and Fumba itself. Nungwi comprised sampling at Nungwi, Tumbatu Island and Mnemba Island, while Jambiani was divided into Jambiani and Paje. Kizimkazi and Uroa each consisted of a single sampling location. Notably, Chumbe was a protected no-take zone, distinguishing it from the other locations.

The study took place between mid- February to mid-April, coinciding with a seasonal shift in monsoon winds—from northeasterly winds until March to southeasterly winds starting in April (RGoZ, 2023). Water temperatures in the Tanzanian shelf region are influenced by seasonal changes within the upper 40 m of the water column, with the thermocline depth having an annual mean range of 70-80 m (Manyilizu, 2022). During the the study period, surface water temperatures were expected to reach their annual peak which ranges from 29°C to 31°C (RGoZ 2023).

Unguja Island is located on the continental shelf and the water depths differ around the island. The channel between Unguja Island and mainland Tanzania reaches depths up to 65 m, while the east coast of Unguja Island continues down to 200 m on the continental shelf (RGoZ 2023).

A total of 52 samples were collected, including 7 control samples without any bait, and were divided into location clusters (Figure 2). However, due to limited information on the locations of coral reefs at greater depths, sample sites were chosen with assistance from local fishers. This introduced a selection bias, as the sites were based on areas used by fishers rather than being randomly selected. Before deploying the BRUV, I snorkeled and freedived to confirm the presence of a coral reef at depth and to ensure the location was suitable for deployment, minimizing the risk of coral damage. In absence of visual confirmation of a coral reef, audible clues such as fish noise were used to presume the proximity of a nearby reef. Sample sites were spaced with a minimum distance of 350 m to reduce the risk of documenting

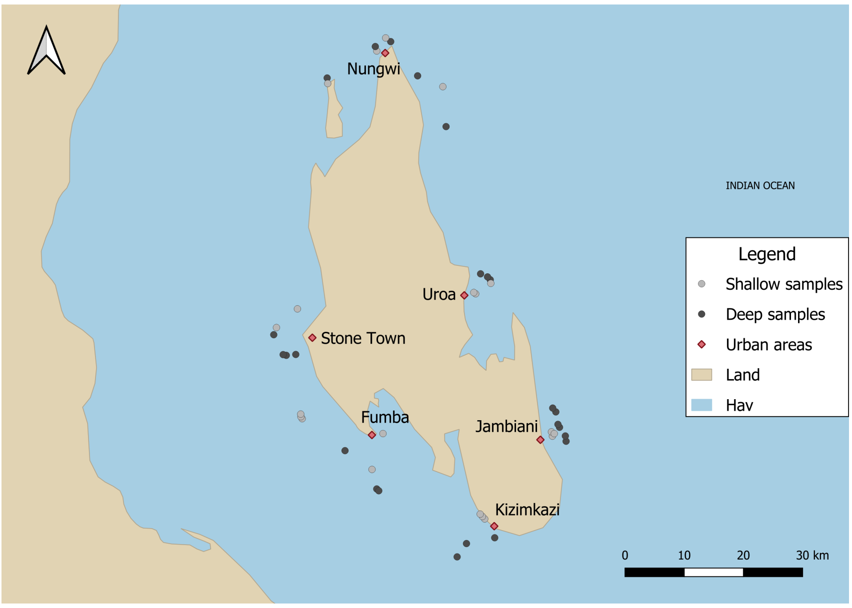


Figure 2: Map of Unguja Island, Tanzania, showing sample sites around the island, excluding control samples. The legend identifies the different points marked on the map. Vector layers for the map were sourced from https://www.naturalearthdata.com/.

same individuals within the same area (Langlois et al. 2020). Samples were divided into two strata: shallow ($\leq$ 10 m) and deep ($>$ 10 m), exceeding the depth limit (7 m) of fishing pressure effect presented by Tyler et al. (2009). The choice of the 10 m limit is explained by deeper sample depth in this study compared to Tyler et al. (2009). The distribution between depth strata consisted of 20 shallow and 24 deep samples collected around Unguja Island, near selected urban areas. One shallow sample was excluded from the analysis because of its proximity to other samples in the area, reducing the risk of overlap and registering same individuals. In addition to the 44 samples, 3 control samples were collected from the shallow sites and 4 from deep sites to account for the effects of bait.

2.3 Bait

All samples (51), except for two in the northern part of Uguja Island, used bait from the *Dorosomatidae* family. The exception baits were from the *Carangidae* family and were used because the fish of the *Dorosomatidae* family were scarce in Nungwi. Both families are oily fish suited for BRUV sampling (Dorman et al. 2012; Frose & Pauly 2024). Bait availability differed across locations so it was occasionally purchased and frozen to ensure standardization of bait. The bait was prepared by cutting the fish into 3 cm pieces, which were put into a mesh bag. Every mesh bag contained 800 ± 200 g of bait.

2.4 Sample method

Before deploying the BRUV in the water, the following procedures were followed. Recording was initiated on stereo cameras, the bottom-facing camera, and the temperature data logger. After deploying the BRUV, I snorkeled to ensure that the rig was in an upright position and tightened the attached rope to the buoy until the rope was vertical to the frame. This allowed me to mark the length of the rope, which indicated the depth of deployment. The knots on the rope were counted from the water surface until no longer visible for estimation of the visibility in the water. Upon returning to the boat, time and GPS-coordinates were documented and the boat was moved away from the deployment site. Weather conditions were documented by selecting from predefined categories: sunny, mostly sunny, mostly cloudy, cloudy, and rainy. Similarly, water conditions were categorized as calm (0 m), small waves (< 0.5 m), medium waves ($0.5 - 1$ m), or big waves (> 1 m). The BRUV recorded 35 minutes at each sample site, during which habitat data was collected. After 35 minute recording period, the BRUV was retrieved, and depth documented by counting the knots between the bouy and the BRUV.

2.5 Habitat categorization

Habitat categorization was carried out using two methods: one for all samples and one only for shallow samples. The method for shallow samples involved data collection by snorkeling, which was used to ensure precision for the other method. Habitat categorization for all samples was performed by estimating substrate cover from the collected video footage. This approach was chosen to maintain consistency across all samples, as deep samples were limited by the depth restrictions of snorkeling. Both methods employed the same categorization and measurement approach, but differed in the data collection and analysis methods used.

Habitat categorization for shallow samples was performed on sites shallower than 10 m. Ten 1 m^2 quadrats were randomly placed in the area surrounding the deployed BRUV, maintaining a minimum distance of 10 m from the BRUV to minimize potential disturbances to fish behavior. Pictures of the quadrat were taken with a GoPro Hero Session camera to analyze the percentage of substratum cover. Substrate cover was categorized by: soft coral, sponges, macroalgaes, seagrass, sand, hard substrate, rubble, and hard live coral. Structural complexity was estimated in each quadrate on a scale 0-5, where $0 =$ no vertical relief, $1 =$ low vertical relief (< 10 cm), $2 =$ some vertical relief ($11 - 30$ cm), $3 =$ moderate vertical relief ($31 - 60$ cm), $4 =$ high vertical relief ($61 - 100$ cm), and $5 =$ very high vertical relief (> 100 cm), following the method of Polunin & Roberts (1993) and van Lier et al. (2018). An average value for substratum cover and structural complexity was calculated for each sample site. Habitat categorization for all samples followed a similar approach; however, instead of using vertical photos from quadrats, a horizontal view of the area in front of the BRUV was analyzed. For BRUV footage, averages were not calculated, as categorization was based on a single image.

2.6 Video data analysis

The video data collected was analyzed using the software EventMeasure (SeaGIS), where fish were identified to the lowest possible taxonomic level using the description from FishBase (Frose & Pauly 2024) and documentation from Fricke et al (2024). The maximum number of individuals of each species observed in a single video frame (MaxN) was recorded to estimate relative abundance per species within the fish community. Due to a technical issue with the camera settings, stereo BRUV was not utilized for fish measurements. The first 5 minutes after the BRUV touched the bottom were excluded from the analysis to minimize potential disturbance effects on fish behavior, followed by 30 minutes of video analysis. All individuals were registered in the left camera except for one sample where the right camera was used, because of limited view in the left camera.

Species trophic levels and commercial status were assigned using data from FishBase (Frose & Pauly 2024). For individuals identified only to the genus level, average trophic levels were calculated based on species from the same genus recorded in BRUV samples. Trophic levels were classified into four categories following Graham et al. (2017): low ($2-2.5$), intermediate ($2.5-3.5$), high ($3.5-4$) and top trophic position ($4-4.5$). Low trophic level species primarily feed on primary producers, while species at the top trophic level are the apex predators of the ecosystem. For full classification of commercial status and trophic levels for identified species, refer to Appendix A.

2.7 Data analysis

2.7.1 Fish community

Data analyses were performed in R (R Core Team 2023), with multidimensional analyses from vegan package (Oksanen et al. 2022). The term 'fish community' in these analyses refers to the assemblage of fish species present within a given sample. This includes the examination of relative abundance, which compares the number of individuals of a particular species in one sample with the number of the same species in another. Fish community analyses included all fish identified to the species or genus level. Schools of fish containing potentially mixed species were assumed to consist of a single species for consistency. Fish community data (Appendix B) was transformed using the Hellinger transformation. Rare species, defined as those observed in only one sample or with fewer than three individuals across the entire dataset, were excluded from all multivariate analyses to minimize their influence. All fish community analyses involving habitat data used data derived from BRUV footage. Additionally, a rarefaction curve was created to visualize the accumulation of species richness over the number of BRUV deployments, assessing whether shallow and deep sites had a sufficient number of samples to adequately represent the fish communities at each depth.

Dissimilarities between communities across shallow and deep habitats were visualized using Non-metric MultiDimensional Scaling (NMDS). Permutational multivariate analysis of variance (PERMANOVA), with location as a stratification factor and 1000 permutations, was used to assess the effects of depth strata, hard live coral cover, habitat complexity, weather, water conditions, visibility, tide and temperature on fish community variation. PERMANOVA is sensitive to heterogeneity in group dispersions (Anderson 2008). To assess the assumption of homogeneity, a beta dispersion test was conducted. When significant heterogeneity was detected, Analysis of Similarities (ANOSIM) was conducted to provide additional support for significant PERMANOVA results. Lastly, a Similarity Percentage Analysis (SIMPER) was used to identify the taxa contributing most to the dissimilarities in relative abundance between groups. A permutation test was applied in the SIMPER analysis to assess whether the species contributions to dissimilarity in relative abundance were consistent across strata. Specifically, this analysis identified whether the species contributing most to the dissimilarity were more abundant in the shallow or deep strata. Similarly, PERMANOVA with location strata and beta dispersion was performed to compare commercial fish communities and trophic groups between shallow and deep strata. A SIMPER analysis assessed potential drivers of dissimilarity in these datasets.

A Wilcoxon rank sum test or a t-test, depending on the normality of the data, was used to compare species richness and total species abundance for both the entire fish community and the commercial fish community across depth strata. Additionally, the abundances of trophic groups, transformed using the Hellinger transformation, were compared across depth strata using the same tests.

To assess the influence of bait on species' relative abundance and potential biases toward species in higher trophic levels, PERMANOVA analyses were conducted on baited and non-baited samples. These analyses evaluated relative abundances at the genus and family levels, as well as among trophic groups. To reduce the impact of location variance, baited and non-baited samples were paired within the same location. However, the sample size for control samples was relatively small, limiting the number of permutations to 95 for genus, 191 for family, and 95 for trophic groups.

2.7.2 Habitat

Habitat categorization methods were compared using a Wilcoxon signed-rank test to evaluate differences in habitat estimates across methods (Appendix C and D). Differences in substrate cover and complexity across depths were also assessed using Wilcoxon signed-rank tests on BRUV footage habitat data. The correlation between species richness, total abundance, and habitat variables (hard live coral cover and habitat complexity) was tested using Kendall's tau correlation on the on the complete dataset, with shallow and deep samples combined. The relationships between these variables were visualized using locally estimated scatterplot smoothing (LOESS), with a regression line and 95% confidence interval.

3 Results

The results of this study are presented in five sections: (1) Sample effort, (2) depth's influence on whole fish communities, (3) depth's influence on commercial fish communities, (4) depth's influence on trophic groups, and (5) habitat differences and their impact on fish communities. Depth significantly influenced fish communities, including commercial fish and trophic groups. Fish communities exhibited greater variance in relative abundance in the deep strata, while the shallow strata showed more homogeneous patterns. Consistent dissimilarities were primarily driven by species more abundant in shallow stratum, both in overall and commercially important fish communities. Moreover, differences in trophic groups between depth strata were primarily driven by species from intermediate trophic level, which were also more abundant in shallow waters. However, when the impact of schooling species was excluded, the low-class trophic group was the only one to show a significant difference between depth strata. In contrast, fish communities in paired control samples (baited and non-baited) did not differ significantly (Appendix E). Habitat factors, including hard live coral cover and habitat complexity, which were higher in both cover ratio and structural complexity in shallow habitats, contributed to the differences in fish communities between shallow and deep strata. These factors were positively correlated with species richness and total relative abundance.

Habitat categorization revealed significant differences in the estimation of hard substrate, sponges, and habitat complexity between snorkeling and BRUV methods. Furthermore, significant differences were observed in seagrass, rubble, hard live coral, and habitat complexity between shallow and deep samples in BRUV footage. Weather, water conditions, visibility, tide, and temperature did not significantly affect dissimilarities between shallow and deep fish communities (PERMANOVA and ANOSIM). Full site data can be found in Appendix F and G.

3.1 Sample effort

A total of 237 species and 124 genera across 51 families were documented from 51 BRUV deployment samples. Fish communities from both deep and shallow depths were adequately sampled, as shown in Figure 3. The species richness accumulation curves begin to plateau after 20 shallow samples and 24 deep samples, but a complete leveling off has not yet been achieved, indicating additional sampling might capture more species. On average, 9 individuals per sample were unidentified and not included in the analyses.

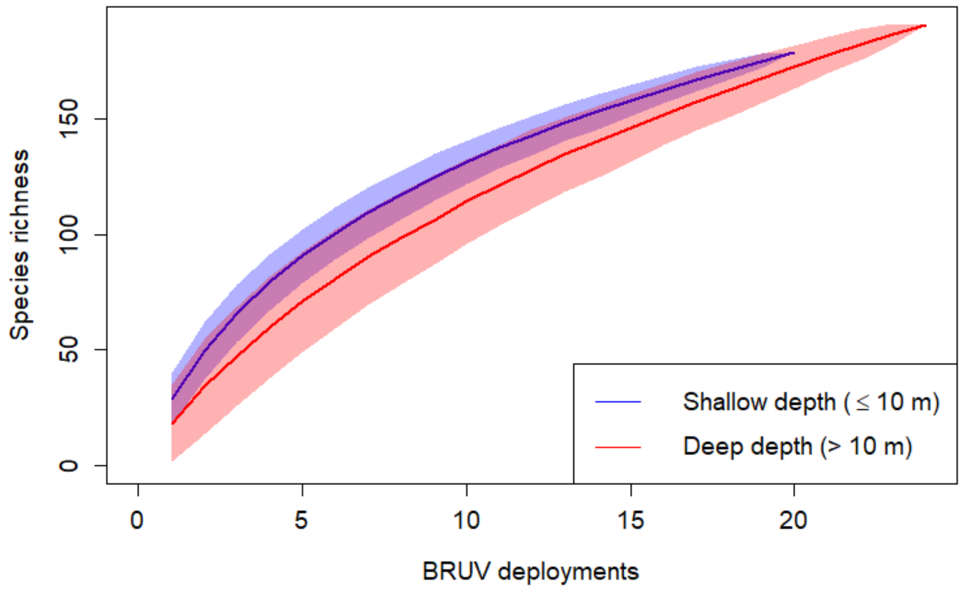


Figure 3: Species richness rarefaction curve with 95% confidence intervals based on 1000 permutations. Blue represents shallow samples, and red represents deep samples. The shaded areas in corresponding colors indicate the confidence intervals.

3.2 Depth contributes to differences in fish communities

Depth was a significant factor contributing to dissimilarities between fish communities in shallow and deep strata (PERMANOVA, $Df = 1, R^2 = 0.07602; F = 3.2911; p < 0.001$). Fish communities at deep sites exhibited greater dissimilarity than fish communities at shallow sites, and both depths showed an overlap in their communities (Figure 4). Species richness did not differ significantly between depth but exhibited greater variance in the deep strata (Figure 5a). The total abundance of all individuals identified at the genus level significantly differed between depth strata (Wilcoxon rank sum test, $W = 141334, p = 0.002$). Deep habitats exhibited greater variance and higher maximum abundances compared to shallow habitats, while shallow habitats had a higher median value (Figure 5b).

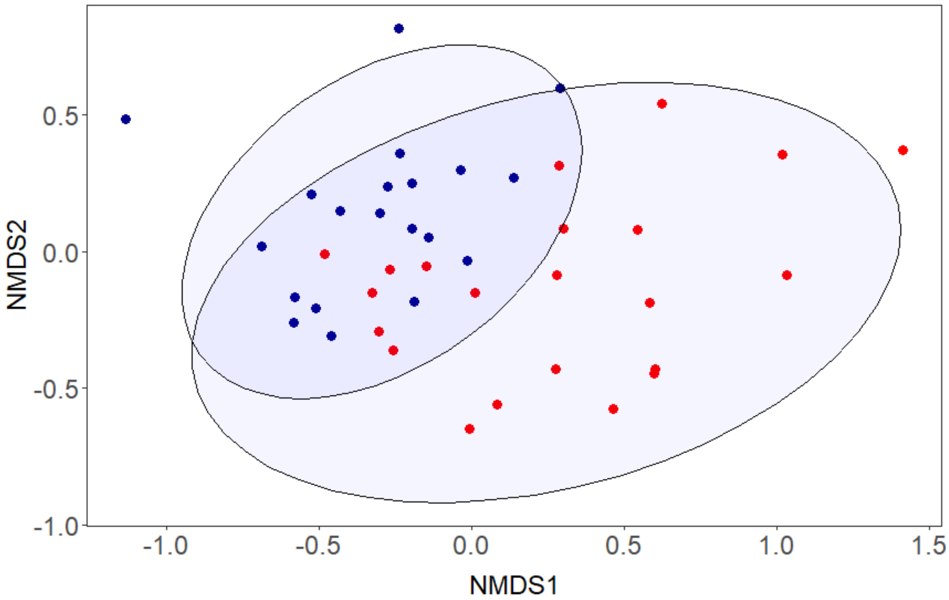
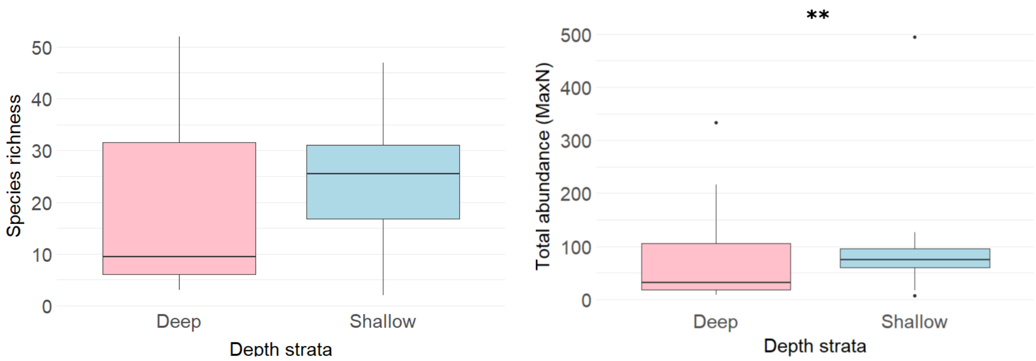


Figure 4: Non-metric multidimensional scaling plot illustrating fish communities across shallow (blue) and deep (red) samples. Ellipses represent 95% confidence intervals around the group centroids, highlighting the degree of overlap between depth strata.



(a) Species richness (b) Total relative abundance (MaxN)

Figure 5: Boxplots of a) species richness and b) total relative abundance of fish communities across shallow (light blue) and deep (pink) strata. The box represents the interquartile range (IQR, from the first to the third quartile), with the median indicated by the black line. Whiskers extend to the minimum and maximum values within 1.5 times the IQR, and dots outside the whiskers represent outliers. Significant differences between the deep and shallow strata are represented by two asterisks (**)($p < 0.01$).

Table 1 presents the top ten significant results from the SIMPER analysis on fish communities, highlighting taxa that consistently contributed more to dissimilarities in relative abundance from a specific stratum. Although non-significant taxa also contributed to dissimilarities in relative abundance, their contribution across strata did not differ significantly. For the full set of SIMPER results, refer to Appendix H. The analysis revealed that taxa consistently contributing to dissimilarities were primarily from the shallow stratum, which exhibited greater abundances.

Table 1: The top ten significant results of the similarity percentage (SIMPER) analysis, detailing the contributions of individual taxa to the dissimilarity in abundance in fish communities across shallow and deep strata.

Taxon	Average shallow abundance	Average deep abundance	Dissimilarity contribution (%)
Thalassoma hebraicum	0.12	0.01	2.01
Lutjanus fulviflamma	0.09	0.02	1.70
Acanthurus sp.	0.10	0.01	1.58
Gomphosus caeruleus	0.09	0.02	1.50
Ctenochaetus sp.	0.09	0.03	1.40
Centropyge multispinis	0.09	0.03	1.33
Thalassoma sp.	0.07	0.01	1.33
Scarus ghobban	0.09	0.01	1.32
Chaetodon trifasciatus	0.08	0.03	1.17
Hipposcarus harid	0.08	0.00	1.12

3.3 Depth affects commercial fish communities

Depth significantly contributed to dissimilarities between commercial fish communities in shallow and deep strata (PERMANOVA, $Df = 1, R^2 = 0.06443; F = 2.6856; p < 0.001$). The shallow communities completely overlapped deep communities, although deep communities exhibited greater dissimilarity (Figure 6). Similarly to the total fish community, species richness did not differ significantly between depths in commercial fish communities, and the deep strata exhibited greater variation compared to the shallow strata (Figure 7a). Furthermore, the total abundance of commercial species differed significantly between deep and shallow habitats (Wilcoxon rank sum test, $W = 85611, p < 0.001$). Shallow habitats exhibited a greater median value, while deep habitats displayed higher variance and maximum values compared to shallow habitats (Figure 7b).

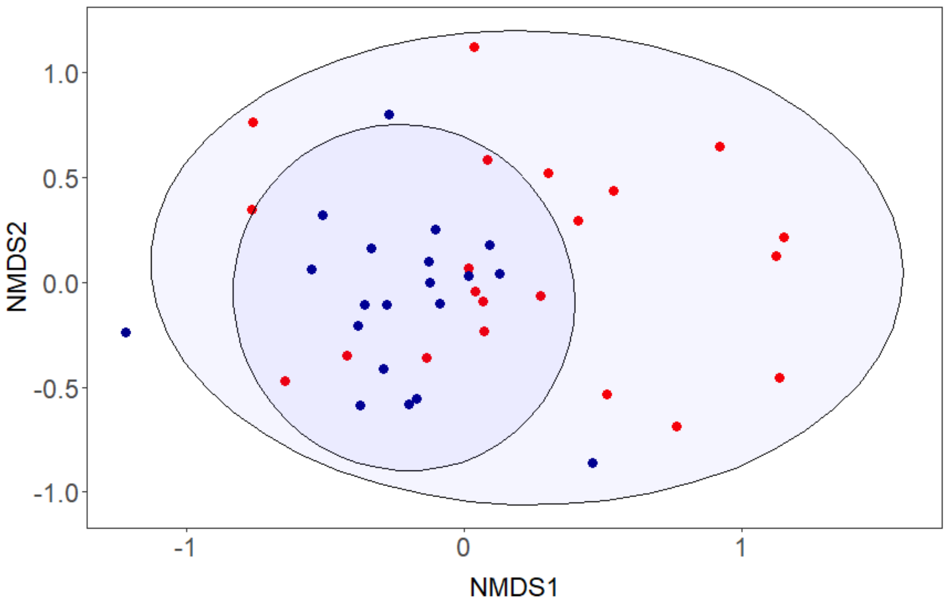
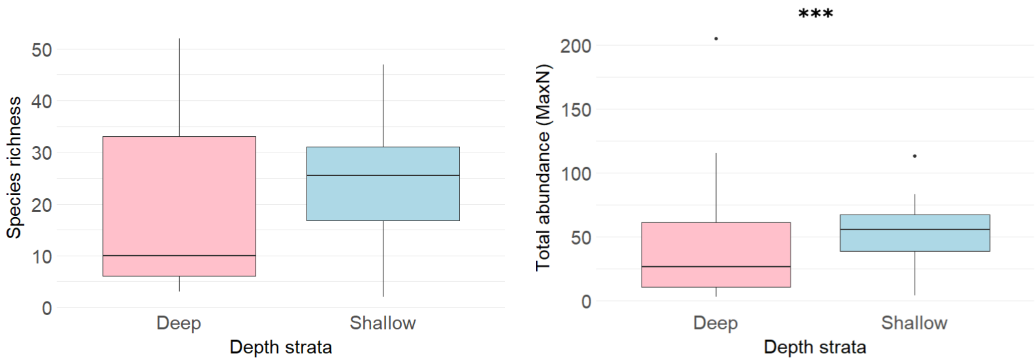


Figure 6: Non-metric multidimensional scaling plot illustrating fish communities across shallow (blue) and deep (red) samples. Ellipses represent 95% confidence intervals around the group centroids, highlighting the degree of overlap between depth strata.



(a) Species richness (b) Total relative abundance (MaxN)

Figure 7: Boxplots of a) species richness and b) total relative abundance of commercial fish communities across shallow (light blue) and deep (pink) strata. The box represents the interquartile range (IQR, from the first to the third quartile), with the median indicated by the black line. Whiskers extend to the minimum and maximum values within 1.5 times the IQR, and dots outside the whiskers represent outliers. Significant differences between the deep and shallow strata are represented by three asterisks (***)($p < 0.001$).

Table 2 presents the top ten significant results from the SIMPER analysis on commercial fish communities, highlighting species that consistently contributed more to dissimilarities in relative abundance from a specific stratum. Although non-significant species also contributed to dissimilarities in relative abundance, their contribution across strata did not differ significantly. For the full set of SIMPER results on commercial fish communities, refer to Appendix I. The majority of species listed in the table also appeared in the SIMPER analysis of the total fish community (Table 1), with similar patterns observed. Species that consistently contributed to dissimilarities were primarily from the shallow stratum, where they exhibited greater abundances.

Table 2: The top ten significant results of the similarity percentage (SIMPER), detailing the contributions of commercial species to the dissimilarity in abundance in fish communities across shallow and deep strata.

Species	Average shallow abundance	Average deep abundance	Dissimilarity contribution (%)
Thalassoma hebraicum	0.16	0.01	2.99
Lutjanus fulviflamma	0.11	0.03	2.35
Gomphosus caeruleus	0.12	0.02	2.28
Centropyge multispinis	0.11	0.04	1.83
Scarus ghobban	0.10	0.01	1.78
Chaetodon trifasciatus	0.10	0.04	1.61
Hipposcarus harid	0.10	0.00	1.46
Chlorurus sordidus	0.08	0.03	1.46
Cheilio inermis	0.08	0.02	1.46
Chaetodon lunula	0.07	0.02	1.18

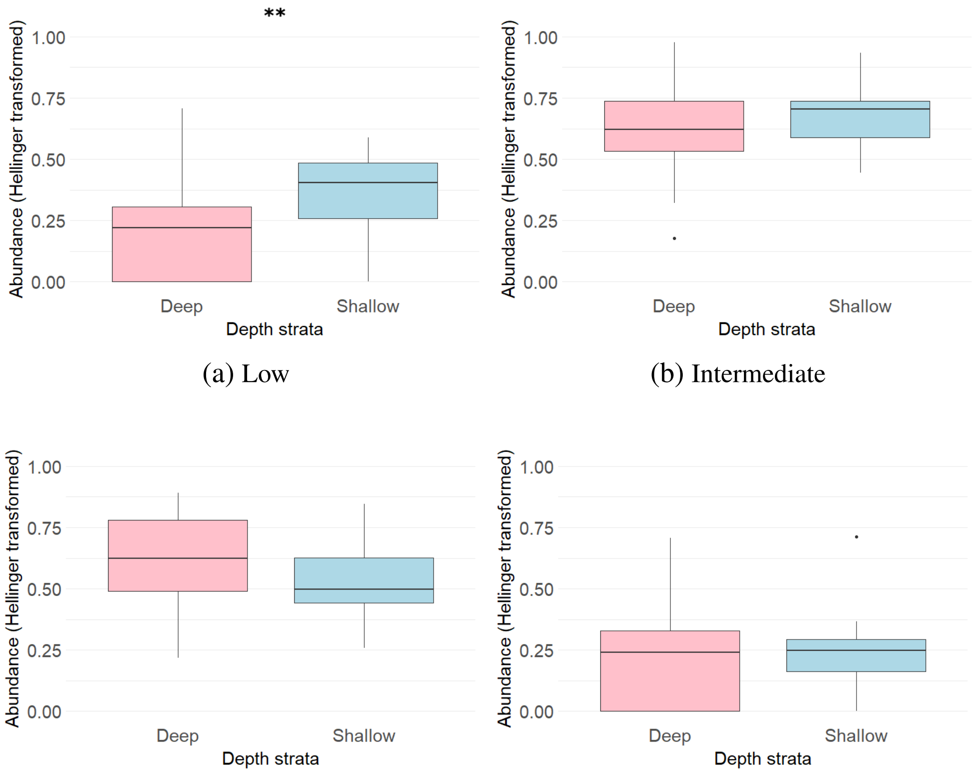
3.4 Trophic groups differ across depths

Depth significantly contributed to dissimilarities between trophic groups in shallow and deep strata (PERMANOVA, $Df =, R^2 = 0.07324; F = 3.24; p = 0.031$). Table 3 presents the results of the SIMPER analysis, showing the contribution of each trophic group to the dissimilarity in abundance across depth strata. For the full set of SIMPER results on trophic groups, refer to Appendix J. Intermediate and low trophic groups were more abundant in the shallow stratum, consistently contributing to the dissimilarities from the shallow stratum. Species from the high and top trophic groups also contributed to the dissimilarities, but their contribution to dissimilarity across strata did not differ significantly.

Table 3: Results of the similarity percentage (SIMPER) analysis are presented, detailing the contributions of each trophic group to the dissimilarity across shallow and deep strata. Results marked in bold differ significantly in their contributions across strata.

Trophic group	Average shallow abundance	Average deep abundance	Dissimilarity contribution (%)	P-value
Intermediate	**53.45**	**36.57**	**50.92**	**0.030**
High	21.2	21.61	22.66	0.993
Low	**13.5**	**5.04**	**16.84**	**0.001**
Top	6.5	5.26	9.59	0.351

SIMPER analysis was performed on raw data to analyze abundance dissimilarities but when the groups were compared without the influence of schooling species through data transformation, the low-class trophic group community emerged as the only one to differ significantly across depth strata (Wilcoxon rank sum test, $W = 106, p = 0.002$). Figure 8 illustrates the abundances of trophic groups transformed using the Hellinger transformation across depth strata. The low-class trophic group exhibited higher median and interquartile values in shallow strata, while deep strata showed higher maximum values.



(a) Low

(b) Intermediate

(c) High

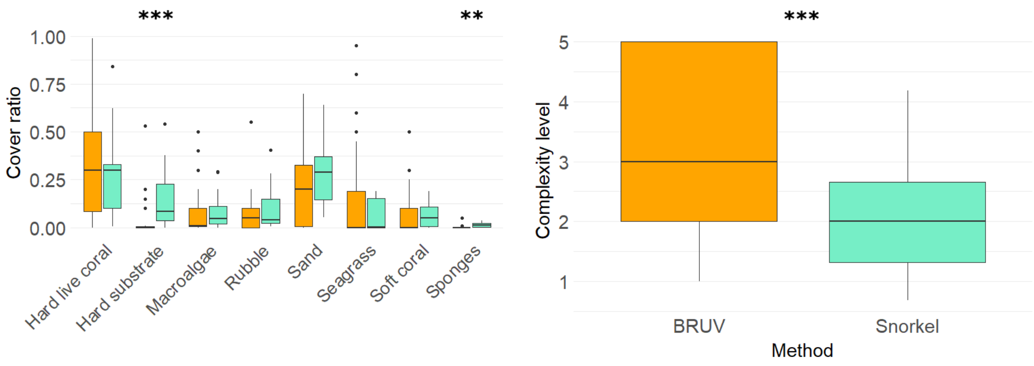
(d) Top

Figure 8: Boxplots showing the transformed relative abundance of each trophic group: a) low, b) intermediate, c) high, and d) top, across shallow (light blue) and deep (pink) strata. The box represents the interquartile range (IQR, from the first to the third quartile), with the median indicated by the black line. Whiskers extend to the minimum and maximum values within 1.5 times the IQR, and dots outside the whiskers represent outliers. Significant differences between the deep and shallow strata are represented by two asterisks (**)($p < 0.01$).

3.5 Depth's influence in combination with habitat

3.5.1 Differences in habitat categorization methods

Wilcoxon signed-rank test showed a significant difference in percent cover of sponges ($p = 0.007$), hard substrate ($p < 0.001$), and complexity estimation ($p < 0.001$), between the two habitat categorization methods. Complexity was found to be greater when estimated from BRUV footage compared to snorkeling (Figure 9b). Conversely, the habitat cover ratio of sponges and hard substrate was lower when estimated using the BRUV method compared to snorkeling (Figure 9a). Additionally, there was a greater variety and higher maximum values in the BRUV method's estimations for the categories of hard live coral, sand, and complexity (Figure 9).



(a) Substrate (b) Complexity

Figure 9: Boxplots comparing habitat estimations using two different categorization methods: with BRUV footage (orange) and with snorkeling footage (turquoise). Figure a) shows substrate estimation, while figure b) shows habitat complexity estimation. The box represents the interquartile range (IQR, from the first to the third quartile), with the median indicated by the black line. Whiskers extend to the minimum and maximum values within 1.5 times the IQR, and dots outside the whiskers represent outliers. Significant differences between the deep and shallow strata are represented by two asterisks (**)($p < 0.01$), and three asterisks (***)($p < 0.001$).

3.5.2 Fish communities influenced by depth and habitat

Table 4 presents the significant factors influencing dissimilarities between fish communities. Depth explained 7.6% of the variation in fish community dissimilarities. The combination of hard live coral cover ratio and habitat complexity explained 18.4% of the dissimilarity, while the total combination of hard live coral, habitat complexity, and depth accounted for 22.7% of the dissimilarity in fish community structures.

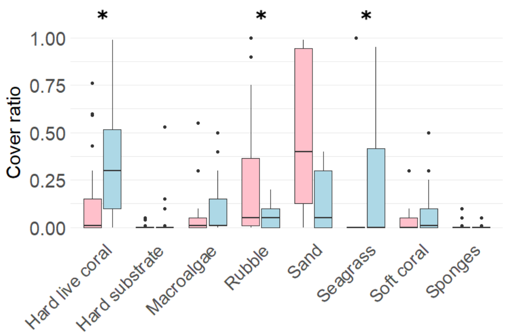
Table 4: Results of permutational analysis of variance (PERMANOVA) on fish communities across depth strata and interacting habitat factors: hard live coral cover and habitat complexity.

Factors	Df	R2	F	P-value
Depth	1	0.07602	3.2911	< 0.001
Complexity * Hard live coral cover	3	0.18425	2.7856	< 0.001
Complexity * Hard live coral cover + Depth	4	0.22664	2.6375	< 0.001

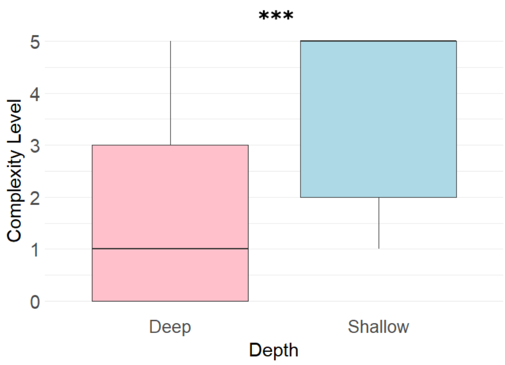
Note: $*$ *indicate interaction between factors.* $+$ *indicates additive effects.*

3.5.3 Habitat differences between shallow and deep sites

The Wilcoxon rank sum test revealed significant differences between shallow and deep habitats for seagrass ($W = 222, p = 0.032$), rubble ($W = 380, p = 0.048$), hard live coral ($W = 166, p = 0.012$), and complexity ($W = 110, p < 0.001$). Figure 10 illustrates these differences across shallow and deep habitats. Shallow habitats displayed greater cover of hard live coral and higher habitat complexity (Figure 10), while deep habitats showed a greater median, higher variance, and higher maximum values in sand cover compared to shallow habitats. However, sand cover did not differ significantly between depth strata.



(a) Substrate



(b) Complexity

Figure 10: Boxplots comparing a) habitat substrates and b) habitat complexity across shallow (light blue) and deep (pink) strata. The box represents the interquartile range (IQR, from the first to the third quartile), with the median indicated by the black line. Whiskers extend to the minimum and maximum values within 1.5 times the IQR, and dots outside the whiskers represent outliers. Significant differences between the deep and shallow strata are represented by one asterisk (*)($p < 0.05$), and three asterisks (***)($p < 0.001$).

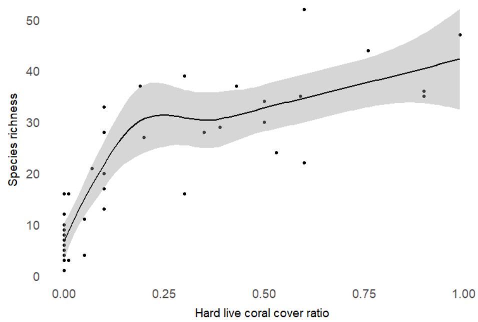
3.5.4 Impact of coral and complexity on fish communities

The results of Kendall's tau correlation tests, conducted on both shallow and deep samples combined, indicated significant positive correlation between fish community variables (species richness and total fish abundance) and habitat variables (hard live coral cover and habitat complexity), as shown in Table 5.

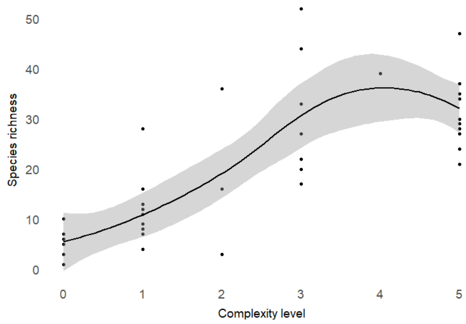
Table 5: Results of Kendall's tau correlation between total abundance, species richness of fish communities, and habitat variables.

Fish community variable	Habitat variable	Tau estimate	z-value	p-value
Species richness	Hard live coral	0.684	6.061	< 0.001
Species richness	Habitat complexity	0.639	5.473	< 0.001
Total abundance	Hard live coral	0.626	5.561	< 0.001
Total abundance	Habitat complexity	0.588	5.049	< 0.001

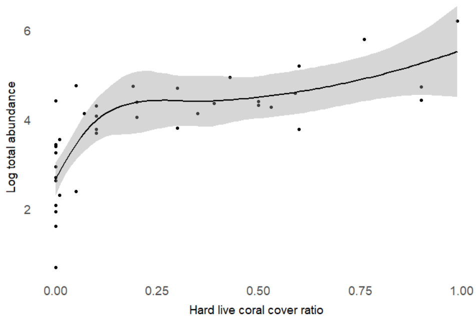
Figure 11 illustrates positive relationships between species richness, total abundance, and habitat factors, including hard live coral cover and habitat complexity. For hard live coral cover ratios below 0.25, species richness and total abundance exhibited a noticeable increase. However, for ratios exceeding 0.25, the trend became less distinct due to greater variation and the limited number of data points for cover ratios exceeding 0.5. In these cases, the relationship appeared to level off (Figures 11a and 11c). Habitat complexity showed substantial variability in its influence on species richness and total abundance, with species richness increasing up to complexity level 4, after which the rate of increase plateaued.



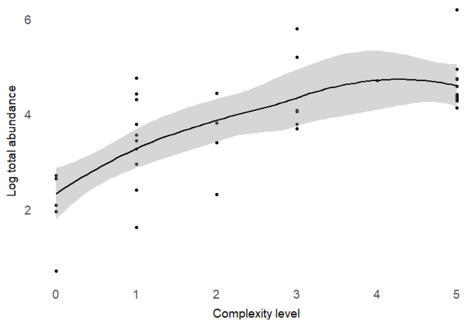
(a) Species richness and hard live coral cover



(b) Species richness and habitat complexity



(c) Total abundance and hard live coral cover



(d) Total abundance and habitat complexity

Figure 11: Locally estimated scatterplot smoothing (LOESS) showing the relationship between fish community and habitat variables: (a) species richness vs. hard live coral cover, (b) species richness vs. habitat complexity, (c) total abundance vs. hard live coral cover, and (d) total abundance vs. habitat complexity. The LOESS curves represent the smoothed relationships, with shaded areas indicating 95% confidence intervals. Total abundance is log-transformed with a $+1$ shift.

4 Discussion

4.1 Fish community analyses

Depth was a significant factor influencing relative abundance of fish communities, including overall fish communities, commercially important species, and trophic groups. Shallow habitats consistently contributed more to these dissimilarities, exhibiting greater average abundances among the species with the highest contributions to dissimilarities across strata in both overall and commercial fish communities (Table 1 and 2). These findings partially align with Tyler et al. (2009) for overall fish communities but diverge when considering commercially important species. In this study, a total of 237 species were documented, and the sampling effort was sufficient to capture species richness. However, the rarefaction curve in Figure 3 did not reach a plateau, suggesting that additional species may still be found. For instance, Tyler et al. (2009) reported 403 species across Unguja and Pemba Islands. While this study encountered challenges in registering small cryptic species, the documented species still accounted for over half of the total species reported by Tyler et al. (2009). This comparison suggests that BRUV sampling is a useful method for documenting coral reef biodiversity.

Abiotic factors including weather, water conditions, visibility, tide, and temperature did not significantly influence fish communities across depth strata. While the effects of these variables may still be relevant when discussing depth-related differences and their impact on individual fish, they were not captured in this study. Temperature did not differ substantially across sampling sites and most of the samples sites exhibited an average of 30°C. Furthermore, bait did not significantly affect the relative abundance of fish communities, supporting its use as an effective method for assessing relative abundance in fish communities (Coghlan et al. 2017; Harvey et al. 2007; Schramm, 2020). My observations in this study indicated that fish across all trophic groups exhibited curiosity toward the bait, which simplified identification as individuals approached the camera. However, it is important to note that these observations were not formally tested, and not all species displayed interest in the bait. Although this study did not observe significant impacts of bait on relative abundance in fish communities, bait can affect sampling of fish communities because of its bias towards predatory reef fish (Harvey et al. 2007). Additionally, the dispersal direction of bait scent and spatial variation can affect fish assemblages, further contributing to potential sampling biases (Wraith et al. 2013).

Species that were consistently more abundant in shallow habitats and contributed to dissimilarities between strata, as identified through SIMPER analyses (Tables 1 and 2), were compared with the FishBase database (Froese & Pauly 2024). All identified species were recorded on FishBase as inhabiting both shallow and deep habitats, with most documented at depths of up to 30 meters. Notably, most species were associated with coral-rich areas, with the exception of *Cheilio inermis*, which prefers seagrass habitats but is also known to occur on coral reefs. The deep stratum exhibited greater variability and higher maximum species richness for both overall and commercial fish communities compared to the shallow stratum, while the shallow stratum showed higher median values. However, these differences were not statistically significant. In contrast, total abundance differed significantly between depth strata, with the shallow stratum having higher median values, while the deep habitats exhibited higher maximum values and greater variation in abundance for both overall and commercial fish communities (Figures 4, 6, 5, and 7). These findings suggest greater variability in fish communities within deep habitats, where certain sites exhibit high abundances, while shallow sites are less variable and more homogeneous in their fish communities. However, the variation in habitat types across deep sample sites likely contributed to these results, as different habitats attract distinct species (Bell & Galzin 1984; Hall & Kingsford 2021; Papastamatiou et al. 2009). For instance, species from the *Mullidae* family were frequently observed feeding in sandy areas, whereas species from the *Holocentridae* family were more often found in habitats with complex structures and minimal sand coverage. Additional research is needed to explore the relationship between specific habitat types at depth and their influence on fish communities. This study focuses on depth comparisons on coral reefs; however, identification of these reefs is limited at deeper sites where visibility is restricted by depth. Although the samples were likely located near coral reefs, the exact proximity of the reefs was unknown, and some samples were dominated by sand. To better assess the relationship between habitat types at depth and their influence on fish communities, sand-dominated sites with more than 50% sand cover were excluded, allowing for a comparison between coral or rocky reef substrates. This exclusion reduced the total sample size from 51 to 36, removing 3 shallow and 12 deep samples, which ultimately resulted in insufficient data for drawing definitive conclusions.

4.2 Habitat differences and their influence

Habitat significantly differed between shallow and deep sites in the categories of seagrass, rubble, hard live coral, and habitat complexity. Shallow habitats were more complex and had a higher ratio of hard live coral cover compared to deep habitats. These differences likely influenced the results when fish communities were compared across depth strata. To confirm these findings, additional coral reefs in the deep stratum should be sampled. The difficulty in placing the BRUV near coral reefs in deep samples may reflect the absence or reduced size of these reefs compared to the shallow stratum. This could suggest that coral reefs at greater depths are less common around Unguja Island, or that their locations remain unknown. Nevertheless, hard live coral cover and habitat complexity significantly influenced dissimilarities in fish communities. In combination with depth, these three factors explained nearly a quarter of the dissimilarities in fish communities (Table 4). Species richness and total abundance also exhibited significant positive correlations with both hard live coral and habitat complexity (Table 5), which is consistent with previous research (Bell & Galzin 1984; Darling et al. 2017).

4.3 Trophic group differences across depth

Depth was also a significant factor contributing to dissimilarities in relative abundance among trophic groups. SIMPER analysis of raw count data revealed that species at intermediate trophic levels were the primary drivers of dissimilarities across depth strata. Species in the shallow stratum consistently contributed to dissimilarity in both the intermediate and low trophic level groups by exhibiting higher abundances. Focusing on species of intermediate trophic level (Appendix A) and their abundances at each site (Appendix B), schooling families such as *Pomacentridae* and *Caesionidae* stood out with high MaxN values, which likely influenced the results. When the influence of schooling species was excluded through data transformation, only the low trophic group showed significant differences between depth strata. Intermediate trophic groups in shallow and deep strata exhibited similar values, while species of higher trophic levels showed a trend toward greater abundance in the deep strata, although this difference was not statistically significant (Figure 8).

Differences across depths in the abundance of species of low trophic level may be explained by their reliance on autotrophic organisms for food, which are more productive in shallow depths (Bellwood et al. 2018; Nemeth & Appeldoorn 2009; Russ 2003), or by the greater habitat complexity in shallow habitats, providing more opportunities for shelter from predators (Friedlander et al. 2003; Hall & Kingsford 2021). Species in higher trophic levels did not differ significantly between strata, which contrasts with the results of Osuka et al. (2022). Their study included a larger sample size, allowing for a more robust comparison across depths, and sampled deeper depths than in this study. Another potential explanation for this discrepancy could be the difference in depth between the islands: the channel between Pemba and the mainland reaches 800 m in depth (Semba et al. 2019), whereas the channel between Unguja and the mainland is less than 65 m deep (RGoZ 2023). These variations in depth may contribute to differences in physical factors and habitat characteristics. Osuka et al. (2022) found a positive relationship between the abundance of predatory fish and both depth and habitat types. Their study employed a finer resolution by distinguishing between resident and transient predators and correlating these predator categories and species with depth and habitat characteristics. Classifying species solely by trophic groups may oversimplify these relationships, failing to account for behavioral differences among species. Such generalizations could introduce excessive variability when analyzing entire fish communities. This highlights the potential value of categorizing predators based on habitat preferences or focusing on individual species to achieve more precise and meaningful insights.

4.4 Improvements and future studies

4.4.1 Improvements

Data collection for habitat characterization requires more detailed and consistent approaches, particularly in addressing differences in habitat substrates and complexity between shallow and deep strata, as well as in the variation between habitat categorization methods. The ideal approach to understanding the spatial distribution of habitats would involve mapping the coastline of Unguja Island to a certain depth using sonar or drop video. This would enable random sampling from known coral reefs, allowing for objective sampling of fish communities on these reefs. However, this approach would be costly. In this study, sample sites were selected with the assistance of local fishers, who identified potential coral reef locations at certain sites and depths. Confirming these locations with sonar would enhance the accuracy of BRUV deployment, bringing it closer to the potential coral or rocky reefs. This approach could also help assess the size of the reef, providing additional insights into how reef size might influence fish community differences. Furthermore, a more suitable method for assessing habitat complexity would help accurately reflect the complexity of specific sites. Estimating complexity through snorkeling and quadrat sampling may not capture the full complexity of a site unless a large number of quadrats are used. However, estimating complexity based on BRUV footage and categorizing the entire habitat by the highest observed structure class could lead to an overestimation of habitat complexity, which may explain the differences observed in Figure 9b. I suggest using BRUV footage and dividing the image into 20 vertical sections, documenting the highest observed complexity in each section, and calculating the average complexity for the entire image. Alternatively, a program like TransectMeasure (SeaGIS) could be used to position grid lines across the image, with a similar estimation approach that averages the complexity from all grid quadrats. In this case, quadrats that only include the water column should be excluded from the analysis.

Fish communities were documented over a period of two and a half months, and as noted in RGoZ (2023), significant seasonal variations occur throughout the year. To accurately capture the dynamics of fish communities across seasons, it is essential to incorporate more temporal variation over an extended period to reduce the potential influence of anomalies from a short data collection window. Additionally, to gain a deeper understanding of how commercial fish communities are affected on Unguja Island, local commercial data would provide a more accurate representation of fishing pressure on different species. Based on my personal observations of fish species sold at fishing markets on Unguja Island, I believe that data from FishBase does not fully reflect the commercial status of species around the island. The majority of species documented in this study were assigned some level of commercial status, but there appear to be more and less targeted groups (Appendix A). Data from local studies, such as Jiddawi (2002), Rehren et al. (2022), and Thyresson et al. (2013), offers a more accurate understanding of which species face high fishing pressure and which are less affected. Focusing on species that are regularly targeted for commercial purposes would provide a clearer picture of how these species are impacted by fishing pressure and whether they experience a potential depth refuge effect, as suggested by Tyler et al. (2009).

4.4.2 Future studies

Determining the size distribution of registered species across different depths is an aspect not included in this study but would be an interesting factor to investigate. It can provide valuable insights into biomass at various depths and potential depth preferences based on size (Morais & Bellwood 2018). Size distribution, combined with fisheries data, can also shed light on whether there is a fishing selectivity trend for certain sizes of individuals, which can influence fish community structures (Robinson et al. 2017). Using stereo-BRUV as a standardized method, as described by Langlois et al. (2020), allows for non-invasive collection of size distribution data. Given this context, reports suggest that Unguja Island is under high fishing pressure. While this study did not investigate the effects of fishing, it reveals differences in fish communities across depth strata. By combining the findings from this study with size distribution data and comparing them to more regulated fishing zones or no-take areas, we can better understand whether and how fishing activities in a highly touristic area impact fish communities around the island (Jiddawi et al. 2002; Rehren et al. 2020; Robertson et al. 2018). Gaining deeper insights into fish communities, their variations, and the potential effects of human activity will support the implementation of sustainable management strategies. This is vital for ensuring that populations, such as those on Zanzibar, can continue relying on this critical resource.

Moreover, to capture the full biodiversity of Unguja Island, BRUV data can be complemented with SCUBA diving survey data to document species that are difficult to document with BRUV sampling. Additionally, recording at higher resolution settings can improve identification by providing clearer zoomed-in details. However, this approach may still present challenges in identifying small individuals, and requires significantly more storage space for the footage.

5 Conclusion

This study aimed to examine variation in fish communities on coral reefs across depth, focusing on species richness, relative abundance, commercial species and trophic groups. The results indicated that depth significantly influenced the relative abundances of fish communities. While no significant differences in species richness were found, the average abundances of species driving dissimilarities between shallow and deep strata were greater in shallow habitats for both overall fish communities and communities of commercial species. Additionally, only low trophic level species exhibited significant differences between strata, with greater abundances in shallow habitats when the influence of schooling species was excluded from the analysis. The initial hypotheses, which proposed that deeper habitats would exhibit greater species richness, as well as a higher relative abundance of commercial species and species from higher trophic levels, were not supported, as no such relationships were observed. While the study provides valuable insights into fish communities across shallow and deep strata, it was limited by a short data collection period and inconsistent habitat types in the deep stratum. Both hard live coral cover and habitat complexity significantly influenced fish communities, and to better understand community differences on coral reefs, more comprehensive sampling in the deep stratum is necessary. Nevertheless, these findings support the importance of habitat structure in influencing relative abundance and species richness within fish communities on coral reefs.

Future research should address these limitations and incorporate size measurements, collect data on locally important commercial species, and evaluate fishing pressures. These efforts will enhance our understanding of community structures and the potential impacts of fishing around Unguja Island. Such insights are crucial for developing sustainable management strategies to protect this critical resource for the communities that rely on it.

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References

[1] Anderson, M.J. (2001). A new method for non-parametric multivariate analysis of variance. Austral Ecology, 26 (1), 32–46. https://doi.org/10.1111/j.1442-9993.2001.01070.pp.x

[2] Bell, J.D. & Galzin, R. (1984). Influence of live coral cover on coral-reef fish communities. Marine Ecology Progress Series, 15, 265–274. https://doi.org/10.3354/meps015265

[3] Bellwood, D.R., Tebbett, S.B., Bellwood, O., Mihalitsis, M., Morais, R.A., Streit, R.P. & Fulton, C.J. (2018). The role of the reef flat in coral reef trophodynamics: Past, present, and future. Ecology and Evolution, 8 (8), 4108–4119. https://doi.org/10.1002/ece3.3967

[4] Bierwagen, S.L., Heupel, M.R., Chin, A. & Simpfendorfer, C.A. (2018). Trophodynamics as a Tool for Understanding Coral Reef Ecosystems. Frontiers in Marine Science, 5. https://doi.org/10.3389/fmars.2018.00024

[5] Brandl, S.J., Rasher, D.B., Côté, I.M., Casey, J.M., Darling, E.S., Lefcheck, J.S. & Duffy, J.E. (2019). Coral reef ecosystem functioning: eight core processes and the role of biodiversity. Frontiers in Ecology and the Environment, 17 (8), 445–454. https://doi.org/10.1002/fee.2088

[6] Brokovich, E., Einbinder, S., Shashar, N., Kiflawi, M. & Kark, S. (2008). Descending to the twilight-zone: changes in coral reef fish assemblages along a depth gradient down to 65 m. Marine Ecology Progress Series, 371, 253–262. https://doi.org/10.3354/meps07591

[7] Burke, L., Reytar, K., Spalding, M. & Perry, A. (2011). Reefs at Risk Revisited. World Resources Institute.

[8] Catano, L.B., Rojas, M.C., Malossi, R.J., Peters, J.R., Heithaus, M.R., Fourqurean, J.W. & Burkepile, D.E. (2016). Reefscapes of fear: predation risk and reef hetero-geneity interact to shape herbivore foraging behaviour. Journal of Animal Ecology, 85 (1), 146–156. https://doi.org/10.1111/1365-2656.12440

[9] Ceccarelli, D.M., Evans, R.D., Logan, M., Jones, G.P., Puotinen, M., Petus, C., Russ, G.R., Srinivasan, M. & Williamson, D.H. (2023). Physical, biological and anthropogenic drivers of spatial patterns of coral reef fish assemblages at regional and local scales. Science of The Total Environment, 904, 166695. https://doi.org/10.1016/j.scitotenv.2023.166695

[10] Christensen, V. & Pauly, D. (eds) (1993). Trophic models of aquatic ecosystems. International Center for Living Aquatic Resources Management [u.a.]. (ICLARM conference proceedings; 26)

[11] Coghlan, A.R., McLean, D.L., Harvey, E.S. & Langlois, T.J. (2017a). Does fish behaviour bias abundance and length information collected by baited underwater video? Journal of Experimental Marine Biology and Ecology, 497, 143–151. https://doi.org/10.1016/j.jembe.2017.09.005

[12] Coghlan, A.R., McLean, D.L., Harvey, E.S. & Langlois, T.J. (2017b). Does fish behaviour bias abundance and length information collected by baited underwater video? Journal of Experimental Marine Biology and Ecology, 497, 143–151. https://doi.org/10.1016/j.jembe.2017.09.005

[13] Cooper, W.T., Barbieri, L.R., Murphy, M.D. & Lowerre-Barbieri, S.K. (2013). Assessing stock reproductive potential in species with indeterminate fecundity: Effects of age truncation and size-dependent reproductive timing. Fisheries Research, 138, 31–41. https://doi.org/10.1016/j.fishres.2012.05.016

[14] Costello, M.J. & Chaudhary, C. (2017). Marine Biodiversity, Biogeography, Deep-Sea Gradients, and Conservation. Current Biology, 27 (11), R511–R527. https://doi.org/10.1016/j.cub.2017.04.060

[15] Darling, E.S., Graham, N.A.J., Januchowski-Hartley, F.A., Nash, K.L., Pratchett, M.S. & Wilson, S.K. (2017). Relationships between structural complexity, coral traits, and reef fish assemblages. Coral Reefs, 36 (2), 561–575. https://doi.org/10.1007/s00338-017-1539-z

[16] Dorman, S.R., Harvey, E.S. & Newman, S.J. (2012). Bait Effects in Sampling Coral Reef Fish Assemblages with Stereo-BRUVs. PLOS ONE, 7 (7), e41538. https://doi.org/10.1371/journal.pone.0041538

[17] Elton, C.S. (1927). Animal ecology. Macmillan Co. [2024-10-31] Ferretti, F., Worm, B., Britten, G.L., Heithaus, M.R. & Lotze, H.K. (2010). Patterns and ecosystem consequences of shark declines in the ocean. Ecology Letters, 13 (8), 1055–1071. https://doi.org/10.1111/j.1461-0248.2010.01489.x

[18] Fricke, R., Eschmeyer, W.N. & Van der Laan, R. (2014). ESCHMEYER'S CATALOG OF FISHES: GENERA, SPECIES, REFERENCES. Zootaxa, 3882 (1). https://doi.org/10.11646/zootaxa.3882.1.1

[19] Friedlander, A.M., Brown, E.K., Jokiel, P.L., Smith, W.R. & Rodgers, K.S. (2003). Effects of habitat, wave exposure, and marine protected area status on

coral reef fish assemblages in the Hawaiian archipelago. Coral Reefs, 22 (3), 291–305. https://doi.org/10.1007/s00338-003-0317-2

[20] Froese, R. & Pauly, D. (2024). FishBase. https://fishbase.org/ [2024-08 / 2024-11] Fulton, C., Bellwood, D. & Wainwright, P. (2001). The relationship between swimming ability and habitat use in wrasses (Labridae). Marine Biology, 139 (1), 25–33. https://doi.org/10.1007/s002270100565

[21] Graham, N.A.J., McClanahan, T.R., MacNeil, M.A., Wilson, S.K., Cinner, J.E., Huchery, C. & Holmes, T.H. (2017). Human Disruption of Coral Reef Trophic Structure. Current Biology, 27 (2), 231–236. https://doi.org/10.1016/j.cub.2016.10.062

[22] Grigg, R.W., Polovina, J.J. & Atkinson, M.J. (1984). Model of a coral reef ecosystem. Coral Reefs, 3 (1), 23–27. https://doi.org/10.1007/BF00306137

[23] Hall, A.E. & Kingsford, M.J. (2021). Habitat type and complexity drive fish assemblages in a tropical seascape. Journal of Fish Biology, 99 (4), 1364–1379. https://doi.org/10.1111/jfb.14843

[24] Harvey, E.S., Cappo, M., Butler, J.J., Hall, N. & Kendrick, G.A. (2007). Bait attraction affects the performance of remote underwater video stations in assessment of demersal fish community structure. Marine Ecology Progress Series, 350, 245–254. https://doi.org/10.3354/meps07192

[25] Hixon, M.A., Johnson, D.W. & Sogard, S.M. (2014). BOFFFFs: on the importance of conserving old-growth age structure in fishery populations. ICES Journal of Marine Science, 71 (8), 2171–2185. https://doi.org/10.1093/icesjms/fst200

[26] Houk, P. & Musburger, C. (2013). Trophic interactions and ecological stability across coral reefs in the Marshall Islands. Marine Ecology Progress Series, 488, 23–34. https://doi.org/10.3354/meps10410

[27] Jankowski, M., Graham, N. & Jones, G. (2015). Depth gradients in diversity, distribution and habitat specialisation in coral reef fishes: implications for the depth-refuge hypothesis. Marine Ecology Progress Series, 540, 203–215. https://doi.org/10.3354/meps11523

[28] Jiddawi, N.S. & Öhman, M.C. (2002). Marine Fisheries in Tanzania. AMBIO: A Journal of the Human Environment, 31 (7), 518–527. https://doi.org/10.1579/0044-7447-31.7.518

[29] Klumpp, D.W. & McKinnon, A.D. (1989). Temporal and spatial patterns in primary production of a coral-reef epilithic algal community. Journal of Experimental Marine Biology and Ecology, 131 (1), 1–22. https://doi.org/10.1016/0022-0981(89)90008-7

[30] LaJeunesse, T.C. (2020). Zooxanthellae. Current Biology, 30 (19), R1110–R1113. https://doi.org/10.1016/j.cub.2020.03.058

[31] Langlois, T., Goetze, J., Bond, T., Monk, J., Abesamis, R.A., Asher, J., Barrett, N., Bernard, A.T.F., Bouchet, P.J., Birt, M.J., Cappo, M., Currey-Randall, L.M., Driessen, D., Fairclough, D.V., Fullwood, L.A.F., Gibbons, B.A., Harasti, D., Heupel, M.R., Hicks, J., Holmes, T.H., Huveneers, C., Ierodiaconou, D., Jordan, A., Knott, N.A., Lindfield, S., Malcolm, H.A., McLean, D., Meekan, M., Miller, D., Mitchell, P.J., Newman, S.J., Radford, B., Rolim, F.A., Saunders, B.J., Stowar, M., Smith, A.N.H., Travers, M.J., Wakefield, C.B., Whitmarsh, S.K., Williams, J. & Harvey, E.S. (2020). A field and video annotation guide for baited remote underwater stereo-video surveys of demersal fish assemblages. Methods in Ecology and Evolution, 11 (11), 1401–1409. https://doi.org/10.1111/2041-210X.13470

[32] van Lier, J.R., Wilson, S.K., Depczynski, M., Wenger, L.N. & Fulton, C.J. (2018). Habitat connectivity and complexity underpin fish community structure across a seascape of tropical macroalgae meadows. Landscape Ecology, 33 (8), 1287–1300. https://doi.org/10.1007/s10980-018-0682-4

[33] Manyilizu, M.C. (2023). Simulation of spatiotemporal interannual variability of oceanic subsurface temperature off East Africa. Western Indian Ocean Journal of Marine Science, 21 (2), 57–70. https://doi.org/10.4314/wiojms.v21i2.6

[34] McClanahan, T.R. (2019). Coral reef fish communities, diversity, and their fisheries and biodiversity status in East Africa. Marine Ecology Progress Series, 632, 175–191. https://doi.org/10.3354/meps13153

[35] Morais, R.A. & Bellwood, D.R. (2018). Global drivers of reef fish growth. Fish and Fisheries, 19 (5), 874–889. https://doi.org/10.1111/faf.12297

[36] Morais, R.A. & Bellwood, D.R. (2020). Principles for estimating fish productivity on coral reefs. Coral Reefs, 39 (5), 1221–1231. https://doi.org/10.1007/s00338-020-01969-9

[37] Nemeth, M. & Appeldoorn, R. (2009). The Distribution of Herbivorous Coral Reef Fishes within Fore-reef Habitats: the Role of Depth,

Light and Rugosity. Caribbean Journal of Science, 45 (2–3), 247–253. https://doi.org/10.18475/cjos.v45i2.a11

[38] Nhat, N.H., Saito, M., Hamada, M. & Onodera, S. (2024). Evaluation of the Effects of Environmental Factors on Seasonal Variations in Fish Diversity on a Coastal Island in Western Japan. Environments, 11 (3), 60. https://doi.org/10.3390/environments11030060

[39] Oksanen, J., Simpson, G., Blanchet, F., Kindt, R., Legendre, P., Minchin, P., O'Hara, R., Solymos, P., Stevens, M., Szoecs, E., Wagner, H., Barbour, M., Bedward, M., Bolker, B., Borcard, D., Carvalho, G., Chirico, M., De Caceres, M., Durand, S., Evangelista, H., FitzJohn, R., Friendly, M., Furneaux, B., Hannigan, G., Hill, M., Lahti, L., McGlinn, D., Ouellette, M., Ribeiro Cunha, E., Smith, T., Stier, A, Ter Braak, C. & Weedon, J. (2024). vegan: Community Ecology Package. R package version 2.6-8, https://CRAN.R-project.org/package=vegan

[40] Osuka, K.E., Stewart, B.D., Samoilys, M., McClean, C.J., Musembi, P., Yahya, S., Hamad, A.R. & Mbugua, J. (2022). Depth and habitat are important drivers of abundance for predatory reef fish off Pemba Island, Tanzania. Marine Environmental Research, 175, 105587. https://doi.org/10.1016/j.marenvres.2022.105587

[41] Papastamatiou, P., Lowe, C.G., Caselle, J.E. & Friedlander, A.M. (2009). Scale-dependent effects of habitat on movements and path structure of reef sharks at a predator-dominated atoll. Ecology, 90 (4), 996–1008. https://doi.org/10.1890/08-0491.1

[42] Paulay, G. (1997). Diversity and Distribution of Reef Organisms. 298–353.

[43] Pinheiro, H.T., MacDonald, C., Quimbayo, J.P., Shepherd, B., Phelps, T.A., Loss, A.C., Teixeira, J.B. & Rocha, L.A. (2023). Assembly rules of coral reef fish communities along the depth gradient. Current Biology, 33 (8), 1421-1430.e4. https://doi.org/10.1016/j.cub.2023.02.040

[44] Polunin, N.V.C. & Roberts, C.M. (1993). Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. Marine Ecology Progress Series, 100, 167–176. https://doi.org/10.3354/meps100167

[45] R Core Team (2023). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

[46] Rehren, J., Samoilys, M., Reuter, H., Jiddawi, N. & Wolff, M. (2022). Integrating Resource Perception, Ecological Surveys, and Fisheries Statistics: A Review of the Fisheries in Zanzibar. Reviews in Fisheries Science & Aquaculture, 30 (1), 1–18. https://doi.org/10.1080/23308249.2020.1802404

[47] Revolutionary Government of Zanzibar (RGoZ) (2023). State of the Coast for Zanzibar, Zanzibar, Tanzania. xxii + 238pp

[48] Robertson, M.D., Midway, S.R., West, L., Tillya, H. & Rivera-Monroy, V.H. (2018). Fishery characteristics in two districts of coastal Tanzania. Ocean & Coastal Management, 163, 254–268. https://doi.org/10.1016/j.ocecoaman.2018.06.015

[49] Robinson, J.P.W., Williams, I.D., Edwards, A.M., McPherson, J., Yeager, L., Vigliola, L., Brainard, R.E. & Baum, J.K. (2017). Fishing degrades size structure of coral reef fish communities. Global Change Biology, 23 (3), 1009–1022. https://doi.org/10.1111/gcb.13482

[50] Rummer, J.L., Couturier, C.S., Stecyk, J.A.W., Gardiner, N.M., Kinch, J.P., Nilsson, G.E. & Munday, P.L. (2014). Life on the edge: thermal optima for aerobic scope of equatorial reef fishes are close to current day temperatures. Global Change Biology, 20 (4), 1055–1066. https://doi.org/10.1111/gcb.12455

[51] Russ, G.R. (2003). Grazer biomass correlates more strongly with production than with biomass of algal turfs on a coral reef. Coral Reefs, 22 (1), 63–67. https://doi.org/10.1007/s00338-003-0286-5

[52] Samoilys, M., Alvarez-Filip, L., Myers, R. & Chabanet, P. (2022). Diversity of Coral Reef Fishes in the Western Indian Ocean: Implications for Conservation. Diversity, 14 (2), 102. https://doi.org/10.3390/d14020102

[53] Schramm, K.D., Harvey, E.S., Goetze, J.S., Travers, M.J., Warnock, B. & Saunders, B.J. (2020). A comparison of stereo-BRUV, diver operated and remote stereo-video transects for assessing reef fish assemblages. Journal of Experimental Marine Biology and Ecology, 524, 151273. https://doi.org/10.1016/j.jembe.2019.151273

[54] Semba, M., Lumpkin, R., Kimirei, I., Shaghude, Y. & Nyandwi, N. (2019). Seasonal and spatial variation of surface current in the Pemba Channel, Tanzania. PLOS ONE, 14 (1), e0210303. https://doi.org/10.1371/journal.pone.0210303

[55] Staehr, P.A., Sheikh, M., Rashid, R., Ussi, A., Suleiman, M., Kloiber, U., Dahl, K., Tairova, Z. & Strand, J. (2018). Managing human pressures to re-

store ecosystem health of zanzibar coastal waters. Aquac Mar Biol, 7 (2), 59. https://doi.org/10.15406/jamb.2018.07.00185

[56] Takarina, N.D., Chuan, O.M., Afifudin, M.I., Tristan, L. & Adiwibowo, A. (2023). Modeling the tropical fish community related to land uses and environmental determinants. Global J. Environ. Sci. Manage, 9 (3), 515–530. https://doi.org/10.22035/gjesm.2023.03.10

[57] Thyresson, M., Crona, B., Nyström, M., de la Torre-Castro, M. & Jiddawi, N. (2013). Tracing value chains to understand effects of trade on coral reef fish in Zanzibar, Tanzania. Marine Policy, 38, 246–256. https://doi.org/10.1016/j.marpol.2012.05.041

[58] Tyler, E.H.M., Speight, M.R., Henderson, P. & Manica, A. (2009). Evidence for a depth refuge effect in artisanal coral reef fisheries. Biological Conservation, 142 (3), 652–667. https://doi.org/10.1016/j.biocon.2008.11.017

[59] Ulega, A., Mgaya, Y., Lokina, R. & Mushy, R. (2022). The Contribution of Marine Fisheries to Socio-economic Development in Tanzania Mainland: Reflections on the Blue Economy Concept from Selected Coastal Villages. JOURNAL OF THE GEOGRAPHICAL ASSOCIATION OF TANZANIA, 42 (2), 1–22. https://doi.org/10.56279/jgat.v42i2.229

[60] Walker, B.K., Fisco Becker, D., Williams, G.J., Kilfoyle, A.K., Smith, S.G. & Kozachuk, A. (2024). Regional reef fish assemblage maps provide baseline biogeography for tropicalization monitoring. Scientific Reports, 14 (1), 7893. https://doi.org/10.1038/s41598-024-58185-6

[61] Williams, I.V., Richards, B.M., Sandin, S.A., Baum, J.K., Schroeder, R.E., Nadon, M.O., Zgliczynski, B., Craig, P., McIlwain, J.L. & Brainard, R.E. (2011). Differences in Reef Fish Assemblages between Populated and Remote Reefs Spanning Multiple Archipelagos Across the Central and Western Pacific. Journal of Marine Sciences, 2011 (1), 826234. https://doi.org/10.1155/2011/826234 Zanzibar Investment Promotion Authority (ZIPA) (n.d.). Blue Economy. https://www.zipa.go.tz/sectors/blue-economy/ [2024-09-03]

[62] Wraith, J., Lynch, T., Minchinton, T., Broad, A. & Davis, A. (2013). Bait type affects fish assemblages and feeding guilds observed at baited remote underwater video stations. Marine Ecology Progress Series, 477, 189–199. https://doi.org/10.3354/meps10137

Diving into fish communities across depth

Coral reefs, often called the 'rainforests of the sea,' host diverse marine life. But how does life change as we dive deeper into the reefs? Don't worry—this isn't a story about monsters lurking beneath your feet when you swim. Instead, it's a story about fish and their preference for depth. Think of it like choosing a town to live in: How cold does it get? Can you handle limited sunlight in northern Sweden? Is your favorite food available? Fish are just as picky, and the depth they choose to live at plays a big role in meeting their needs.

This study, conducted on Unguja Island (Zanzibar), Tanzania, examines how fish communities in shallow and deep habitats differ in biodiversity, abundance, and food web roles. It also explores whether commercially valuable fish are more abundant in shallow or deep waters and how these patterns relate to coral cover and habitat structure.

Shallow habitats are the new Italy

Just as Italy is a desirable place to live, shallow habitats appear to be preferred by fish. Shallow habitats consistently contributed to differences in fish communities across depths, showing higher abundances for species driving these dissimilarities. They also had more uniform communities compared to deep habitats, which showed greater variation between sites, lower abundance in species driving the dissimilarities, but occasionally higher overall fish abundance when all species were considered. This trend was observed in both total and commercial communities. Why do fish prefer shallow habitats? While this study didn't directly test that question, shallow sites had more coral cover and well-developed structures, both linked to higher fish abundance and biodiversity in this and previous research. Think of it like having a comfortable hiding place to escape stress or a convenient commute to work. Fish abundance was similar in shallow and deep habitats across most food web classes, except for species that prefer photosynthetic organisms, which were more abundant in shallow waters, perhaps appreciating the "short commute" to their favorite meals.

Why should we care about fish preferences?

Understanding fish habitat preferences and community structures is essential for protecting fish habitats and supporting sustainable fisheries. Coastal communities in Tanzania, and many other regions, rely on fishing for both income and food. By managing fish populations sustainably, we can ensure food security and support the livelihoods of those who depend on them.

A Trophic level and commercial status

Table: Trophic level and commercial status of documented fish. "Troph" represents the trophic level, and "seTroph" represents the standard deviation for trophic levels.

Species	Troph	seTroph	Importance
Abalistes stellatus	3.43	0.41	commercial
Abudefduf sexfasciatus	2.70	0.30	minor commercial
Abudefduf sparoides	3.03	0.36	of no interest
Abudefduf vaigiensis	2.57	0.40	subsistence fisheries
Acanthurus leucosternon	2.00	0.00	minor commercial
Acanthurus tennentii	2.00	0.00	commercial
Acanthurus thompsoni	3.64	0.41	commercial
Acanthurus triostegus	2.78	0.35	commercial
Acanthurus xanthopterus	2.87	0.23	minor commercial
Aeoliscus strigatus	3.46	0.48	of no interest
Aethaloperca rogaa	4.11	0.68	minor commercial
Aetobatus ocellatus	3.63	0.53	
Amblyglyphidodon indicus	2.72	0.30	
Amphiprion akallopisos	2.73	0.31	of no interest
Amphiprion allardi	2.69	0.30	commercial
Anampses caeruleopunctatus	3.37	0.42	minor commercial
Anampses geographicus	3.50	0.50	minor commercial
Anampses lineatus	3.37	0.39	commercial
Anampses meleagrides	3.50	0.37	minor commercial
Anampses twistii	3.50	0.37	minor commercial
Apolemichthys trimaculatus	2.64	0.00	minor commercial
Aphareus furca	4.14	0.73	commercial
Aprion virescens	4.28	0.42	highly commercial
Arothron stellatus	3.65	0.22	of no interest
Aspidontus dussumieri	2.00	0.00	commercial
Aulostomus chinensis	4.24	0.75	minor commercial
Azurina lepidolepis	3.41	0.35	of no interest
Balistapus undulatus	3.37	0.42	commercial
Balistoides viridescens	3.33	0.44	commercial
Bodianus anthioides	3.44	0.44	commercial
Bodianus axillaris	3.42	0.45	minor commercial
Bodianus bilunulatus	3.44	0.49	minor commercial
Bodianus diana	3.88	0.33	minor commercial

Bodianus trilineatus	3.46	0.48	
Calotomus carolinus	2.00	0.00	commercial
Caesio teres	3.40	0.45	minor commercial
Caesio xanthalytos	3.35	0.44	commercial
Caesio xanthonota	3.40	0.45	minor commercial
Canthigaster bennetti	2.54	0.20	
Canthigaster cyanospilota	3.09	0.31	
Canthigaster smithae	3.09	0.31	
Canthigaster solandri	3.56	0.23	commercial
Canthigaster valentini	2.84	0.30	commercial
Caranx ignobilis	4.22	0.41	commercial
Caranx melampygus	4.49	0.79	commercial
Caranx papuensis	3.98	0.52	minor commercial
Carcharhinus amblyrhynchos	4.11	0.49	minor commercial
Carcharhinus melanopterus	3.94	0.41	commercial
Centropyge multispinis	2.79	0.31	commercial
Cephalopholis argus	4.29	0.73	commercial
Cephalopholis boenak	4.07	0.62	subsistence fisheries
Cephalopholis leopardus	4.01	0.66	minor commercial
Cephalopholis miniata	4.29	0.51	commercial
Cephalopholis nigripinnis	4.00	0.68	
Cephalopholis sonnerati	3.77	0.54	commercial
Cephalopholis spiloparaea	4.03	0.68	minor commercial
Cetoscarus ocellatus	2.00	0.00	
Chaetodon auriga	3.69	0.30	minor commercial
Chaetodon bennetti	3.06	0.46	minor commercial
Chaetodon falcula	3.50	0.37	commercial
Chaetodon guttatissimus	3.07	0.33	commercial
Chaetodon interruptus	3.35	0.60	
Chaetodon kleinii	2.93	0.18	subsistence fisheries
Chaetodon lineolatus	3.39	0.55	minor commercial
Chaetodon lunula	3.70	0.14	minor commercial
Chaetodon madagaskariensis	2.76	0.25	commercial
Chaetodon melannotus	4.35	0.17	commercial
Chaetodon meyeri	3.34	0.61	minor commercial
Chaetodon trifascialis	3.34	0.61	commercial
Chaetodon trifasciatus	3.34	0.61	minor commercial
Chaetodon vagabundus	3.36	0.29	minor commercial
Chaetodon xanthocephalus	2.70	0.24	commercial

Cheilinus chlorourus	3.46	0.52	minor commercial
Cheilinus fasciatus	3.37	0.40	minor commercial
Cheilinus trilobatus	3.88	0.24	minor commercial
Cheilinus undulatus	3.99	0.61	minor commercial
Cheilio inermis	3.49	0.54	minor commercial
Cheilodipterus macrodon	4.12	0.61	
Chlorurus atrilunula	2.00	0.00	commercial
Chlorurus capistratoides	2.07	0.00	
Chlorurus sordidus	2.62	0.29	commercial
Chlorurus strongylocephalus	2.00	0.00	commercial
Chromis opercularis	2.72	0.31	of no interest
Chromis ternatensis	3.40	0.45	of no interest
Chromis weberi	3.40	0.45	of no interest
Coris batuensis	3.57	0.36	minor commercial
Coris caudimacula	3.38	0.50	commercial
Coris cuvieri	3.38	0.40	minor commercial
Coris formosa	3.83	0.26	minor commercial
Ctenochaetus truncatus	2.10	0.00	
Dascyllus aruanus	3.35	0.42	of no interest
Dascyllus carneus	2.67	0.29	of no interest
Dascyllus trimaculatus	2.99	0.24	minor commercial
Echeneis naucrates	3.68	0.25	minor commercial
Echidna nebulosa	4.17	0.71	minor commercial
Epibulus insidiator	4.01	0.66	minor commercial
Epinephelus fasciatus	3.72	0.42	commercial
Ferdauia ferdau	4.31	0.48	commercial
Fistularia commersonii	4.26	0.66	minor commercial
Flavocaranx bajad	4.26	0.59	commercial
Gadella edelmanni	3.24	0.29	
Gnathodentex aureolineatus	3.65	0.57	commercial
Gomphosus caeruleus	3.50	0.37	minor commercial
Gymnocranius grandoculis	3.48	0.59	minor commercial
Gymnothorax griseus	3.97	0.64	minor commercial
Gymnothorax undulatus	3.57	0.31	minor commercial
Halichoeres hortulanus	3.40	0.42	minor commercial
Halichoeres scapularis	3.50	0.50	minor commercial
Halichoeres zeylonicus	3.50	0.53	commercial
Haliophis guttatus	3.76	0.62	commercial
Hemigymnus fasciatus	3.50	0.37	minor commercial

Hemigymnus melapterus	3.55	0.45	minor commercial
Hemitaurichthys zoster	3.33	0.20	of no interest
Heniochus monoceros	3.50	0.37	commercial
Hipposcarus harid	2.00	0.00	commercial
Hologymnosus annulatus	4.20	0.73	minor commercial
Hologymnosus doliatus	3.79	0.57	minor commercial
Kyphosus vaigiensis	2.11	0.00	commercial
Labrichthys unilineatus	3.34	0.61	minor commercial
Labroides bicolor	4.02	0.67	commercial
Labroides dimidiatus	3.46	0.44	of no interest
Lagocephalus sceleratus	3.70	0.36	of no interest
Leptoscarus vaigiensis	2.00	0.00	commercial
Lethrinus borbonicus	3.47	0.41	minor commercial
Lethrinus harak	3.59	0.47	commercial
Lethrinus lentjan	3.94	0.25	highly commercial
Lethrinus mahsena	3.75	0.33	highly commercial
Lethrinus microdon	3.79	0.51	commercial
Lethrinus obsoletus	3.89	0.24	minor commercial
Lethrinus rubrioperculatus	3.75	0.43	highly commercial
Lethrinus variegatus	3.50	0.40	minor commercial
Lutjanus bohar	4.27	0.50	commercial
Lutjanus fulviflamma	3.79	0.29	commercial
Lutjanus gibbus	4.12	0.27	commercial
Lutjanus kasmira	3.87	0.32	commercial
Lutjanus lutjanus	4.05	0.62	highly commercial
Macolor niger	4.01	0.66	commercial
Malacanthus brevirostris	3.50	0.37	commercial
Meiacanthus mossambicus	3.41	0.44	commercial
Melichthys indicus	2.95	0.29	commercial
Monotaxis grandoculis	3.45	0.41	commercial
Mulloidichthys ayliffe	3.74	0.30	
Mulloidichthys flavolineatus	3.84	0.32	commercial
Mulloidichthys vanicolensis	3.91	0.44	commercial
Myrichthys maculosus	3.55	0.46	commercial
Myripristis kuntee	3.36	0.24	minor commercial
Naso annulatus	2.12	0.09	commercial
Naso brachycentron	2.67	0.29	commercial
Naso brevirostris	2.22	0.15	commercial
Naso fageni	2.19	0.13	commercial

Naso hexacanthus	3.06	0.33	commercial
Naso minor	2.64	0.29	
Naso unicornis	2.17	0.11	commercial
Naso vlamingii	2.16	0.11	minor commercial
Nemateleotris magnifica	3.10	0.30	of no interest
Neoglyphidodon melas	3.43	0.44	of no interest
Novaculichthys taeniourus	3.25	0.40	minor commercial
Ostracion meleagris	2.71	0.00	subsistence fisheries
Oxycheilinus bimaculatus	3.50	0.57	subsistence fisheries
Oxycheilinus digramma	3.69	0.36	minor commercial
Paracirrhites forsteri	4.30	0.76	minor commercial
Parapercis hexophtalma	3.55	0.28	minor commercial
Parapercis maculata	3.52	0.39	
Parupeneus barberinus	3.44	0.38	commercial
Parupeneus ciliatus	3.51	0.42	commercial
Parupeneus cyclostomus	4.20	0.62	commercial
Parupeneus heptacanthus	3.50	0.42	commercial
Parupeneus indicus	3.50	0.37	commercial
Parupeneus macronemus	3.52	0.41	commercial
Parupeneus pleurostigma	3.41	0.24	minor commercial
Parupeneus rubescens	3.50	0.37	commercial
Pempheris adusta	3.46	0.47	commercial
Pervagor janthinosoma	2.88	0.40	
Platax orbicularis	3.33	0.49	minor commercial
Plectorhinchus flavomaculatus	3.77	0.58	commercial
Plectorhinchus gaterinus	3.79	0.50	commercial
Plectorhinchus schotaf	3.77	0.49	commercial
Plectroglyphidodon johnstonianus	3.35	0.59	of no interest
Plectropomus laevis	4.14	0.57	commercial
Pomacanthus imperator	2.93	0.05	minor commercial
Pomacanthus semicirculatus	2.69	0.00	minor commercial
Pomacentrus sulfureus	2.63	0.29	
Pomacentrus trichrourus	2.68	0.30	of no interest
Priacanthus hamrur	3.64	0.45	minor commercial
Pristiapogon kallopterus	3.60	0.50	commercial
Pseudalutarius nasicornis	2.87	0.40	
Pseudanthias squamipinnis	3.40	0.45	minor commercial
Pseudobalistes flavimarginatus	2.78	0.26	commercial
Pseudodax moluccanus	2.82	0.26	minor commercial

Pseudocheilinus evanidus	3.50	0.37	commercial
Pterocaesio chrysozona	3.40	0.45	commercial
Pterocaesio marri	3.40	0.45	minor commercial
Pterocaesio pisang	3.40	0.45	commercial
Pterocaesio tile	3.33	0.33	commercial
Pterois miles	4.50	0.80	commercial
Pycnochromis fieldi	2.97	0.24	
Pycnochromis nigrurus	3.40	0.45	of no interest
Pygoplites diacanthus	2.69	0.00	minor commercial
Rachycentron canadum	4.22	0.59	minor commercial
Sargocentron caudimaculatum	3.89	0.67	minor commercial
Sargocentron diadema	3.37	0.17	minor commercial
Scarus frenatus	2.00	0.00	commercial
Scarus ghobban	2.00	0.00	commercial
Scarus niger	2.00	0.00	commercial
Scarus psittacus	2.00	0.00	commercial
Scarus russelii	2.00	0.00	commercial
Scarus scaber	2.00	0.00	commercial
Scarus tricolor	2.00	0.00	commercial
Scolopsis bimaculata	3.76	0.56	minor commercial
Scolopsis curite	3.67	0.51	
Scolopsis ghanam	3.96	0.36	subsistence fisheries
Siganus stellatus	2.70	0.30	commercial
Siganus argenteus	2.00	0.00	commercial
Siganus luridus	2.00	0.01	minor commercial
Sphyraena barracuda	4.49	0.55	minor commercial
Sphyraena qenie	4.50	0.80	commercial
Stethojulis albovittata	3.56	0.50	commercial
Stethojulis strigiventer	3.14	0.10	commercial
Sufflamen bursa	3.63	0.18	minor commercial
Sufflamen chrysopterum	3.76	0.20	minor commercial
Synodus jaculum	4.00	0.68	minor commercial
Synodus variegatus	4.20	0.53	commercial
Taeniura lymma	3.77	0.45	commercial
Thalassoma hardwicke	3.50	0.37	minor commercial
Thalassoma hebraicum	3.50	0.37	subsistence fisheries
Thalassoma lunare	4.16	0.27	minor commercial
Triaenodon obesus	4.19	0.57	minor commercial
Tripterodon orbis	3.50	0.37	commercial

Turrum coeruleopinnatum	4.44	0.73	minor commercial
Turrum fulvoguttatum	4.43	0.54	commercial
Upeneus margarethae	3.41	0.43	
Variola albimarginata	4.50	0.80	subsistence fisheries
Zanclus cornutus	2.49	0.00	subsistence fisheries
Zebrasoma desjardinii	2.00	0.00	commercial
Zebrasoma scopas	2.00	0.00	commercial

B F: Fish community data

Table: Registered maximum number of individuals (MaxN) of identified individuals from BRUV samples.

SampleID	Bait	Depth (m)	Species	MaxN
2024_02_20_P1	No	3	*Acanthurus xanthopterus*	1
2024_02_20_P1	No	3	*Chaetodon sp1*	1
2024_02_20_P1	No	3	*Chaetodon sp2*	1
2024_02_20_P1	No	3	*Chaetodon trifasciatus*	2
2024_02_20_P1	No	3	*Gomphosus caeruleus*	1
2024_02_20_P1	No	3	*Halichoeres hortulanus*	1
2024_02_20_P1	No	3	*Hemigymnus melapterus*	1
2024_02_20_P1	No	3	*Thalassoma hebraicum*	3
2024_02_20_P1	No	3	*Scolopsis ghanam*	1
2024_02_20_P1	No	3	*Abudefduf sparoides*	5
2024_02_20_P1	No	3	*Abudefduf vaigiensis*	2
2024_02_20_P1	No	3	*Amblyglyphidodon indicus*	6
2024_02_20_P1	No	3	*Neoglyphidodon melas*	1
2024_02_20_P1	No	3	*Scarus niger*	1
2024_02_20_P1	No	3	*Canthigaster valentini*	1
2024_02_23_P2	Yes	5	*Chaetodon sp.*	1
2024_02_23_P2	Yes	5	*Chaetodon sp1*	1
2024_02_23_P2	Yes	5	*Gomphosus caeruleus*	1
2024_02_23_P2	Yes	5	*Thalassoma hebraicum*	1
2024_02_23_P2	Yes	5	*Thalassoma sp.*	1
2024_02_23_P2	Yes	5	*Lethrinus obsoletus*	1
2024_02_23_P2	Yes	5	*Gymnothorax undulatus*	1
2024_02_24_P1	Yes	13	*Cephalopholis boenak*	1
2024_02_24_P1	Yes	13	*Halichoeres hortulanus*	1
2024_02_24_P1	Yes	13	*Thalassoma lunare*	1
2024_02_24_P1	Yes	13	*Lethrinus harak*	2
2024_02_24_P1	Yes	13	*Lethrinus sp.*	2
2024_02_24_P1	Yes	13	*Lutjanus bohar*	1
2024_02_24_P1	Yes	13	*Macolor niger*	1
2024_02_24_P1	Yes	13	*Scolopsis ghanam*	1
2024_02_24_P1	Yes	13	*Parapercis hexophtalma*	2
2024_02_24_P1	Yes	13	*Chromis opercularis*	1
2024_02_24_P1	Yes	13	*Canthigaster valentini*	2

2024_02_24_P2	Yes	4	*Acanthurus triostegus*	1
2024_02_24_P2	Yes	4	*Naso annulatus*	1
2024_02_24_P2	Yes	4	*Naso brevirostris*	2
2024_02_24_P2	Yes	4	*Chaetodon sp.*	1
2024_02_24_P2	Yes	4	*Chaetodon trifascialis*	3
2024_02_24_P2	Yes	4	*Cephalopholis boenak*	1
2024_02_24_P2	Yes	4	*Anampses meleagrides*	4
2024_02_24_P2	Yes	4	*Anampses twistii*	1
2024_02_24_P2	Yes	4	*Epibulus insidiator*	1
2024_02_24_P2	Yes	4	*Gomphosus caeruleus*	1
2024_02_24_P2	Yes	4	*Halichoeres hortulanus*	2
2024_02_24_P2	Yes	4	*Hemigymnus fasciatus*	1
2024_02_24_P2	Yes	4	*Hemigymnus melapterus*	2
2024_02_24_P2	Yes	4	*Oxycheilinus digramma*	2
2024_02_24_P2	Yes	4	*Thalassoma hardwicke*	4
2024_02_24_P2	Yes	4	*Thalassoma hebraicum*	6
2024_02_24_P2	Yes	4	*Thalassoma lunare*	1
2024_02_24_P2	Yes	4	*Lethrinus harak*	1
2024_02_24_P2	Yes	4	*Parupeneus macronemus*	2
2024_02_24_P2	Yes	4	*Gymnothorax griseus*	3
2024_02_24_P2	Yes	4	*Scolopsis ghanam*	1
2024_02_24_P2	Yes	4	*Parapercis hexophtalma*	2
2024_02_24_P2	Yes	4	*Abudefduf sparoides*	3
2024_02_24_P2	Yes	4	*Amblyglyphidodon indicus*	7
2024_02_24_P2	Yes	4	*Dascyllus trimaculatus*	1
2024_02_24_P2	Yes	4	*Neoglyphidodon melas*	2
2024_02_24_P2	Yes	4	*Chlorurus sordidus*	13
2024_02_24_P2	Yes	4	*Scarus frenatus*	1
2024_02_24_P2	Yes	4	*Scarus ghobban*	1
2024_02_24_P2	Yes	4	*Canthigaster bennetti*	2
2024_02_24_P2	Yes	4	*Canthigaster valentini*	2
2024_02_26_P1	Yes	6	*Acanthurus sp.*	1
2024_02_26_P1	Yes	6	*Heniochus sp.*	1
2024_02_26_P1	Yes	6	*Lutjanus fulviflamma*	3
2024_02_26_P1	Yes	6	*Dascyllus trimaculatus*	12
2024_02_27_P1	Yes	12	*Turrum fulvoguttatum*	1
2024_02_27_P1	Yes	12	*Chaetodon kleinii*	2
2024_02_27_P1	Yes	12	*Cheilio inermis*	2
2024_02_27_P1	Yes	12	*Lethrinus harak*	2

2024_02_27_P1	Yes	12	*Lethrinus mahsena*	2
2024_02_27_P1	Yes	12	*Lethrinus sp.*	1
2024_02_27_P1	Yes	12	*Parupeneus barberinus*	5
2024_02_27_P1	Yes	12	*Scolopsis ghanam*	1
2024_02_27_P1	Yes	12	*Siganus luridus*	15
2024_02_27_P1	Yes	12	*Siganus sp.*	1
2024_02_27_P2	Yes	13	*Ctenochaetus sp.*	1
2024_02_27_P2	Yes	13	*Naso brevirostris*	11
2024_02_27_P2	Yes	13	*Zebrasoma scopas*	1
2024_02_27_P2	Yes	13	*Balistapus undulatus*	2
2024_02_27_P2	Yes	13	*Melichthys indicus*	2
2024_02_27_P2	Yes	13	*Sufflamen sp.*	1
2024_02_27_P2	Yes	13	*Chaetodon falcula*	2
2024_02_27_P2	Yes	13	*Chaetodon kleinii*	1
2024_02_27_P2	Yes	13	*Chaetodon lineolatus*	3
2024_02_27_P2	Yes	13	*Chaetodon lunula*	2
2024_02_27_P2	Yes	13	*Chaetodon sp.*	1
2024_02_27_P2	Yes	13	*Chaetodon trifasciatus*	1
2024_02_27_P2	Yes	13	*Chaetodon vagabundus*	4
2024_02_27_P2	Yes	13	*Fistularia commersonii*	1
2024_02_27_P2	Yes	13	*Myripristis sp.*	1
2024_02_27_P2	Yes	13	*Bodianus anthioides*	1
2024_02_27_P2	Yes	13	*Gomphosus caeruleus*	1
2024_02_27_P2	Yes	13	*Oxycheilinus digramma*	2
2024_02_27_P2	Yes	13	*Lethrinus harak*	1
2024_02_27_P2	Yes	13	*Lethrinus microdon*	1
2024_02_27_P2	Yes	13	*Monotaxis grandoculis*	1
2024_02_27_P2	Yes	13	*Aphareus furca*	1
2024_02_27_P2	Yes	13	*Lutjanus bohar*	2
2024_02_27_P2	Yes	13	*Lutjanus fulviflamma*	1
2024_02_27_P2	Yes	13	*Lutjanus gibbus*	2
2024_02_27_P2	Yes	13	*Lutjanus kasmira*	2
2024_02_27_P2	Yes	13	*Mulloidichthys ayliffe*	6
2024_02_27_P2	Yes	13	*Mulloidichthys flavolineatus*	3
2024_02_27_P2	Yes	13	*Mulloidichthys vanicolensis*	7
2024_02_27_P2	Yes	13	*Parupeneus macronemus*	1
2024_02_27_P2	Yes	13	*Scolopsis ghanam*	1
2024_02_27_P2	Yes	13	*Pomacanthus imperator*	1
2024_02_27_P2	Yes	13	*Pomacanthus semicirculatus*	1

2024_02_27_P2	Yes	13	*Pygoplites diacanthus*	1
2024_02_27_P2	Yes	13	*Dascyllus trimaculatus*	4
2024_02_27_P2	Yes	13	*Pycnochromis fieldi*	20
2024_02_27_P2	Yes	13	*Priacanthus hamrur*	1
2024_02_27_P2	Yes	13	*Chlorurus sordidus*	1
2024_02_27_P2	Yes	13	*Siganus sp.*	3
2024_02_27_P2	Yes	13	*Zanclus cornutus*	5
2024_02_27_P3	Yes	2	*Acanthurus sp.*	4
2024_02_27_P3	Yes	2	*Ctenochaetus sp.*	2
2024_02_27_P3	Yes	2	*Naso brevirostris*	4
2024_02_27_P3	Yes	2	*Zebrasoma scopas*	3
2024_02_27_P3	Yes	2	*Aulostomus chinensis*	1
2024_02_27_P3	Yes	2	*Caranx melampygus*	1
2024_02_27_P3	Yes	2	*Chaetodon auriga*	2
2024_02_27_P3	Yes	2	*Chaetodon lunula*	3
2024_02_27_P3	Yes	2	*Chaetodon sp.*	1
2024_02_27_P3	Yes	2	*Fistularia commersonii*	2
2024_02_27_P3	Yes	2	*Cheilinus sp.*	1
2024_02_27_P3	Yes	2	*Cheilio inermis*	1
2024_02_27_P3	Yes	2	*Halichoeres hortulanus*	1
2024_02_27_P3	Yes	2	*Thalassoma hebraicum*	1
2024_02_27_P3	Yes	2	*Thalassoma sp.*	1
2024_02_27_P3	Yes	2	*Lethrinus sp.*	1
2024_02_27_P3	Yes	2	*Parupeneus cyclostomus*	1
2024_02_27_P3	Yes	2	*Parupeneus macronemus*	2
2024_02_27_P3	Yes	2	*Centropyge multispinis*	2
2024_02_27_P3	Yes	2	*Chromis opercularis*	14
2024_02_27_P3	Yes	2	*Dascyllus trimaculatus*	4
2024_02_27_P3	Yes	2	*Scarus ghobban*	2
2024_02_27_P3	Yes	2	*Canthigaster sp.*	1
2024_02_28_P1	Yes	12	*Acanthurus sp.*	4
2024_02_28_P1	Yes	12	*Naso brachycentron*	1
2024_02_28_P1	Yes	12	*Naso brevirostris*	1
2024_02_28_P1	Yes	12	*Naso sp.*	1
2024_02_28_P1	Yes	12	*Balistoides viridescens*	1
2024_02_28_P1	Yes	12	*Sufflamen chrysopterum*	1
2024_02_28_P1	Yes	12	*Chaetodon kleinii*	3
2024_02_28_P1	Yes	12	*Fistularia commersonii*	1
2024_02_28_P1	Yes	12	*Bodianus anthioides*	1

2024_02_28_P1	Yes	12	*Cheilinus sp.*	1
2024_02_28_P1	Yes	12	*Coris cuvieri*	1
2024_02_28_P1	Yes	12	*Halichoeres hortulanus*	2
2024_02_28_P1	Yes	12	*Halichoeres zeylonicus*	1
2024_02_28_P1	Yes	12	*Hemigymnus fasciatus*	2
2024_02_28_P1	Yes	12	*Hemigymnus melapterus*	1
2024_02_28_P1	Yes	12	*Novaculichthys taeniourus*	1
2024_02_28_P1	Yes	12	*Lethrinus borbonicus*	1
2024_02_28_P1	Yes	12	*Lethrinus harak*	2
2024_02_28_P1	Yes	12	*Lethrinus mahsena*	1
2024_02_28_P1	Yes	12	*Lethrinus obsoletus*	1
2024_02_28_P1	Yes	12	*Lethrinus sp.*	18
2024_02_28_P1	Yes	12	*Lutjanus fulviflamma*	3
2024_02_28_P1	Yes	12	*Lutjanus gibbus*	2
2024_02_28_P1	Yes	12	*Lutjanus sp.*	25
2024_02_28_P1	Yes	12	*Mulloidichthys ayliffe*	2
2024_02_28_P1	Yes	12	*Parupeneus barberinus*	3
2024_02_28_P1	Yes	12	*Parupeneus macronemus*	5
2024_02_28_P1	Yes	12	*Parupeneus pleurostigma*	4
2024_02_28_P1	Yes	12	*Scolopsis ghanam*	4
2024_02_28_P1	Yes	12	*Centropyge multispinis*	2
2024_02_28_P1	Yes	12	*Pomacanthus imperator*	1
2024_02_28_P1	Yes	12	*Dascyllus trimaculatus*	2
2024_02_28_P1	Yes	12	*Pycnochromis fieldi*	1
2024_02_28_P1	Yes	12	*Calotomus carolinus*	1
2024_02_28_P1	Yes	12	*Chlorurus sordidus*	1
2024_02_28_P1	Yes	12	*Scarus frenatus*	1
2024_02_28_P1	Yes	12	*Scarus sp.*	1
2024_02_28_P1	Yes	12	*Canthigaster valentini*	2
2024_02_28_P1	Yes	12	*Zanclus cornutus*	2
2024_02_28_P2	Yes	9	*Aulostomus chinensis*	1
2024_02_28_P2	Yes	9	*Turrum fulvoguttatum*	1
2024_02_28_P2	Yes	9	*Fistularia commersonii*	2
2024_02_28_P2	Yes	9	*Cheilinus chlorourus*	1
2024_02_28_P2	Yes	9	*Cheilinus undulatus*	1
2024_02_28_P2	Yes	9	*Cheilio inermis*	2
2024_02_28_P2	Yes	9	*Coris caudimacula*	2
2024_02_28_P2	Yes	9	*Oxycheilinus digramma*	1
2024_02_28_P2	Yes	9	*Thalassoma hebraicum*	1

2024_02_28_P2	Yes	9	*Lethrinus harak*	4
2024_02_28_P2	Yes	9	*Lethrinus mahsena*	1
2024_02_28_P2	Yes	9	*Lethrinus sp.*	5
2024_02_28_P2	Yes	9	*Lutjanus sp.*	26
2024_02_28_P2	Yes	9	*Parupeneus barberinus*	6
2024_02_28_P2	Yes	9	*Parupeneus macronemus*	1
2024_02_28_P2	Yes	9	*Siganus luridus*	3
2024_02_28_P2	Yes	9	*Siganus sp.*	1
2024_02_28_P2	Yes	9	*Sphyraena barracuda*	1
2024_02_28_P2	Yes	9	*Canthigaster valentini*	1
2024_03_01_P1	Yes	13	*Ctenochaetus sp.*	1
2024_03_01_P1	Yes	13	*Pseudanthias squamipinnis*	3
2024_03_01_P1	Yes	13	*Pristiapogon kallopterus*	1
2024_03_01_P1	Yes	13	*Meiacanthus mossambicus*	1
2024_03_01_P1	Yes	13	*Caesio teres*	3
2024_03_01_P1	Yes	13	*Pterocaesio pisang*	1
2024_03_01_P1	Yes	13	*Pterocaesio sp.*	4
2024_03_01_P1	Yes	13	*Chaetodon guttatissimus*	2
2024_03_01_P1	Yes	13	*Chaetodon trifasciatus*	2
2024_03_01_P1	Yes	13	*Aethaloperca rogaa*	1
2024_03_01_P1	Yes	13	*Cephalopholis boenak*	4
2024_03_01_P1	Yes	13	*Cephalopholis miniata*	1
2024_03_01_P1	Yes	13	*Cephalopholis sonnerati*	1
2024_03_01_P1	Yes	13	*Bodianus axillaris*	1
2024_03_01_P1	Yes	13	*Bodianus diana*	3
2024_03_01_P1	Yes	13	*Labroides bicolor*	1
2024_03_01_P1	Yes	13	*Labroides dimidiatus*	1
2024_03_01_P1	Yes	13	*Thalassoma lunare*	5
2024_03_01_P1	Yes	13	*Lethrinus harak*	3
2024_03_01_P1	Yes	13	*Lethrinus sp.*	30
2024_03_01_P1	Yes	13	*Monotaxis grandoculis*	3
2024_03_01_P1	Yes	13	*Lutjanus bohar*	1
2024_03_01_P1	Yes	13	*Parupeneus barberinus*	1
2024_03_01_P1	Yes	13	*Parupeneus macronemus*	1
2024_03_01_P1	Yes	13	*Scolopsis ghanam*	2
2024_03_01_P1	Yes	13	*Pempheris adusta*	8
2024_03_01_P1	Yes	13	*Pempheris sp.*	2
2024_03_01_P1	Yes	13	*Parapercis hexophtalma*	2
2024_03_01_P1	Yes	13	*Centropyge multispinis*	2

2024_03_01_P1	Yes	13	*Amblyglyphidodon indicus*	4
2024_03_01_P1	Yes	13	*Azurina lepidolepis*	30
2024_03_01_P1	Yes	13	*Chromis opercularis*	1
2024_03_01_P1	Yes	13	*Chromis ternatensis*	4
2024_03_01_P1	Yes	13	*Chromis weberi*	21
2024_03_01_P1	Yes	13	*Pycnochromis fieldi*	14
2024_03_01_P1	Yes	13	*Calotomus carolinus*	1
2024_03_01_P1	Yes	13	*Chlorurus sordidus*	2
2024_03_01_P1	Yes	13	*Chlorurus strongylocephalus*	2
2024_03_01_P1	Yes	13	*Scarus ghobban*	1
2024_03_01_P1	Yes	13	*Scarus tricolor*	2
2024_03_01_P1	Yes	13	*Canthigaster valentini*	2
2024_03_01_P2	No	8	*Ctenochaetus sp.*	4
2024_03_01_P2	No	8	*Meiacanthus mossambicus*	1
2024_03_01_P2	No	8	*Chaetodon auriga*	1
2024_03_01_P2	No	8	*Chaetodon bennetti*	1
2024_03_01_P2	No	8	*Chaetodon lunula*	4
2024_03_01_P2	No	8	*Chaetodon trifasciatus*	2
2024_03_01_P2	No	8	*Cephalopholis boenak*	1
2024_03_01_P2	No	8	*Bodianus axillaris*	1
2024_03_01_P2	No	8	*Cheilinus fasciatus*	2
2024_03_01_P2	No	8	*Cheilinus sp.*	1
2024_03_01_P2	No	8	*Gomphosus caeruleus*	1
2024_03_01_P2	No	8	*Hemigymnus fasciatus*	1
2024_03_01_P2	No	8	*Labroides sp.*	1
2024_03_01_P2	No	8	*Oxycheilinus digramma*	2
2024_03_01_P2	No	8	*Thalassoma sp.*	1
2024_03_01_P2	No	8	*Lethrinus harak*	1
2024_03_01_P2	No	8	*Lethrinus sp.*	6
2024_03_01_P2	No	8	*Monotaxis grandoculis*	2
2024_03_01_P2	No	8	*Lutjanus bohar*	1
2024_03_01_P2	No	8	*Pervagor janthinosoma*	1
2024_03_01_P2	No	8	*Parupeneus barberinus*	5
2024_03_01_P2	No	8	*Parupeneus cyclostomus*	1
2024_03_01_P2	No	8	*Scolopsis ghanam*	1
2024_03_01_P2	No	8	*Centropyge multispinis*	1
2024_03_01_P2	No	8	*Pygoplites diacanthus*	2
2024_03_01_P2	No	8	*Abudefduf vaigiensis*	12
2024_03_01_P2	No	8	*Amblyglyphidodon indicus*	15

2024_03_01_P2	No	8	*Chromis ternatensis*	1
2024_03_01_P2	No	8	*Pycnochromis fieldi*	25
2024_03_01_P2	No	8	*Priacanthus hamrur*	2
2024_03_01_P2	No	8	*Calotomus carolinus*	1
2024_03_01_P2	No	8	*Chlorurus capistratoides*	1
2024_03_01_P2	No	8	*Chlorurus strongylocephalus*	4
2024_03_01_P2	No	8	*Hipposcarus harid*	2
2024_03_01_P2	No	8	*Synodus variegatus*	1
2024_03_01_P2	No	8	*Canthigaster valentini*	2
2024_03_01_P3	Yes	8	*Ctenochaetus sp.*	2
2024_03_01_P3	Yes	8	*Meiacanthus mossambicus*	2
2024_03_01_P3	Yes	8	*Aethaloperca rogaa*	1
2024_03_01_P3	Yes	8	*Cephalopholis boenak*	1
2024_03_01_P3	Yes	8	*Cheilinus fasciatus*	4
2024_03_01_P3	Yes	8	*Cheilinus undulatus*	2
2024_03_01_P3	Yes	8	*Gomphosus caeruleus*	1
2024_03_01_P3	Yes	8	*Labroides bicolor*	1
2024_03_01_P3	Yes	8	*Labroides sp.*	1
2024_03_01_P3	Yes	8	*Oxycheilinus digramma*	1
2024_03_01_P3	Yes	8	*Thalassoma sp.*	1
2024_03_01_P3	Yes	8	*Lethrinus harak*	1
2024_03_01_P3	Yes	8	*Monotaxis grandoculis*	16
2024_03_01_P3	Yes	8	*Lutjanus bohar*	1
2024_03_01_P3	Yes	8	*Parupeneus barberinus*	3
2024_03_01_P3	Yes	8	*Parapercis hexophtalma*	2
2024_03_01_P3	Yes	8	*Centropyge multispinis*	2
2024_03_01_P3	Yes	8	*Amblyglyphidodon indicus*	9
2024_03_01_P3	Yes	8	*Chromis ternatensis*	1
2024_03_01_P3	Yes	8	*Dascyllus trimaculatus*	1
2024_03_01_P3	Yes	8	*Chlorurus strongylocephalus*	8
2024_03_01_P3	Yes	8	*Siganus argenteus*	1
2024_03_01_P3	Yes	8	*Siganus stellatus*	2
2024_03_01_P3	Yes	8	*Canthigaster valentini*	1
2024_03_01_P4	Yes	2	*Acanthurus sp.*	13
2024_03_01_P4	Yes	2	*Acanthurus thompsoni*	2
2024_03_01_P4	Yes	2	*Aspidontus dussumieri*	1
2024_03_01_P4	Yes	2	*Caranx melampygus*	1
2024_03_01_P4	Yes	2	*Cheilinus sp.*	1
2024_03_01_P4	Yes	2	*Oxycheilinus bimaculatus*	1

2024_03_01_P4	Yes	2	*Stethojulis strigiventer*	1
2024_03_01_P4	Yes	2	*Thalassoma hebraicum*	2
2024_03_01_P4	Yes	2	*Thalassoma lunare*	1
2024_03_01_P4	Yes	2	*Lethrinus harak*	1
2024_03_01_P4	Yes	2	*Lethrinus sp.*	3
2024_03_01_P4	Yes	2	*Lutjanus fulviflamma*	12
2024_03_01_P4	Yes	2	*Parupeneus barberinus*	2
2024_03_01_P4	Yes	2	*Parupeneus macronemus*	2
2024_03_01_P4	Yes	2	*Parupeneus rubescens*	2
2024_03_01_P4	Yes	2	*Scolopsis ghanam*	1
2024_03_01_P4	Yes	2	*Stegastes sp.*	2
2024_03_01_P4	Yes	2	*Chlorurus sordidus*	1
2024_03_01_P4	Yes	2	*Chlorurus strongylocephalus*	1
2024_03_01_P4	Yes	2	*Leptoscarus vaigiensis*	1
2024_03_01_P4	Yes	2	*Scarus ghobban*	7
2024_03_01_P4	Yes	2	*Siganus sp.*	8
2024_03_05_P1	Yes	26	*Decapterus sp.*	2
2024_03_05_P1	Yes	26	*Turrum coeruleopinnatum*	3
2024_03_05_P1	Yes	26	*Pseudalutarius nasicornis*	2
2024_03_05_P1	Yes	26	*Nemipterus sp.*	1
2024_03_05_P1	Yes	26	*Parapercis maculata*	1
2024_03_05_P2	Yes	2	*Ctenochaetus sp.*	5
2024_03_05_P2	Yes	2	*Zebrasoma scopas*	2
2024_03_05_P2	Yes	2	*Zebrasoma sp.*	1
2024_03_05_P2	Yes	2	*Aulostomus chinensis*	1
2024_03_05_P2	Yes	2	*Chaetodon guttatissimus*	2
2024_03_05_P2	Yes	2	*Chaetodon trifascialis*	1
2024_03_05_P2	Yes	2	*Chaetodon trifasciatus*	2
2024_03_05_P2	Yes	2	*Aethaloperca rogaa*	1
2024_03_05_P2	Yes	2	*Cheilinus sp.*	1
2024_03_05_P2	Yes	2	*Cheilio inermis*	2
2024_03_05_P2	Yes	2	*Coris caudimacula*	1
2024_03_05_P2	Yes	2	*Gomphosus caeruleus*	2
2024_03_05_P2	Yes	2	*Halichoeres hortulanus*	1
2024_03_05_P2	Yes	2	*Labroides bicolor*	2
2024_03_05_P2	Yes	2	*Thalassoma hardwicke*	1
2024_03_05_P2	Yes	2	*Thalassoma hebraicum*	4
2024_03_05_P2	Yes	2	*Thalassoma sp.*	4
2024_03_05_P2	Yes	2	*Lethrinus harak*	2

2024_03_05_P2	Yes	2	*Lutjanus fulviflamma*	6
2024_03_05_P2	Yes	2	*Lutjanus sp.*	1
2024_03_05_P2	Yes	2	*Parupeneus macronemus*	3
2024_03_05_P2	Yes	2	*Centropyge multispinis*	3
2024_03_05_P2	Yes	2	*Amblyglyphidodon indicus*	2
2024_03_05_P2	Yes	2	*Chlorurus sordidus*	1
2024_03_05_P2	Yes	2	*Leptoscarus vaigiensis*	1
2024_03_05_P2	Yes	2	*Scarus scaber*	2
2024_03_05_P2	Yes	2	*Siganus sp.*	4
2024_03_05_P2	Yes	2	*Canthigaster valentini*	1
2024_03_07_P1	Yes	18	*Sufflamen chrysopterum*	1
2024_03_07_P1	Yes	18	*Decapterus sp.*	3
2024_03_07_P1	Yes	18	*Halichoeres hortulanus*	1
2024_03_07_P1	Yes	18	*Novaculichthys taeniourus*	1
2024_03_07_P1	Yes	18	*Lethrinus harak*	5
2024_03_07_P1	Yes	18	*Lethrinus lentjan*	6
2024_03_07_P1	Yes	18	*Lethrinus sp.*	2
2024_03_07_P1	Yes	18	*Aprion virescens*	1
2024_03_07_P1	Yes	18	*Mulloidichthys flavolineatus*	7
2024_03_07_P1	Yes	18	*Parupeneus macronemus*	2
2024_03_07_P1	Yes	18	*Parupeneus pleurostigma*	1
2024_03_07_P1	Yes	18	*Siganus sp.*	2
2024_03_07_P2	Yes	10	*Acanthurus sp.*	2
2024_03_07_P2	Yes	10	*Ctenochaetus sp.*	3
2024_03_07_P2	Yes	10	*Aulostomus chinensis*	1
2024_03_07_P2	Yes	10	*Sufflamen bursa*	1
2024_03_07_P2	Yes	10	*Caesio xanthalytos*	3
2024_03_07_P2	Yes	10	*Caesio xanthonota*	2
2024_03_07_P2	Yes	10	*Decapterus sp.*	4
2024_03_07_P2	Yes	10	*Chaetodon kleinii*	2
2024_03_07_P2	Yes	10	*Chaetodon trifasciatus*	2
2024_03_07_P2	Yes	10	*Fistularia commersonii*	2
2024_03_07_P2	Yes	10	*Anampses lineatus*	1
2024_03_07_P2	Yes	10	*Anampses meleagrides*	1
2024_03_07_P2	Yes	10	*Cheilio inermis*	1
2024_03_07_P2	Yes	10	*Coris caudimacula*	1
2024_03_07_P2	Yes	10	*Coris formosa*	1
2024_03_07_P2	Yes	10	*Gomphosus caeruleus*	1
2024_03_07_P2	Yes	10	*Halichoeres hortulanus*	1

2024_03_07_P2	Yes	10	*Novaculichthys taeniourus*	1
2024_03_07_P2	Yes	10	*Oxycheilinus digramma*	1
2024_03_07_P2	Yes	10	*Stethojulis albovittata*	1
2024_03_07_P2	Yes	10	*Thalassoma hebraicum*	3
2024_03_07_P2	Yes	10	*Thalassoma sp.*	2
2024_03_07_P2	Yes	10	*Lethrinus borbonicus*	6
2024_03_07_P2	Yes	10	*Lethrinus harak*	1
2024_03_07_P2	Yes	10	*Monotaxis grandoculis*	1
2024_03_07_P2	Yes	10	*Parupeneus barberinus*	1
2024_03_07_P2	Yes	10	*Parupeneus cyclostomus*	3
2024_03_07_P2	Yes	10	*Parupeneus macronemus*	5
2024_03_07_P2	Yes	10	*Parupeneus pleurostigma*	2
2024_03_07_P2	Yes	10	*Gymnothorax griseus*	1
2024_03_07_P2	Yes	10	*Apolemichthys trimaculatus*	1
2024_03_07_P2	Yes	10	*Centropyge multispinis*	2
2024_03_07_P2	Yes	10	*Amphiprion allardi*	1
2024_03_07_P2	Yes	10	*Dascyllus trimaculatus*	18
2024_03_07_P2	Yes	10	*Priacanthus hamrur*	2
2024_03_07_P2	Yes	10	*Calotomus carolinus*	1
2024_03_07_P2	Yes	10	*Hipposcarus harid*	5
2024_03_07_P2	Yes	10	*Scarus psittacus*	2
2024_03_07_P2	Yes	10	*Siganus luridus*	2
2024_03_07_P2	Yes	10	*Siganus sp.*	1
2024_03_07_P2	Yes	10	*Zanclus cornutus*	3
2024_03_07_P3	Yes	3	*Naso brevirostris*	3
2024_03_07_P3	Yes	3	*Caesio teres*	3
2024_03_07_P3	Yes	3	*Caranx papuensis*	4
2024_03_07_P3	Yes	3	*Chaetodon auriga*	1
2024_03_07_P3	Yes	3	*Chaetodon interruptus*	2
2024_03_07_P3	Yes	3	*Chaetodon kleinii*	2
2024_03_07_P3	Yes	3	*Chaetodon trifasciatus*	2
2024_03_07_P3	Yes	3	*Epinephelus fasciatus*	2
2024_03_07_P3	Yes	3	*Cheilinus sp.*	1
2024_03_07_P3	Yes	3	*Cheilio inermis*	1
2024_03_07_P3	Yes	3	*Thalassoma hebraicum*	1
2024_03_07_P3	Yes	3	*Thalassoma lunare*	3
2024_03_07_P3	Yes	3	*Lethrinus harak*	1
2024_03_07_P3	Yes	3	*Lethrinus sp.*	15
2024_03_07_P3	Yes	3	*Monotaxis grandoculis*	1

2024_03_07_P3	Yes	3	*Lutjanus gibbus*	1
2024_03_07_P3	Yes	3	*Mulloidichthys flavolineatus*	1
2024_03_07_P3	Yes	3	*Parupeneus barberinus*	2
2024_03_07_P3	Yes	3	*Parupeneus cyclostomus*	1
2024_03_07_P3	Yes	3	*Parupeneus macronemus*	1
2024_03_07_P3	Yes	3	*Parupeneus pleurostigma*	2
2024_03_07_P3	Yes	3	*Echidna nebulosa*	1
2024_03_07_P3	Yes	3	*Gymnothorax griseus*	3
2024_03_07_P3	Yes	3	*Scolopsis ghanam*	2
2024_03_07_P3	Yes	3	*Centropyge multispinis*	4
2024_03_07_P3	Yes	3	*Dascyllus trimaculatus*	21
2024_03_07_P3	Yes	3	*Hipposcarus harid*	3
2024_03_07_P3	Yes	3	*Scarus ghobban*	2
2024_03_07_P3	Yes	3	*Canthigaster valentini*	2
2024_03_07_P3	Yes	3	*Zanclus cornutus*	1
2024_03_07_P4	Yes	18	*Fistularia commersonii*	1
2024_03_07_P4	Yes	18	*Gymnocranius sp.*	2
2024_03_07_P4	Yes	18	*Lethrinus lentjan*	1
2024_03_07_P4	Yes	18	*Pseudalutarius nasicornis*	2
2024_03_07_P4	Yes	18	*Mulloidichthys flavolineatus*	2
2024_03_07_P4	Yes	18	*Siganus sp.*	1
2024_03_07_P4	Yes	18	*Arothron stellatus*	1
2024_03_08_P1	Yes	24	*Acanthurus tennentii*	3
2024_03_08_P1	Yes	24	*Sufflamen chrysopterum*	1
2024_03_08_P1	Yes	24	*Chaetodon kleinii*	21
2024_03_08_P1	Yes	24	*Halichoeres hortulanus*	2
2024_03_08_P1	Yes	24	*Hologymnosus doliatus*	1
2024_03_08_P1	Yes	24	*Lethrinus microdon*	2
2024_03_08_P1	Yes	24	*Lethrinus rubrioperculatus*	1
2024_03_08_P1	Yes	24	*Monotaxis grandoculis*	1
2024_03_08_P1	Yes	24	*Parupeneus macronemus*	4
2024_03_08_P1	Yes	24	*Parupeneus pleurostigma*	2
2024_03_08_P1	Yes	24	*Apolemichthys trimaculatus*	2
2024_03_08_P1	Yes	24	*Scarus psittacus*	1
2024_03_08_P1	Yes	24	*Canthigaster valentini*	2
2024_03_08_P2	Yes	9	*Acanthurus sp.*	1
2024_03_08_P2	Yes	9	*Naso brevirostris*	1
2024_03_08_P2	Yes	9	*Naso sp.*	1
2024_03_08_P2	Yes	9	*Sufflamen chrysopterum*	1

2024_03_08_P2	Yes	9	*Pterocaesio marri*	2
2024_03_08_P2	Yes	9	*Pterocaesio sp.*	15
2024_03_08_P2	Yes	9	*Chaetodon auriga*	2
2024_03_08_P2	Yes	9	*Chaetodon kleinii*	2
2024_03_08_P2	Yes	9	*Chaetodon sp.*	1
2024_03_08_P2	Yes	9	*Chaetodon trifasciatus*	2
2024_03_08_P2	Yes	9	*Kyphosus sp.*	9
2024_03_08_P2	Yes	9	*Cheilinus sp.*	2
2024_03_08_P2	Yes	9	*Cheilinus trilobatus*	3
2024_03_08_P2	Yes	9	*Halichoeres hortulanus*	1
2024_03_08_P2	Yes	9	*Halichoeres scapularis*	5
2024_03_08_P2	Yes	9	*Thalassoma hebraicum*	2
2024_03_08_P2	Yes	9	*Thalassoma sp.*	1
2024_03_08_P2	Yes	9	*Gymnocranius grandoculis*	1
2024_03_08_P2	Yes	9	*Lethrinus borbonicus*	2
2024_03_08_P2	Yes	9	*Lethrinus harak*	1
2024_03_08_P2	Yes	9	*Lethrinus sp.*	1
2024_03_08_P2	Yes	9	*Monotaxis grandoculis*	1
2024_03_08_P2	Yes	9	*Aprion virescens*	2
2024_03_08_P2	Yes	9	*Lutjanus fulviflamma*	1
2024_03_08_P2	Yes	9	*Lutjanus sp.*	1
2024_03_08_P2	Yes	9	*Mulloidichthys flavolineatus*	7
2024_03_08_P2	Yes	9	*Parupeneus macronemus*	2
2024_03_08_P2	Yes	9	*Parupeneus pleurostigma*	1
2024_03_08_P2	Yes	9	*Gymnothorax griseus*	1
2024_03_08_P2	Yes	9	*Scolopsis ghanam*	2
2024_03_08_P2	Yes	9	*Pycnochromis fieldi*	30
2024_03_08_P2	Yes	9	*Chlorurus atrilunula*	2
2024_03_08_P2	Yes	9	*Chlorurus sordidus*	2
2024_03_08_P2	Yes	9	*Scarus psittacus*	1
2024_03_08_P2	Yes	9	*Scarus russelii*	2
2024_03_08_P2	Yes	9	*Scarus sp.*	1
2024_03_08_P2	Yes	9	*Zanclus cornutus*	1
2024_03_08_P3	Yes	18	*Naso brevirostris*	2
2024_03_08_P3	Yes	18	*Naso unicornis*	1
2024_03_08_P3	Yes	18	*Aulostomus chinensis*	1
2024_03_08_P3	Yes	18	*Sufflamen chrysopterum*	1
2024_03_08_P3	Yes	18	*Caesio sp.*	2
2024_03_08_P3	Yes	18	*Triaenodon obesus*	1

2024_03_08_P3	Yes	18	*Chaetodon auriga*	1
2024_03_08_P3	Yes	18	*Chaetodon madagaskariensis*	2
2024_03_08_P3	Yes	18	*Chaetodon trifasciatus*	2
2024_03_08_P3	Yes	18	*Tripterodon orbis*	1
2024_03_08_P3	Yes	18	*Aethaloperca rogaa*	1
2024_03_08_P3	Yes	18	*Kyphosus sp.*	1
2024_03_08_P3	Yes	18	*Anampses meleagrides*	1
2024_03_08_P3	Yes	18	*Bodianus anthioides*	1
2024_03_08_P3	Yes	18	*Cheilio inermis*	1
2024_03_08_P3	Yes	18	*Halichoeres hortulanus*	1
2024_03_08_P3	Yes	18	*Hologymnosus annulatus*	2
2024_03_08_P3	Yes	18	*Novaculichthys taeniourus*	1
2024_03_08_P3	Yes	18	*Oxycheilinus digramma*	2
2024_03_08_P3	Yes	18	*Gymnocranius grandoculis*	15
2024_03_08_P3	Yes	18	*Lethrinus harak*	2
2024_03_08_P3	Yes	18	*Aprion virescens*	2
2024_03_08_P3	Yes	18	*Lutjanus kasmira*	9
2024_03_08_P3	Yes	18	*Gadella edelmanni*	1
2024_03_08_P3	Yes	18	*Mulloidichthys flavolineatus*	7
2024_03_08_P3	Yes	18	*Parupeneus barberinus*	1
2024_03_08_P3	Yes	18	*Parupeneus macronemus*	7
2024_03_08_P3	Yes	18	*Parupeneus pleurostigma*	6
2024_03_08_P3	Yes	18	*Scolopsis ghanam*	3
2024_03_08_P3	Yes	18	*Ostracion meleagris*	1
2024_03_08_P3	Yes	18	*Parapercis hexophtalma*	2
2024_03_08_P3	Yes	18	*Centropyge multispinis*	2
2024_03_08_P3	Yes	18	*Pomacanthus imperator*	1
2024_03_08_P3	Yes	18	*Chromis opercularis*	1
2024_03_08_P3	Yes	18	*Dascyllus trimaculatus*	15
2024_03_08_P3	Yes	18	*Calotomus carolinus*	1
2024_03_08_P3	Yes	18	*Chlorurus sordidus*	4
2024_03_08_P3	Yes	18	*Scarus russelii*	2
2024_03_08_P3	Yes	18	*Siganus sp.*	3
2024_03_08_P3	Yes	18	*Siganus stellatus*	3
2024_03_08_P3	Yes	18	*Canthigaster valentini*	1
2024_03_08_P3	Yes	18	*Zanclus cornutus*	1
2024_03_10_P1	Yes	8	*Acanthurus sp.*	10
2024_03_10_P1	Yes	8	*Acanthurus thompsoni*	3
2024_03_10_P1	Yes	8	*Ctenochaetus sp.*	2

2024_03_10_P1	Yes	8	*Zebrasoma scopas*	3
2024_03_10_P1	Yes	8	*Zebrasoma sp.*	1
2024_03_10_P1	Yes	8	*Sufflamen chrysopterum*	2
2024_03_10_P1	Yes	8	*Meiacanthus mossambicus*	8
2024_03_10_P1	Yes	8	*Caranx ignobilis*	3
2024_03_10_P1	Yes	8	*Chaetodon lineolatus*	2
2024_03_10_P1	Yes	8	*Chaetodon lunula*	1
2024_03_10_P1	Yes	8	*Chaetodon trifasciatus*	2
2024_03_10_P1	Yes	8	*Platax orbicularis*	1
2024_03_10_P1	Yes	8	*Aethaloperca rogaa*	1
2024_03_10_P1	Yes	8	*Cephalopholis argus*	1
2024_03_10_P1	Yes	8	*Bodianus axillaris*	1
2024_03_10_P1	Yes	8	*Bodianus diana*	1
2024_03_10_P1	Yes	8	*Cheilinus sp.*	1
2024_03_10_P1	Yes	8	*Gomphosus caeruleus*	1
2024_03_10_P1	Yes	8	*Halichoeres hortulanus*	1
2024_03_10_P1	Yes	8	*Labroides bicolor*	1
2024_03_10_P1	Yes	8	*Labroides dimidiatus*	3
2024_03_10_P1	Yes	8	*Labroides sp.*	1
2024_03_10_P1	Yes	8	*Thalassoma lunare*	4
2024_03_10_P1	Yes	8	*Thalassoma sp.*	1
2024_03_10_P1	Yes	8	*Lutjanus bohar*	1
2024_03_10_P1	Yes	8	*Macolor niger*	2
2024_03_10_P1	Yes	8	*Parupeneus macronemus*	1
2024_03_10_P1	Yes	8	*Parupeneus sp.*	1
2024_03_10_P1	Yes	8	*Scolopsis ghanam*	1
2024_03_10_P1	Yes	8	*Parapercis hexophtalma*	2
2024_03_10_P1	Yes	8	*Centropyge multispinis*	2
2024_03_10_P1	Yes	8	*Pomacanthus semicirculatus*	1
2024_03_10_P1	Yes	8	*Chromis opercularis*	1
2024_03_10_P1	Yes	8	*Dascyllus aruanus*	5
2024_03_10_P1	Yes	8	*Dascyllus carneus*	1
2024_03_10_P1	Yes	8	*Pycnochromis fieldi*	11
2024_03_10_P1	Yes	8	*Chlorurus sordidus*	1
2024_03_10_P1	Yes	8	*Chlorurus sp.*	1
2024_03_10_P1	Yes	8	*Chlorurus strongylocephalus*	1
2024_03_10_P1	Yes	8	*Hipposcarus harid*	9
2024_03_10_P1	Yes	8	*Scarus tricolor*	1
2024_03_10_P1	Yes	8	*Canthigaster valentini*	2

2024_03_10_P2	Yes	9	*Acanthurus sp.*	1
2024_03_10_P2	Yes	9	*Ctenochaetus sp.*	3
2024_03_10_P2	Yes	9	*Balistapus undulatus*	1
2024_03_10_P2	Yes	9	*Sufflamen chrysopterum*	2
2024_03_10_P2	Yes	9	*Carcharhinus amblyrhynchos*	1
2024_03_10_P2	Yes	9	*Chaetodon trifasciatus*	2
2024_03_10_P2	Yes	9	*Heniochus monoceros*	1
2024_03_10_P2	Yes	9	*Taeniura lymma*	1
2024_03_10_P2	Yes	9	*Echeneis naucrates*	2
2024_03_10_P2	Yes	9	*Platax orbicularis*	1
2024_03_10_P2	Yes	9	*Aethaloperca rogaa*	2
2024_03_10_P2	Yes	9	*Plectorhinchus schotaf*	1
2024_03_10_P2	Yes	9	*Kyphosus sp.*	1
2024_03_10_P2	Yes	9	*Cheilinus fasciatus*	1
2024_03_10_P2	Yes	9	*Gomphosus caeruleus*	1
2024_03_10_P2	Yes	9	*Halichoeres hortulanus*	1
2024_03_10_P2	Yes	9	*Thalassoma lunare*	1
2024_03_10_P2	Yes	9	*Monotaxis grandoculis*	5
2024_03_10_P2	Yes	9	*Lutjanus bohar*	2
2024_03_10_P2	Yes	9	*Macolor niger*	1
2024_03_10_P2	Yes	9	*Parapercis hexophtalma*	2
2024_03_10_P2	Yes	9	*Centropyge multispinis*	2
2024_03_10_P2	Yes	9	*Chromis weberi*	2
2024_03_10_P2	Yes	9	*Pycnochromis fieldi*	20
2024_03_10_P2	Yes	9	*Priacanthus hamrur*	2
2024_03_10_P2	Yes	9	*Chlorurus sordidus*	1
2024_03_10_P2	Yes	9	*Chlorurus strongylocephalus*	1
2024_03_10_P2	Yes	9	*Hipposcarus harid*	1
2024_03_10_P2	Yes	9	*Pterois sp.*	1
2024_03_10_P2	Yes	9	*Synodus variegatus*	1
2024_03_10_P2	Yes	9	*Canthigaster valentini*	1
2024_03_10_P2	Yes	9	*Zanclus cornutus*	2
2024_03_10_P3	Yes	3	*Ctenochaetus sp.*	4
2024_03_10_P3	Yes	3	*Naso brevirostris*	13
2024_03_10_P3	Yes	3	*Naso sp.*	1
2024_03_10_P3	Yes	3	*Zebrasoma scopas*	2
2024_03_10_P3	Yes	3	*Aulostomus chinensis*	1
2024_03_10_P3	Yes	3	*Balistapus undulatus*	1
2024_03_10_P3	Yes	3	*Melichthys indicus*	1

2024_03_10_P3	Yes	3	*Meiacanthus mossambicus*	2
2024_03_10_P3	Yes	3	*Carcharhinus melanopterus*	1
2024_03_10_P3	Yes	3	*Chaetodon lunula*	3
2024_03_10_P3	Yes	3	*Chaetodon trifasciatus*	2
2024_03_10_P3	Yes	3	*Platax orbicularis*	2
2024_03_10_P3	Yes	3	*Aethaloperca rogaa*	2
2024_03_10_P3	Yes	3	*Cephalopholis argus*	1
2024_03_10_P3	Yes	3	*Kyphosus sp.*	2
2024_03_10_P3	Yes	3	*Cheilinus fasciatus*	4
2024_03_10_P3	Yes	3	*Gomphosus caeruleus*	1
2024_03_10_P3	Yes	3	*Halichoeres hortulanus*	2
2024_03_10_P3	Yes	3	*Hemigymnus melapterus*	1
2024_03_10_P3	Yes	3	*Labroides dimidiatus*	1
2024_03_10_P3	Yes	3	*Labroides sp.*	1
2024_03_10_P3	Yes	3	*Thalassoma hebraicum*	1
2024_03_10_P3	Yes	3	*Lutjanus bohar*	2
2024_03_10_P3	Yes	3	*Parupeneus cyclostomus*	6
2024_03_10_P3	Yes	3	*Abudefduf sexfasciatus*	2
2024_03_10_P3	Yes	3	*Chromis ternatensis*	15
2024_03_10_P3	Yes	3	*Pomacentrus sulfureus*	1
2024_03_10_P3	Yes	3	*Pycnochromis fieldi*	30
2024_03_10_P3	Yes	3	*Calotomus carolinus*	2
2024_03_10_P3	Yes	3	*Cetoscarus ocellatus*	1
2024_03_10_P3	Yes	3	*Chlorurus atrilunula*	1
2024_03_10_P3	Yes	3	*Chlorurus sordidus*	1
2024_03_10_P3	Yes	3	*Chlorurus strongylocephalus*	2
2024_03_10_P3	Yes	3	*Scarus frenatus*	1
2024_03_10_P3	Yes	3	*Scarus niger*	1
2024_03_10_P3	Yes	3	*Siganus sp.*	1
2024_03_10_P3	Yes	3	*Siganus stellatus*	2
2024_03_10_P3	Yes	3	*Canthigaster bennetti*	1
2024_03_10_P3	Yes	3	*Canthigaster valentini*	1
2024_03_10_P3	Yes	3	*Zanclus cornutus*	2
2024_03_11_P1	Yes	42	*Lethrinus borbonicus*	6
2024_03_11_P1	Yes	42	*Lethrinus microdon*	1
2024_03_11_P1	Yes	42	*Lethrinus sp.*	9
2024_03_11_P1	Yes	42	*Malacanthus brevirostris*	1
2024_03_11_P1	Yes	42	*Parupeneus pleurostigma*	5
2024_03_11_P1	Yes	42	*Scolopsis bimaculata*	1

2024_03_11_P2	Yes	40	*Ferdauia ferdau*	1
2024_03_11_P2	Yes	40	*Gymnocranius grandoculis*	1
2024_03_11_P2	Yes	40	*Gymnocranius sp.*	1
2024_03_11_P2	Yes	40	*Lethrinus borbonicus*	1
2024_03_11_P2	Yes	40	*Lethrinus sp.*	4
2024_03_11_P2	Yes	40	*Malacanthus brevirostris*	1
2024_03_11_P2	Yes	40	*Parupeneus heptacanthus*	6
2024_03_11_P2	Yes	40	*Parupeneus pleurostigma*	3
2024_03_11_P3	Yes	10	*Caesio xanthalytos*	23
2024_03_11_P3	Yes	10	*Caranx papuensis*	19
2024_03_11_P3	Yes	10	*Flavocaranx bajad*	1
2024_03_11_P3	Yes	10	*Aeoliscus strigatus*	3
2024_03_11_P3	Yes	10	*Fistularia commersonii*	6
2024_03_11_P3	Yes	10	*Cheilio inermis*	1
2024_03_11_P3	Yes	10	*Coris caudimacula*	1
2024_03_11_P3	Yes	10	*Oxycheilinus bimaculatus*	1
2024_03_11_P3	Yes	10	*Lethrinus harak*	20
2024_03_11_P3	Yes	10	*Mulloidichthys flavolineatus*	3
2024_03_11_P3	Yes	10	*Siganus sp.*	2
2024_03_11_P3	Yes	10	*Canthigaster bennetti*	2
2024_03_11_P3	Yes	10	*Canthigaster solandri*	2
2024_03_12_P1	Yes	6	*Ctenochaetus truncatus*	2
2024_03_12_P1	Yes	6	*Zebrasoma scopas*	1
2024_03_12_P1	Yes	6	*Zebrasoma sp.*	2
2024_03_12_P1	Yes	6	*Pristiapogon kallopterus*	4
2024_03_12_P1	Yes	6	*Aulostomus chinensis*	2
2024_03_12_P1	Yes	6	*Balistapus undulatus*	1
2024_03_12_P1	Yes	6	*Chaetodon auriga*	2
2024_03_12_P1	Yes	6	*Chaetodon falcula*	2
2024_03_12_P1	Yes	6	*Chaetodon guttatissimus*	2
2024_03_12_P1	Yes	6	*Chaetodon lunula*	3
2024_03_12_P1	Yes	6	*Chaetodon trifasciatus*	2
2024_03_12_P1	Yes	6	*Chaetodon vagabundus*	2
2024_03_12_P1	Yes	6	*Paracirrhites forsteri*	1
2024_03_12_P1	Yes	6	*Aethaloperca rogaa*	1
2024_03_12_P1	Yes	6	*Cephalopholis leopardus*	2
2024_03_12_P1	Yes	6	*Myripristis kuntee*	3
2024_03_12_P1	Yes	6	*Sargocentron diadema*	1
2024_03_12_P1	Yes	6	*Anampses geographicus*	1

2024_03_12_P1	Yes	6	*Anampses meleagrides*	2
2024_03_12_P1	Yes	6	*Anampses twistii*	1
2024_03_12_P1	Yes	6	*Bodianus axillaris*	1
2024_03_12_P1	Yes	6	*Cheilinus sp.*	2
2024_03_12_P1	Yes	6	*Cheilinus sp1*	1
2024_03_12_P1	Yes	6	*Cheilio inermis*	4
2024_03_12_P1	Yes	6	*Epibulus insidiator*	1
2024_03_12_P1	Yes	6	*Gomphosus caeruleus*	2
2024_03_12_P1	Yes	6	*Halichoeres hortulanus*	1
2024_03_12_P1	Yes	6	*Labrichthys unilineatus*	1
2024_03_12_P1	Yes	6	*Labroides dimidiatus*	1
2024_03_12_P1	Yes	6	*Labroides sp.*	1
2024_03_12_P1	Yes	6	*Thalassoma hardwicke*	1
2024_03_12_P1	Yes	6	*Thalassoma hebraicum*	1
2024_03_12_P1	Yes	6	*Thalassoma lunare*	4
2024_03_12_P1	Yes	6	*Lethrinus harak*	9
2024_03_12_P1	Yes	6	*Lutjanus fulviflamma*	1
2024_03_12_P1	Yes	6	*Pervagor janthinosoma*	1
2024_03_12_P1	Yes	6	*Parupeneus barberinus*	6
2024_03_12_P1	Yes	6	*Parupeneus ciliatus*	2
2024_03_12_P1	Yes	6	*Parupeneus macronemus*	4
2024_03_12_P1	Yes	6	*Centropyge multispinis*	3
2024_03_12_P1	Yes	6	*Amphiprion akallopisos*	1
2024_03_12_P1	Yes	6	*Chromis opercularis*	1
2024_03_12_P1	Yes	6	*Chromis ternatensis*	100
2024_03_12_P1	Yes	6	*Plectroglyphidodon johnstonianus*	1
2024_03_12_P1	Yes	6	*Pycnochromis fieldi*	300
2024_03_12_P1	Yes	6	*Priacanthus hamrur*	1
2024_03_12_P1	Yes	6	*Calotomus carolinus*	1
2024_03_12_P1	Yes	6	*Chlorurus sordidus*	1
2024_03_12_P1	Yes	6	*Hipposcarus harid*	1
2024_03_12_P1	Yes	6	*Pterois miles*	1
2024_03_12_P1	Yes	6	*Zanclus cornutus*	3
2024_03_12_P2	Yes	7	*Acanthurus leucosternon*	1
2024_03_12_P2	Yes	7	*Acanthurus sp.*	1
2024_03_12_P2	Yes	7	*Acanthurus thompsoni*	3
2024_03_12_P2	Yes	7	*Ctenochaetus sp.*	3
2024_03_12_P2	Yes	7	*Zebrasoma scopas*	2
2024_03_12_P2	Yes	7	*Aulostomus chinensis*	1

2024_03_12_P2	Yes	7	*Caesio xanthalytos*	24
2024_03_12_P2	Yes	7	*Chaetodon auriga*	2
2024_03_12_P2	Yes	7	*Chaetodon lunula*	1
2024_03_12_P2	Yes	7	*Chaetodon melannotus*	1
2024_03_12_P2	Yes	7	*Chaetodon trifasciatus*	1
2024_03_12_P2	Yes	7	*Anampses twistii*	1
2024_03_12_P2	Yes	7	*Bodianus axillaris*	1
2024_03_12_P2	Yes	7	*Cheilinus chlorourus*	1
2024_03_12_P2	Yes	7	*Cheilinus sp.*	1
2024_03_12_P2	Yes	7	*Cheilio inermis*	5
2024_03_12_P2	Yes	7	*Coris formosa*	1
2024_03_12_P2	Yes	7	*Epibulus insidiator*	2
2024_03_12_P2	Yes	7	*Gomphosus caeruleus*	1
2024_03_12_P2	Yes	7	*Halichoeres hortulanus*	1
2024_03_12_P2	Yes	7	*Hemigymnus fasciatus*	1
2024_03_12_P2	Yes	7	*Oxycheilinus digramma*	1
2024_03_12_P2	Yes	7	*Thalassoma hardwicke*	1
2024_03_12_P2	Yes	7	*Thalassoma hebraicum*	5
2024_03_12_P2	Yes	7	*Thalassoma lunare*	3
2024_03_12_P2	Yes	7	*Lethrinus borbonicus*	5
2024_03_12_P2	Yes	7	*Lethrinus harak*	5
2024_03_12_P2	Yes	7	*Lethrinus microdon*	1
2024_03_12_P2	Yes	7	*Mulloidichthys flavolineatus*	4
2024_03_12_P2	Yes	7	*Parupeneus macronemus*	5
2024_03_12_P2	Yes	7	*Parupeneus pleurostigma*	3
2024_03_12_P2	Yes	7	*Centropyge multispinis*	1
2024_03_12_P2	Yes	7	*Dascyllus trimaculatus*	3
2024_03_12_P2	Yes	7	*Chlorurus capistratoides*	1
2024_03_12_P2	Yes	7	*Chlorurus sordidus*	2
2024_03_12_P2	Yes	7	*Chlorurus strongylocephalus*	1
2024_03_12_P2	Yes	7	*Hipposcarus harid*	20
2024_03_12_P2	Yes	7	*Scarus ghobban*	1
2024_03_12_P2	Yes	7	*Scarus psittacus*	1
2024_03_12_P2	Yes	7	*Siganus luridus*	1
2024_03_12_P2	Yes	7	*Siganus sp.*	8
2024_03_12_P3	Yes	22	*Flavocaranx bajad*	1
2024_03_12_P3	Yes	22	*Turrum coeruleopinnatum*	2
2024_03_12_P3	Yes	22	*Echeneis naucrates*	2
2024_03_12_P3	Yes	22	*Fistularia commersonii*	1

2024_03_12_P3	Yes	22	*Lethrinus microdon*	1
2024_03_12_P3	Yes	22	*Lethrinus variegatus*	9
2024_03_12_P3	Yes	22	*Canthigaster cyanospilota*	2
2024_03_13_P1	Yes	5	*Acanthurus sp.*	2
2024_03_13_P1	Yes	5	*Ctenochaetus sp.*	2
2024_03_13_P1	Yes	5	*Aulostomus chinensis*	1
2024_03_13_P1	Yes	5	*Fistularia commersonii*	1
2024_03_13_P1	Yes	5	*Kyphosus sp.*	1
2024_03_13_P1	Yes	5	*Kyphosus vaigiensis*	2
2024_03_13_P1	Yes	5	*Anampses twistii*	1
2024_03_13_P1	Yes	5	*Gomphosus caeruleus*	1
2024_03_13_P1	Yes	5	*Halichoeres hortulanus*	1
2024_03_13_P1	Yes	5	*Halichoeres scapularis*	4
2024_03_13_P1	Yes	5	*Labroides dimidiatus*	1
2024_03_13_P1	Yes	5	*Oxycheilinus digramma*	1
2024_03_13_P1	Yes	5	*Thalassoma sp.*	1
2024_03_13_P1	Yes	5	*Gymnocranius grandoculis*	2
2024_03_13_P1	Yes	5	*Lethrinus borbonicus*	3
2024_03_13_P1	Yes	5	*Lethrinus harak*	1
2024_03_13_P1	Yes	5	*Monotaxis grandoculis*	1
2024_03_13_P1	Yes	5	*Aprion virescens*	1
2024_03_13_P1	Yes	5	*Lutjanus fulviflamma*	5
2024_03_13_P1	Yes	5	*Macolor niger*	2
2024_03_13_P1	Yes	5	*Mulloidichthys flavolineatus*	15
2024_03_13_P1	Yes	5	*Parupeneus barberinus*	1
2024_03_13_P1	Yes	5	*Parupeneus macronemus*	1
2024_03_13_P1	Yes	5	*Scolopsis ghanam*	1
2024_03_13_P1	Yes	5	*Myrichthys maculosus*	1
2024_03_13_P1	Yes	5	*Parapercis hexophtalma*	1
2024_03_13_P1	Yes	5	*Pomacanthus semicirculatus*	1
2024_03_13_P1	Yes	5	*Abudefduf sparoides*	5
2024_03_13_P1	Yes	5	*Abudefduf vaigiensis*	1
2024_03_13_P1	Yes	5	*Amblyglyphidodon indicus*	1
2024_03_13_P1	Yes	5	*Dascyllus aruanus*	7
2024_03_13_P1	Yes	5	*Hipposcarus harid*	1
2024_03_13_P1	Yes	5	*Scarus ghobban*	13
2024_03_13_P2	Yes	3	*Acanthurus triostegus*	6
2024_03_13_P2	Yes	3	*Zebrasoma desjardinii*	1
2024_03_13_P2	Yes	3	*Zebrasoma sp.*	2

2024_03_13_P2	Yes	3	*Chaetodon lunula*	1
2024_03_13_P2	Yes	3	*Chaetodon trifasciatus*	2
2024_03_13_P2	Yes	3	*Cheilio inermis*	1
2024_03_13_P2	Yes	3	*Coris formosa*	1
2024_03_13_P2	Yes	3	*Gomphosus caeruleus*	2
2024_03_13_P2	Yes	3	*Halichoeres scapularis*	1
2024_03_13_P2	Yes	3	*Lethrinus harak*	2
2024_03_13_P2	Yes	3	*Monotaxis grandoculis*	1
2024_03_13_P2	Yes	3	*Mulloidichthys flavolineatus*	2
2024_03_13_P2	Yes	3	*Parupeneus barberinus*	11
2024_03_13_P2	Yes	3	*Parupeneus macronemus*	1
2024_03_13_P2	Yes	3	*Gymnothorax griseus*	1
2024_03_13_P2	Yes	3	*Scolopsis ghanam*	2
2024_03_13_P2	Yes	3	*Myrichthys maculosus*	2
2024_03_13_P2	Yes	3	*Centropyge multispinis*	1
2024_03_13_P2	Yes	3	*Abudefduf sexfasciatus*	5
2024_03_13_P2	Yes	3	*Abudefduf sparoides*	5
2024_03_13_P2	Yes	3	*Abudefduf vaigiensis*	2
2024_03_13_P2	Yes	3	*Hipposcarus harid*	3
2024_03_13_P2	Yes	3	*Scarus ghobban*	5
2024_03_13_P2	Yes	3	*Scarus psittacus*	12
2024_03_13_P2	Yes	3	*Siganus sp.*	2
2024_03_13_P2	Yes	3	*Zanclus cornutus*	1
2024_03_13_P3	Yes	1	*Acanthurus triostegus*	4
2024_03_13_P3	Yes	1	*Ctenochaetus sp.*	1
2024_03_13_P3	Yes	1	*Chaetodon auriga*	1
2024_03_13_P3	Yes	1	*Chaetodon kleinii*	1
2024_03_13_P3	Yes	1	*Chaetodon lunula*	2
2024_03_13_P3	Yes	1	*Chaetodon trifasciatus*	2
2024_03_13_P3	Yes	1	*Sargocentron diadema*	1
2024_03_13_P3	Yes	1	*Halichoeres hortulanus*	1
2024_03_13_P3	Yes	1	*Halichoeres scapularis*	4
2024_03_13_P3	Yes	1	*Hologymnosus sp.*	1
2024_03_13_P3	Yes	1	*Labroides sp.*	1
2024_03_13_P3	Yes	1	*Thalassoma hebraicum*	2
2024_03_13_P3	Yes	1	*Lutjanus fulviflamma*	3
2024_03_13_P3	Yes	1	*Parupeneus barberinus*	1
2024_03_13_P3	Yes	1	*Parupeneus macronemus*	2
2024_03_13_P3	Yes	1	*Parupeneus pleurostigma*	1

2024_03_13_P3	Yes	1	*Centropyge multispinis*	2
2024_03_13_P3	Yes	1	*Abudefduf sexfasciatus*	3
2024_03_13_P3	Yes	1	*Abudefduf vaigiensis*	2
2024_03_13_P3	Yes	1	*Amphiprion akallopisos*	1
2024_03_13_P3	Yes	1	*Dascyllus trimaculatus*	4
2024_03_13_P3	Yes	1	*Scarus ghobban*	1
2024_03_13_P3	Yes	1	*Scarus psittacus*	5
2024_04_02_P2	Yes	16	*Echeneis naucrates*	2
2024_04_02_P2	Yes	16	*Halichoeres scapularis*	1
2024_04_02_P2	Yes	16	*Pseudalutarius nasicornis*	2
2024_04_02_P2	Yes	16	*Upeneus margarethae*	3
2024_04_02_P2	Yes	16	*Scolopsis bimaculata*	4
2024_04_02_P2	Yes	16	*Parapercis maculata*	1
2024_04_03_P1	No	26	*Lactoria sp.*	1
2024_04_03_P1	No	26	*Parapercis maculata*	1
2024_04_03_P1	No	26	*Haliophis guttatus*	1
2024_04_03_P2	Yes	22	*Abalistes stellatus*	1
2024_04_03_P2	Yes	22	*Lethrinus harak*	3
2024_04_03_P2	Yes	22	*Lethrinus sp.*	3
2024_04_03_P2	Yes	22	*Pseudalutarius nasicornis*	3
2024_04_03_P2	Yes	22	*Scolopsis bimaculata*	2
2024_04_03_P2	Yes	22	*Scolopsis curite*	2
2024_04_03_P2	Yes	22	*Parapercis hexophtalma*	1
2024_04_03_P2	Yes	22	*Dascyllus trimaculatus*	2
2024_04_06_P1	Yes	12	*Acanthurus xanthopterus*	3
2024_04_06_P1	Yes	12	*Ctenochaetus sp.*	3
2024_04_06_P1	Yes	12	*Meiacanthus mossambicus*	1
2024_04_06_P1	Yes	12	*Chaetodon guttatissimus*	1
2024_04_06_P1	Yes	12	*Chaetodon kleinii*	1
2024_04_06_P1	Yes	12	*Chaetodon trifasciatus*	1
2024_04_06_P1	Yes	12	*Heniochus sp.*	2
2024_04_06_P1	Yes	12	*Aethaloperca rogaa*	1
2024_04_06_P1	Yes	12	*Cephalopholis boenak*	3
2024_04_06_P1	Yes	12	*Plectropomus laevis*	1
2024_04_06_P1	Yes	12	*Bodianus axillaris*	1
2024_04_06_P1	Yes	12	*Gomphosus caeruleus*	2
2024_04_06_P1	Yes	12	*Halichoeres hortulanus*	1
2024_04_06_P1	Yes	12	*Labroides bicolor*	1
2024_04_06_P1	Yes	12	*Oxycheilinus digramma*	2

2024_04_06_P1	Yes	12	*Thalassoma lunare*	1
2024_04_06_P1	Yes	12	*Thalassoma sp.*	2
2024_04_06_P1	Yes	12	*Parupeneus macronemus*	1
2024_04_06_P1	Yes	12	*Parupeneus sp.*	4
2024_04_06_P1	Yes	12	*Scolopsis ghanam*	1
2024_04_06_P1	Yes	12	*Parapercis hexophtalma*	2
2024_04_06_P1	Yes	12	*Centropyge multispinis*	2
2024_04_06_P1	Yes	12	*Centropyge sp.*	1
2024_04_06_P1	Yes	12	*Abudefduf vaigiensis*	1
2024_04_06_P1	Yes	12	*Amblyglyphidodon indicus*	6
2024_04_06_P1	Yes	12	*Chromis opercularis*	5
2024_04_06_P1	Yes	12	*Dascyllus trimaculatus*	11
2024_04_06_P1	Yes	12	*Pycnochromis fieldi*	1
2024_04_06_P1	Yes	12	*Calotomus carolinus*	1
2024_04_06_P1	Yes	12	*Siganus luridus*	2
2024_04_06_P1	Yes	12	*Synodus variegatus*	1
2024_04_06_P1	Yes	12	*Canthigaster valentini*	2
2024_04_06_P2	Yes	17	*Iniistius sp.*	1
2024_04_06_P2	Yes	17	*Upeneus sp.*	20
2024_04_06_P2	Yes	17	*Lagocephalus sceleratus*	1
2024_04_11_P1	No	15	*Acanthurus leucosternon*	2
2024_04_11_P1	No	15	*Acanthurus thompsoni*	7
2024_04_11_P1	No	15	*Ctenochaetus sp.*	6
2024_04_11_P1	No	15	*Naso hexacanthus*	14
2024_04_11_P1	No	15	*Naso minor*	2
2024_04_11_P1	No	15	*Naso sp.*	1
2024_04_11_P1	No	15	*Naso unicornis*	3
2024_04_11_P1	No	15	*Naso vlamingii*	5
2024_04_11_P1	No	15	*Cheilodipterus macrodon*	2
2024_04_11_P1	No	15	*Aulostomus chinensis*	2
2024_04_11_P1	No	15	*Balistoides viridescens*	1
2024_04_11_P1	No	15	*Sufflamen chrysopterum*	1
2024_04_11_P1	No	15	*Pterocaesio sp.*	4
2024_04_11_P1	No	15	*Pterocaesio tile*	100
2024_04_11_P1	No	15	*Chaetodon guttatissimus*	1
2024_04_11_P1	No	15	*Chaetodon kleinii*	2
2024_04_11_P1	No	15	*Chaetodon meyeri*	1
2024_04_11_P1	No	15	*Chaetodon trifascialis*	1
2024_04_11_P1	No	15	*Hemitaurichthys zoster*	1

2024_04_11_P1	No	15	*Heniochus monoceros*	2
2024_04_11_P1	No	15	*Aethaloperca rogaa*	1
2024_04_11_P1	No	15	*Cephalopholis argus*	2
2024_04_11_P1	No	15	*Myripristis sp.*	3
2024_04_11_P1	No	15	*Sargocentron caudimaculatum*	1
2024_04_11_P1	No	15	*Sargocentron diadema*	1
2024_04_11_P1	No	15	*Kyphosus sp.*	2
2024_04_11_P1	No	15	*Anampses meleagrides*	1
2024_04_11_P1	No	15	*Anampses twistii*	1
2024_04_11_P1	No	15	*Bodianus axillaris*	1
2024_04_11_P1	No	15	*Bodianus diana*	1
2024_04_11_P1	No	15	*Coris batuensis*	1
2024_04_11_P1	No	15	*Epibulus insidiator*	3
2024_04_11_P1	No	15	*Gomphosus caeruleus*	1
2024_04_11_P1	No	15	*Halichoeres hortulanus*	2
2024_04_11_P1	No	15	*Labroides bicolor*	2
2024_04_11_P1	No	15	*Labroides dimidiatus*	3
2024_04_11_P1	No	15	*Oxycheilinus digramma*	1
2024_04_11_P1	No	15	*Pseudodax moluccanus*	1
2024_04_11_P1	No	15	*Thalassoma hebraicum*	2
2024_04_11_P1	No	15	*Thalassoma sp.*	1
2024_04_11_P1	No	15	*Gnathodentex aureolineatus*	4
2024_04_11_P1	No	15	*Lethrinus sp.*	1
2024_04_11_P1	No	15	*Lutjanus fulviflamma*	8
2024_04_11_P1	No	15	*Lutjanus kasmira*	1
2024_04_11_P1	No	15	*Lutjanus lutjanus*	30
2024_04_11_P1	No	15	*Lutjanus sp.*	15
2024_04_11_P1	No	15	*Pervagor janthinosoma*	1
2024_04_11_P1	No	15	*Mulloidichthys ayliffe*	1
2024_04_11_P1	No	15	*Parupeneus macronemus*	1
2024_04_11_P1	No	15	*Parupeneus pleurostigma*	1
2024_04_11_P1	No	15	*Ostracion meleagris*	1
2024_04_11_P1	No	15	*Centropyge multispinis*	1
2024_04_11_P1	No	15	*Pomacanthus imperator*	1
2024_04_11_P1	No	15	*Chromis opercularis*	1
2024_04_11_P1	No	15	*Dascyllus trimaculatus*	7
2024_04_11_P1	No	15	*Pycnochromis fieldi*	50
2024_04_11_P1	No	15	*Pycnochromis nigrurus*	2
2024_04_11_P1	No	15	*Scarus frenatus*	1

2024_04_11_P1	No	15	*Scarus scaber*	1
2024_04_11_P1	No	15	*Siganus sp.*	1
2024_04_11_P1	No	15	*Arothron sp.*	2
2024_04_11_P1	No	15	*Canthigaster smithae*	1
2024_04_11_P1	No	15	*Canthigaster sp.*	1
2024_04_11_P1	No	15	*Zanclus cornutus*	3
2024_04_11_P2	Yes	18	*Acanthurus thompsoni*	1
2024_04_11_P2	Yes	18	*Ctenochaetus sp.*	2
2024_04_11_P2	Yes	18	*Naso minor*	60
2024_04_11_P2	Yes	18	*Naso unicornis*	1
2024_04_11_P2	Yes	18	*Zebrasoma sp.*	1
2024_04_11_P2	Yes	18	*Aetobatus ocellatus*	1
2024_04_11_P2	Yes	18	*Aulostomus chinensis*	2
2024_04_11_P2	Yes	18	*Balistapus undulatus*	1
2024_04_11_P2	Yes	18	*Melichthys indicus*	20
2024_04_11_P2	Yes	18	*Sufflamen chrysopterum*	1
2024_04_11_P2	Yes	18	*Caesio xanthonota*	14
2024_04_11_P2	Yes	18	*Pterocaesio chrysozona*	50
2024_04_11_P2	Yes	18	*Pterocaesio tile*	8
2024_04_11_P2	Yes	18	*Chaetodon auriga*	6
2024_04_11_P2	Yes	18	*Chaetodon interruptus*	2
2024_04_11_P2	Yes	18	*Chaetodon kleinii*	3
2024_04_11_P2	Yes	18	*Chaetodon lunula*	4
2024_04_11_P2	Yes	18	*Chaetodon madagaskariensis*	2
2024_04_11_P2	Yes	18	*Chaetodon trifasciatus*	2
2024_04_11_P2	Yes	18	*Forcipiger sp.*	1
2024_04_11_P2	Yes	18	*Aethaloperca rogaa*	2
2024_04_11_P2	Yes	18	*Cephalopholis argus*	3
2024_04_11_P2	Yes	18	*Cephalopholis nigripinnis*	2
2024_04_11_P2	Yes	18	*Variola albimarginata*	1
2024_04_11_P2	Yes	18	*Variola sp.*	1
2024_04_11_P2	Yes	18	*Fistularia commersonii*	1
2024_04_11_P2	Yes	18	*Bodianus anthioides*	1
2024_04_11_P2	Yes	18	*Bodianus diana*	3
2024_04_11_P2	Yes	18	*Coris formosa*	1
2024_04_11_P2	Yes	18	*Epibulus insidiator*	1
2024_04_11_P2	Yes	18	*Halichoeres hortulanus*	1
2024_04_11_P2	Yes	18	*Labroides bicolor*	3
2024_04_11_P2	Yes	18	*Oxycheilinus digramma*	1

2024_04_11_P2	Yes	18	*Thalassoma hebraicum*	1
2024_04_11_P2	Yes	18	*Thalassoma sp.*	1
2024_04_11_P2	Yes	18	*Lethrinus borbonicus*	3
2024_04_11_P2	Yes	18	*Lethrinus microdon*	12
2024_04_11_P2	Yes	18	*Lethrinus sp.*	1
2024_04_11_P2	Yes	18	*Lutjanus bohar*	1
2024_04_11_P2	Yes	18	*Lutjanus kasmira*	45
2024_04_11_P2	Yes	18	*Nemateleotris magnifica*	5
2024_04_11_P2	Yes	18	*Parupeneus barberinus*	1
2024_04_11_P2	Yes	18	*Parupeneus macronemus*	2
2024_04_11_P2	Yes	18	*Parupeneus pleurostigma*	1
2024_04_11_P2	Yes	18	*Scolopsis ghanam*	1
2024_04_11_P2	Yes	18	*Apolemichthys trimaculatus*	1
2024_04_11_P2	Yes	18	*Dascyllus trimaculatus*	2
2024_04_11_P2	Yes	18	*Pycnochromis fieldi*	50
2024_04_11_P2	Yes	18	*Scarus frenatus*	1
2024_04_11_P2	Yes	18	*Arothron sp.*	1
2024_04_11_P2	Yes	18	*Zanclus cornutus*	1
2024_04_11_P3	Yes	22	*Ctenochaetus sp.*	1
2024_04_11_P3	Yes	22	*Pseudobalistes flavimarginatus*	1
2024_04_11_P3	Yes	22	*Sufflamen chrysopterum*	1
2024_04_11_P3	Yes	22	*Aspidontus dussumieri*	1
2024_04_11_P3	Yes	22	*Chaetodon kleinii*	3
2024_04_11_P3	Yes	22	*Bodianus trilineatus*	1
2024_04_11_P3	Yes	22	*Labroides bicolor*	2
2024_04_11_P3	Yes	22	*Labroides dimidiatus*	4
2024_04_11_P3	Yes	22	*Oxycheilinus bimaculatus*	2
2024_04_11_P3	Yes	22	*Pseudocheilinus evanidus*	4
2024_04_11_P3	Yes	22	*Gymnocranius grandoculis*	1
2024_04_11_P3	Yes	22	*Lethrinus microdon*	1
2024_04_11_P3	Yes	22	*Lethrinus sp.*	5
2024_04_11_P3	Yes	22	*Lethrinus variegatus*	1
2024_04_11_P3	Yes	22	*Parupeneus macronemus*	9
2024_04_11_P3	Yes	22	*Parupeneus pleurostigma*	1
2024_04_11_P3	Yes	22	*Parapercis maculata*	1
2024_04_11_P3	Yes	22	*Parapercis sp.*	1
2024_04_11_P3	Yes	22	*Synodus jaculum*	1
2024_04_12_P1	No	18	*Naso brevirostris*	1
2024_04_12_P1	No	18	*Naso minor*	3

2024_04_12_P1	No	18	*Naso sp.*	1
2024_04_12_P1	No	18	*Sufflamen chrysopterum*	1
2024_04_12_P1	No	18	*Chaetodon auriga*	1
2024_04_12_P1	No	18	*Chaetodon kleinii*	1
2024_04_12_P1	No	18	*Chaetodon trifascialis*	1
2024_04_12_P1	No	18	*Cephalopholis argus*	2
2024_04_12_P1	No	18	*Variola albimarginata*	1
2024_04_12_P1	No	18	*Myripristis sp.*	1
2024_04_12_P1	No	18	*Sargocentron diadema*	9
2024_04_12_P1	No	18	*Anampses caeruleopunctatus*	1
2024_04_12_P1	No	18	*Anampses geographicus*	1
2024_04_12_P1	No	18	*Bodianus axillaris*	1
2024_04_12_P1	No	18	*Bodianus diana*	1
2024_04_12_P1	No	18	*Cheilinus sp.*	1
2024_04_12_P1	No	18	*Cheilio inermis*	2
2024_04_12_P1	No	18	*Halichoeres hortulanus*	1
2024_04_12_P1	No	18	*Labroides dimidiatus*	3
2024_04_12_P1	No	18	*Novaculichthys taeniourus*	1
2024_04_12_P1	No	18	*Thalassoma sp.*	1
2024_04_12_P1	No	18	*Lethrinus sp.*	3
2024_04_12_P1	No	18	*Lutjanus gibbus*	4
2024_04_12_P1	No	18	*Parupeneus macronemus*	2
2024_04_12_P1	No	18	*Parupeneus sp.*	1
2024_04_12_P1	No	18	*Scolopsis ghanam*	1
2024_04_12_P1	No	18	*Centropyge multispinis*	1
2024_04_12_P1	No	18	*Amphiprion akallopisos*	2
2024_04_12_P1	No	18	*Chromis opercularis*	1
2024_04_12_P1	No	18	*Dascyllus trimaculatus*	12
2024_04_12_P1	No	18	*Priacanthus hamrur*	2
2024_04_12_P1	No	18	*Rachycentron canadum*	3
2024_04_12_P1	No	18	*Calotomus carolinus*	1
2024_04_12_P1	No	18	*Chlorurus sordidus*	2
2024_04_12_P1	No	18	*Scarus frenatus*	1
2024_04_12_P1	No	18	*Scarus ghobban*	1
2024_04_12_P1	No	18	*Scarus psittacus*	2
2024_04_12_P1	No	18	*Siganus sp.*	1
2024_04_12_P1	No	18	*Zanclus cornutus*	1
2024_04_12_P2	Yes	21	*Naso sp.*	1
2024_04_12_P2	Yes	21	*Aetobatus ocellatus*	1

2024_04_12_P2	Yes	21	*Echeneis naucrates*	1
2024_04_12_P2	Yes	21	*Hologymnosus sp.*	1
2024_04_12_P2	Yes	21	*Lethrinus sp.*	9
2024_04_12_P2	Yes	21	*Dascyllus trimaculatus*	7
2024_04_12_P3	Yes	25	*Naso brevirostris*	3
2024_04_12_P3	Yes	25	*Chaetodon kleinii*	1
2024_04_12_P3	Yes	25	*Bodianus diana*	1
2024_04_12_P3	Yes	25	*Hologymnosus sp.*	2
2024_04_12_P3	Yes	25	*Lethrinus sp.*	19
2024_04_12_P3	Yes	25	*Lutjanus lutjanus*	5
2024_04_12_P3	Yes	25	*Parupeneus sp.*	1
2024_04_12_P4	Yes	13	*Naso brevirostris*	1
2024_04_12_P4	Yes	13	*Naso sp.*	1
2024_04_12_P4	Yes	13	*Caesio xanthonota*	31
2024_04_12_P4	Yes	13	*Pterocaesio marri*	65
2024_04_12_P4	Yes	13	*Bodianus bilunulatus*	1
2024_04_12_P4	Yes	13	*Halichoeres hortulanus*	2
2024_04_12_P4	Yes	13	*Lethrinus harak*	1
2024_04_12_P4	Yes	13	*Lethrinus microdon*	2
2024_04_12_P4	Yes	13	*Lethrinus sp.*	1
2024_04_12_P4	Yes	13	*Parupeneus barberinus*	2
2024_04_12_P4	Yes	13	*Parupeneus indicus*	1
2024_04_12_P4	Yes	13	*Parupeneus macronemus*	5
2024_04_12_P4	Yes	13	*Parupeneus pleurostigma*	4
2024_04_12_P4	Yes	13	*Parupeneus sp.*	3
2024_04_12_P5	Yes	20	*Ctenochaetus sp.*	1
2024_04_12_P5	Yes	20	*Naso fageni*	1
2024_04_12_P5	Yes	20	*Naso sp.*	1
2024_04_12_P5	Yes	20	*Aulostomus chinensis*	1
2024_04_12_P5	Yes	20	*Balistapus undulatus*	1
2024_04_12_P5	Yes	20	*Sufflamen chrysopterum*	1
2024_04_12_P5	Yes	20	*Chaetodon guttatissimus*	2
2024_04_12_P5	Yes	20	*Chaetodon kleinii*	2
2024_04_12_P5	Yes	20	*Chaetodon lunula*	2
2024_04_12_P5	Yes	20	*Chaetodon meyeri*	1
2024_04_12_P5	Yes	20	*Chaetodon trifasciatus*	2
2024_04_12_P5	Yes	20	*Chaetodon xanthocephalus*	1
2024_04_12_P5	Yes	20	*Forcipiger sp.*	1
2024_04_12_P5	Yes	20	*Heniochus sp.*	1

2024_04_12_P5	Yes	20	*Paracirrhites forsteri*	1
2024_04_12_P5	Yes	20	*Echeneis naucrates*	1
2024_04_12_P5	Yes	20	*Platax sp.*	1
2024_04_12_P5	Yes	20	*Cephalopholis argus*	4
2024_04_12_P5	Yes	20	*Cephalopholis spiloparaea*	1
2024_04_12_P5	Yes	20	*Plectorhinchus flavomaculatus*	1
2024_04_12_P5	Yes	20	*Plectorhinchus gaterinus*	1
2024_04_12_P5	Yes	20	*Myripristis sp.*	11
2024_04_12_P5	Yes	20	*Sargocentron caudimaculatum*	1
2024_04_12_P5	Yes	20	*Sargocentron diadema*	1
2024_04_12_P5	Yes	20	*Anampses twistii*	2
2024_04_12_P5	Yes	20	*Bodianus anthioides*	1
2024_04_12_P5	Yes	20	*Bodianus axillaris*	2
2024_04_12_P5	Yes	20	*Epibulus insidiator*	1
2024_04_12_P5	Yes	20	*Gomphosus caeruleus*	1
2024_04_12_P5	Yes	20	*Halichoeres hortulanus*	2
2024_04_12_P5	Yes	20	*Labroides bicolor*	2
2024_04_12_P5	Yes	20	*Labroides dimidiatus*	1
2024_04_12_P5	Yes	20	*Oxycheilinus digramma*	2
2024_04_12_P5	Yes	20	*Thalassoma hebraicum*	2
2024_04_12_P5	Yes	20	*Thalassoma sp.*	1
2024_04_12_P5	Yes	20	*Gymnocranius grandoculis*	2
2024_04_12_P5	Yes	20	*Lethrinus borbonicus*	1
2024_04_12_P5	Yes	20	*Lethrinus harak*	1
2024_04_12_P5	Yes	20	*Lethrinus microdon*	1
2024_04_12_P5	Yes	20	*Lethrinus rubrioperculatus*	2
2024_04_12_P5	Yes	20	*Aphareus furca*	1
2024_04_12_P5	Yes	20	*Lutjanus fulviflamma*	6
2024_04_12_P5	Yes	20	*Lutjanus gibbus*	1
2024_04_12_P5	Yes	20	*Lutjanus kasmira*	24
2024_04_12_P5	Yes	20	*Lutjanus lutjanus*	4
2024_04_12_P5	Yes	20	*Mulloidichthys flavolineatus*	15
2024_04_12_P5	Yes	20	*Parupeneus barberinus*	1
2024_04_12_P5	Yes	20	*Parupeneus macronemus*	2
2024_04_12_P5	Yes	20	*Scolopsis ghanam*	1
2024_04_12_P5	Yes	20	*Centropyge multispinis*	2
2024_04_12_P5	Yes	20	*Chromis opercularis*	1
2024_04_12_P5	Yes	20	*Dascyllus trimaculatus*	4
2024_04_12_P5	Yes	20	*Pomacentrus trichrourus*	1

2024_04_12_P5	Yes	20	*Pycnochromis fieldi*	60
2024_04_12_P5	Yes	20	*Scarus ghobban*	2
2024_04_12_P5	Yes	20	*Siganus luridus*	1
2024_04_12_P5	Yes	20	*Siganus sp.*	20
2024_04_12_P5	Yes	20	*Sphyraena qenie*	3
2024_04_12_P5	Yes	20	*Canthigaster smithae*	1
2024_04_12_P5	Yes	20	*Zanclus cornutus*	1

C Habitat categorization by snorkeling

Table: Average substrate ratio and complexity level based on habitat categorization from snorkeling surveys. Substrate categories include: soft coral (Sc), sponges (Sp), macroalgae (M), seagrass (Sg), sand (S), hard substrate (Hs), rubble (R), and hard live coral (Hlc). The table also includes a complexity level (C) for each sample.

SampleID	Sc	Sp	M	Sg	S	Hs	R	Hlc	C
2024_02_20_P1	0.10	0.00	0.00	0.00	0.53	0.08	0.15	0.15	1.11
2024_02_23_P1	0.00	0.00	0.01	0.19	0.36	0.09	0.02	0.32	1.86
2024_02_23_P2	0.00	0.00	0.01	0.19	0.36	0.09	0.02	0.32	1.86
2024_02_24_P1	0.01	0.00	0.00	0.00	0.10	0.04	0.01	0.84	4.18
2024_02_24_P2	0.10	0.00	0.01	0.00	0.64	0.03	0.06	0.16	1.38
2024_02_26_P1	0.06	0.03	0.04	0.07	0.19	0.54	0.02	0.04	1.08
2024_02_27_P1									
2024_02_27_P2									
2024_02_27_P3	0.00	0.01	0.02	0.16	0.27	0.33	0.20	0.01	1.00
2024_02_28_P1									
2024_02_28_P2									
2024_03_01_P1									
2024_03_01_P2	0.12	0.02	0.11	0.00	0.19	0.09	0.16	0.31	2.64
2024_03_01_P3	0.12	0.02	0.11	0.00	0.19	0.09	0.16	0.31	2.64
2024_03_01_P4	0.02	0.02	0.20	0.19	0.34	0.08	0.04	0.11	2.18
2024_03_05_P1									
2024_03_05_P2	0.02	0.00	0.05	0.17	0.37	0.05	0.02	0.32	2.00
2024_03_07_P1									
2024_03_07_P2	0.19	0.02	0.08	0.00	0.09	0.26	0.02	0.34	1.70
2024_03_07_P3	0.06	0.04	0.08	0.00	0.60	0.04	0.11	0.08	1.00
2024_03_07_P4									
2024_03_08_P1									
2024_03_08_P2	0.13	0.00	0.29	0.00	0.12	0.37	0.02	0.06	2.00
2024_03_08_P3									
2024_03_10_P1	0.03	0.02	0.06	0.00	0.12	0.01	0.13	0.62	3.36
2024_03_10_P2	0.00	0.02	0.04	0.00	0.31	0.02	0.05	0.56	2.85
2024_03_10_P3	0.02	0.00	0.06	0.00	0.26	0.01	0.28	0.37	2.85
2024_03_11_P1									
2024_03_11_P2									
2024_03_11_P3	0.14	0.02	0.19	0.02	0.31	0.00	0.01	0.30	3.00
2024_03_12_P1	0.13	0.02	0.29	0.15	0.09	0.01	0.01	0.29	2.25

2024_03_12_P2	0.08	0.01	0.20	0.18	0.05	0.04	0.03	0.41	2.71
2024_03_12_P3									
2024_03_13_P1	0.07	0.01	0.01	0.09	0.38	0.22	0.04	0.17	2.10
2024_03_13_P2	0.04	0.00	0.02	0.00	0.56	0.17	0.01	0.19	1.67
2024_03_13_P3	0.00	0.00	0.04	0.00	0.15	0.38	0.40	0.02	1.07
2024_04_02_P1									
2024_04_02_P2									
2024_04_02_P3									
2024_04_03_P1									
2024_04_03_P2									
2024_04_06_P1									
2024_04_06_P2									
2024_04_11_P1									
2024_04_11_P2									
2024_04_11_P3									
2024_04_12_P1									
2024_04_12_P2									
2024_04_12_P3									
2024_04_12_P4									
2024_04_12_P5									

D Habitat categorization by BRUV footage

Table: Substrate ratio and complexity level based on habitat categorization from BRUV footage. Substrate categories include: soft coral (Sc), sponges (Sp), macroalgae (M), seagrass (Sg), sand (S), hard substrate (Hs), rubble (R), and hard live coral (Hlc). The table also includes a complexity level (C) for each sample.

SampleID	Sc	Sp	M	Sg	S	Hs	R	Hlc	C
2024_02_20_P1	0.00	0.00	0.00	0.00	0.55	0.00	0.05	0.40	3
2024_02_23_P1	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.30	3
2024_02_23_P2	0.00	0.00	0.00	0.95	0.05	0.00	0.00	0.00	1
2024_02_24_P1	0.00	0.00	0.00	0.00	0.99	0.00	0.01	0.00	0
2024_02_24_P2	0.00	0.00	0.00	0.00	0.40	0.00	0.10	0.50	5
2024_02_26_P1									
2024_02_27_P1	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1
2024_02_27_P2	0.00	0.00	0.00	0.00	0.30	0.01	0.10	0.59	5
2024_02_27_P3	0.00	0.00	0.40	0.00	0.00	0.15	0.15	0.30	2
2024_02_28_P1	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.10	3
2024_02_28_P2	0.00	0.00	0.20	0.80	0.00	0.00	0.00	0.00	2
2024_03_01_P1	0.30	0.05	0.01	0.00	0.20	0.00	0.01	0.43	5
2024_03_01_P2	0.50	0.01	0.01	0.00	0.30	0.01	0.10	0.07	5
2024_03_01_P3	0.50	0.01	0.01	0.00	0.30	0.01	0.10	0.07	5
2024_03_01_P4	0.10	0.05	0.10	0.60	0.05	0.00	0.00	0.10	3
2024_03_05_P1	0.00	0.00	0.00	0.00	0.99	0.00	0.01	0.00	0
2024_03_05_P2	0.01	0.00	0.01	0.38	0.00	0.00	0.00	0.60	3
2024_03_07_P1	0.00	0.00	0.30	0.00	0.40	0.00	0.30	0.00	1
2024_03_07_P2	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.90	2
2024_03_07_P3	0.30	0.00	0.00	0.00	0.40	0.00	0.20	0.10	1
2024_03_07_P4	0.00	0.00	0.00	0.00	0.99	0.00	0.01	0.00	0
2024_03_08_P1	0.00	0.05	0.10	0.00	0.70	0.04	0.01	0.10	1
2024_03_08_P2	0.25	0.00	0.10	0.00	0.40	0.00	0.05	0.20	5
2024_03_08_P3	0.05	0.00	0.05	0.00	0.50	0.05	0.05	0.30	4
2024_03_10_P1	0.00	0.00	0.10	0.00	0.30	0.00	0.10	0.50	5
2024_03_10_P2	0.00	0.00	0.20	0.00	0.35	0.00	0.10	0.35	5
2024_03_10_P3	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.90	5
2024_03_11_P1	0.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0
2024_03_11_P2	0.00	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0
2024_03_11_P3	0.00	0.00	0.50	0.45	0.05	0.00	0.00	0.00	1
2024_03_12_P1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	5

2024_03_12_P2	0.00	0.00	0.30	0.50	0.01	0.00	0.00	0.19	5
2024_03_12_P3	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1
2024_03_13_P1	0.30	0.00	0.01	0.00	0.20	0.00	0.10	0.39	5
2024_03_13_P2	0.01	0.00	0.01	0.00	0.30	0.10	0.05	0.53	5
2024_03_13_P3	0.05	0.01	0.01	0.00	0.20	0.53	0.10	0.10	3
2024_04_02_P1									
2024_04_02_P2	0.00	0.00	0.00	0.00	0.90	0.00	0.10	0.00	0
2024_04_02_P3									
2024_04_03_P1	0.00	0.00	0.00	0.00	0.80	0.00	0.20	0.00	0
2024_04_03_P2	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0
2024_04_06_P1	0.05	0.00	0.55	0.00	0.20	0.00	0.00	0.20	3
2024_04_06_P2	0.00	0.00	0.00	0.00	0.99	0.00	0.01	0.00	0
2024_04_11_P1	0.00	0.01	0.05	0.00	0.00	0.01	0.00	0.93	3
2024_04_11_P2	0.01	0.01	0.01	0.00	0.01	0.00	0.20	0.76	3
2024_04_11_P3	0.30	0.01	0.10	0.00	0.10	0.05	0.43	0.01	1
2024_04_12_P1	0.30	0.00	0.10	0.00	0.10	0.00	0.20	0.30	3
2024_04_12_P2	0.05	0.10	0.05	0.00	0.15	0.00	0.64	0.01	2
2024_04_12_P3	0.10	0.00	0.01	0.00	0.54	0.00	0.30	0.05	1
2024_04_12_P4	0.00	0.00	0.00	0.00	0.20	0.00	0.75	0.05	1
2024_04_12_P5	0.08	0.00	0.30	0.00	0.01	0.00	0.01	0.60	3

E Control for the influence of bait

Non-baited control samples did not differ significantly in relative abundance from their paired baited samples. Table 10 presents the PERMANOVA results for analyses conducted at the genus and family level, as well as trophic groups.

Table 10: Results of permutational analysis of variance (PERMANOVA) on paired baited and non-baited samples.

Group	Df	R2	F	P-value
Genus	1	0.075	0.8109	0.1667
Family	1	0.06266	0.7354	0.3333
Trophic groups	1	0.08211	0.8945	0.2708

F Sample site data

SampleID	Location	Depth (m)	Visibility (m)	Temperature (°C)	Tide (m)
2024_02_20_P1	Bawe Island	3	>10	30	2.00
2024_02_23_P1	Changu Island	1	<10	30	0.70
2024_02_23_P2	Changu Island	5	<10	30	0.70
2024_02_24_P1	Bawe Island	13	>10	30	3.50
2024_02_24_P2	Bawe Island	4	>10	30	3.40
2024_02_26_P1	Uroa	6	<10	30	0.90
2024_02_27_P1	Uroa	12	>10	30	2.00
2024_02_27_P2	Uroa	13	>10	30	0.80
2024_02_27_P3	Uroa	2	>10	30	0.40
2024_02_28_P1	Uroa	12	>10	30	2.00
2024_02_28_P2	Uroa	9	>10	30	1.00
2024_03_01_P1	Ukombe Island	13	>10	30	0.80
2024_03_01_P2	Kwale Island	8	>10	31	1.30
2024_03_01_P3	Kwale Island	8	>10	31	1.70
2024_03_01_P4	Fumba	2	<10	32	2.80
2024_03_05_P1	Tumbatu Island	26	<10	30	1.70
2024_03_05_P2	Tumbatu Island	2	<10	31	1.70
2024_03_07_P1	Nungwi	18	<10	30	0.90
2024_03_07_P2	Nungwi	10	>10	30	1.30
2024_03_07_P3	Nungwi	3	>10	31	1.70
2024_03_07_P4	Nungwi	18	>10	31	1.90
2024_03_08_P1	Mnemba	24	>10	30	1.80
2024_03_08_P2	Mnemba	9	<10	30	2.50
2024_03_08_P3	Nungwi	18	>10	30	2.80
2024_03_10_P1	Chumbe	8	>10	30	0.40
2024_03_10_P2	Chumbe	9	>10	30	0.00
2024_03_10_P3	Chumbe	3	>10	31	0.70
2024_03_11_P1	Kizimkazi	42	>10	29	2.00
2024_03_11_P2	Kizimkazi	40	>10	29	0.40
2024_03_11_P3	Kizimkazi	10	>10	30	-0.20
2024_03_12_P1	Kizimkazi	6	<10	30	0.80
2024_03_12_P2	Kizimkazi	7	>10	30	0.00
2024_03_12_P3	Kizimkazi	22	>10	30	0.00
2024_03_13_P1	Jambiani	5	>10	31	1.20
2024_03_13_P2	Jambiani	3	>10	32	0.50

2024_03_13_P3	Jambiani	1	>10	32	-0.10
2024_04_02_P1	Pange Island	17	>10	30	2.00
2024_04_02_P2	Pange Island	16	>10	30	2.20
2024_04_02_P3	Pange Island	19	>10	30	2.30
2024_04_03_P1	Pange Island	26	<10	30	2.20
2024_04_03_P2	Pange Island	22	<10	30	2.40
2024_04_06_P1	Kwale Island	12	>10	30	2.60
2024_04_06_P2	Kwale Island	17	<10	30	3.20
2024_04_11_P1	Paje	15	>10	30	0.10
2024_04_11_P2	Paje	18	>10	30	0.10
2024_04_11_P3	Paje	22	<10	30	0.50
2024_04_12_P1	Jambiani	18	>10	30	0.90
2024_04_12_P2	Jambiani	21	>10	30	0.30
2024_04_12_P3	Jambiani	25	>10	30	0.20
2024_04_12_P4	Jambiani	13	>10	30	0.20
2024_04_12_P5	Jambiani	20	>10	30	0.40

G Weather and water conditions data

SampleID	Weather	Water conditions
2024_02_20_P1	Sunny	Small waves
2024_02_23_P1	Mostly cloudy	Big waves
2024_02_23_P2	Cloudy	Big waves
2024_02_24_P1	Cloudy	Small waves
2024_02_24_P2	Cloudy	Small waves
2024_02_26_P1	Mostly sunny	Calm
2024_02_27_P1	Cloudy	Calm
2024_02_27_P2	Cloudy	Medium waves
2024_02_27_P3	Cloudy	Small waves
2024_02_28_P1	Mostly cloudy	Medium waves
2024_02_28_P2	Sunny	Medium waves
2024_03_01_P1	Sunny	Small waves
2024_03_01_P2	Sunny	Small waves
2024_03_01_P3	Sunny	Calm
2024_03_01_P4	Sunny	Calm
2024_03_05_P1	Mostly cloudy	Small waves
2024_03_05_P2	Mostly sunny	Small waves
2024_03_07_P1	Sunny	Calm
2024_03_07_P2	Mostly sunny	Small waves
2024_03_07_P3	Mostly sunny	Small waves
2024_03_07_P4	Mostly cloudy	Small waves
2024_03_08_P1	Sunny	Small waves
2024_03_08_P2	Sunny	Small waves
2024_03_08_P3	Mostly sunny	Medium waves
2024_03_10_P1	Sunny	Calm
2024_03_10_P2	Sunny	Calm
2024_03_10_P3	Sunny	Calm
2024_03_11_P1	Sunny	Medium waves
2024_03_11_P2	Mostly sunny	Medium waves
2024_03_11_P3	Mostly sunny	Small waves
2024_03_12_P1	Cloudy	Calm
2024_03_12_P2	Cloudy	Calm
2024_03_12_P3	Mostly cloudy	Small waves
2024_03_13_P1	Sunny	Calm
2024_03_13_P2	Mostly sunny	Small waves

2024_03_13_P3	Sunny	Calm
2024_04_02_P1	Cloudy	Medium waves
2024_04_02_P2	Mostly cloudy	Medium waves
2024_04_02_P3	Mostly cloudy	Medium waves
2024_04_03_P1	Rainy	Medium waves
2024_04_03_P2	Cloudy	Medium waves
2024_04_06_P1	Rainy	Big waves
2024_04_06_P2	Cloudy	Big waves
2024_04_11_P1	Cloudy	Calm
2024_04_11_P2	Cloudy	Calm
2024_04_11_P3	Mostly cloudy	Calm
2024_04_12_P1	Mostly cloudy	Small waves
2024_04_12_P2	Mostly cloudy	Medium waves
2024_04_12_P3	Cloudy	Big waves
2024_04_12_P4	Cloudy	Medium waves
2024_04_12_P5	Cloudy	Medium waves

H SIMPER results - Genus and species

Table: Results from SIMPER analysis of fish communities between shallow (ava) and deep (avb) strata. The results are rounded to the nearest hundredth.

Taxon	average	sd	ratio	ava	avb	cumsum	p-value
Lethrinus sp.	0.04	0.04	0.91	0.06	0.25	0.04	0.10
Dascyllus trimaculatus	0.03	0.04	0.67	0.14	0.11	0.07	0.42
Pycnochromis fieldi	0.02	0.03	0.69	0.14	0.09	0.10	0.24
Lethrinus harak	0.02	0.02	0.90	0.11	0.10	0.12	0.72
Thalassoma hebraicum	0.02	0.02	0.78	0.12	0.01	0.14	0.00
Parupeneus macronemus	0.02	0.02	1.08	0.11	0.10	0.16	0.89
Parupeneus pleurostigma	0.02	0.02	0.68	0.04	0.10	0.18	0.96
Mulloidichthys flavolineatus	0.02	0.02	0.71	0.07	0.07	0.20	0.99
Lutjanus fulviflamma	0.01	0.02	0.60	0.09	0.02	0.21	0.00
Siganus sp.	0.01	0.02	0.85	0.08	0.06	0.23	0.76
Parupeneus barberinus	0.01	0.02	0.82	0.09	0.05	0.25	0.14
Chaetodon kleinii	0.01	0.02	0.59	0.03	0.10	0.26	1.00
Acanthurus sp.	0.01	0.02	0.69	0.10	0.01	0.28	0.00
Pseudalutarius nasicornis	0.01	0.03	0.46	0.00	0.09	0.29	0.93
Gomphosus caeruleus	0.01	0.02	0.61	0.09	0.02	0.31	0.00
Ctenochaetus sp.	0.01	0.01	1.01	0.09	0.03	0.32	0.02
Centropyge multispinis	0.01	0.01	1.04	0.09	0.03	0.34	0.01
Thalassoma sp.	0.01	0.02	0.52	0.07	0.01	0.35	0.00
Scarus ghobban	0.01	0.02	0.69	0.09	0.01	0.36	0.00
Lethrinus borbonicus	0.01	0.02	0.53	0.04	0.05	0.37	0.99
Halichoeres hortulanus	0.01	0.01	1.08	0.07	0.06	0.39	0.95
Naso brevirostris	0.01	0.02	0.68	0.05	0.04	0.40	0.94
Canthigaster valentini	0.01	0.01	0.83	0.05	0.05	0.41	0.88
Fistularia commersonii	0.01	0.02	0.64	0.05	0.04	0.42	0.91
Chaetodon trifasciatus	0.01	0.01	1.06	0.08	0.03	0.43	0.02
Hipposcarus harid	0.01	0.01	0.68	0.08	0.00	0.44	0.00
Monotaxis grandoculis	0.01	0.02	0.59	0.07	0.02	0.46	0.04
Scolopsis ghanam	0.01	0.01	0.92	0.05	0.06	0.47	1.00
Cheilio inermis	0.01	0.01	0.85	0.06	0.02	0.48	0.01
Parapercis hexophtalma	0.01	0.01	0.67	0.04	0.05	0.49	1.00
Lethrinus microdon	0.01	0.01	0.66	0.00	0.06	0.50	0.30
Chlorurus sordidus	0.01	0.01	0.74	0.07	0.02	0.51	0.02
Scolopsis bimaculata	0.01	0.03	0.35	0.00	0.06	0.52	1.00

Echeneis naucrates	0.01	0.02	0.43	0.01	0.05	0.53	1.00
Lutjanus sp.	0.01	0.02	0.35	0.04	0.02	0.54	0.20
Siganus luridus	0.01	0.02	0.38	0.02	0.04	0.55	0.99
Caesio xanthalytos	0.01	0.02	0.36	0.06	0.00	0.56	0.00
Thalassoma lunare	0.01	0.01	0.77	0.05	0.03	0.57	0.12
Amblyglyphidodon indicus	0.01	0.02	0.53	0.05	0.02	0.58	0.13
Chromis opercularis	0.01	0.02	0.47	0.03	0.04	0.59	0.74
Chaetodon sp.	0.01	0.02	0.34	0.04	0.00	0.59	0.01
Scarus psittacus	0.01	0.01	0.50	0.05	0.01	0.60	0.03
Turrum coeruleopinnatum	0.01	0.02	0.30	0.00	0.04	0.61	0.99
Chaetodon lunula	0.01	0.01	0.73	0.05	0.02	0.62	0.04
Halichoeres scapularis	0.01	0.01	0.49	0.04	0.01	0.63	0.19
Chromis ternatensis	0.01	0.02	0.40	0.05	0.01	0.64	0.03
Zanclus cornutus	0.01	0.01	0.83	0.04	0.03	0.64	0.15
Lethrinus variegatus	0.01	0.03	0.25	0.00	0.04	0.65	1.00
Gymnocranius grandoculis	0.01	0.01	0.48	0.01	0.04	0.66	1.00
Decapterus sp.	0.01	0.02	0.34	0.01	0.04	0.67	1.00
Chlorurus strongylocephalus	0.01	0.01	0.54	0.05	0.01	0.67	0.01
Sufflamen chrysopterum	0.01	0.01	0.70	0.02	0.04	0.68	1.00
Oxycheilinus digramma	0.01	0.01	0.79	0.04	0.03	0.69	0.32
Lutjanus kasmira	0.01	0.01	0.43	0.00	0.06	0.70	1.00
Parapercis maculata	0.01	0.02	0.36	0.00	0.04	0.70	0.99
Cheilinus sp.	0.01	0.01	0.79	0.05	0.00	0.71	0.00
Aulostomus chinensis	0.01	0.01	0.82	0.04	0.01	0.72	0.01
Zebrasoma scopas	0.01	0.01	0.61	0.05	0.00	0.72	0.00
Pterocaesio marri	0.01	0.02	0.25	0.01	0.03	0.73	1.00
Chaetodon auriga	0.01	0.01	0.67	0.04	0.01	0.74	0.03
Caranx papuensis	0.01	0.02	0.29	0.04	0.00	0.74	0.00
Lutjanus bohar	0.01	0.01	0.60	0.03	0.03	0.75	0.91
Gymnocranius sp.	0.01	0.02	0.30	0.00	0.04	0.76	1.00
Aethaloperca rogaa	0.01	0.01	0.73	0.04	0.02	0.76	0.13
Caesio xanthonota	0.01	0.02	0.32	0.01	0.04	0.77	1.00
Labroides bicolor	0.01	0.01	0.60	0.02	0.03	0.77	1.00
Labroides dimidiatus	0.01	0.01	0.47	0.02	0.02	0.78	0.94
Lethrinus lentjan	0.01	0.02	0.31	0.00	0.03	0.79	1.00
Cephalopholis boenak	0.00	0.01	0.49	0.01	0.03	0.79	1.00
Acanthurus triostegus	0.00	0.01	0.38	0.04	0.00	0.80	0.00
Abudefduf sparoides	0.00	0.01	0.41	0.04	0.00	0.80	0.00
Meiacanthus mossambicus	0.00	0.01	0.48	0.03	0.01	0.81	0.11

Gymnothorax griseus	0.00	0.01	0.53	0.04	0.00	0.81	0.00
Kyphosus sp.	0.00	0.01	0.48	0.03	0.00	0.82	0.01
Hologymnosus sp.	0.00	0.01	0.37	0.01	0.02	0.82	1.00
Abudefduf sexfasciatus	0.00	0.01	0.39	0.03	0.00	0.83	0.00
Parupeneus sp.	0.00	0.01	0.43	0.01	0.03	0.83	1.00
Parupeneus cyclostomus	0.00	0.01	0.48	0.03	0.00	0.84	0.00
Macolor niger	0.00	0.01	0.44	0.02	0.01	0.84	0.31
Naso sp.	0.00	0.01	0.45	0.01	0.02	0.85	1.00
Coris caudimacula	0.00	0.01	0.46	0.03	0.00	0.85	0.00
Cheilinus fasciatus	0.00	0.01	0.39	0.03	0.00	0.85	0.00
Heniochus sp.	0.00	0.01	0.31	0.01	0.01	0.86	0.18
Abudefduf vaigiensis	0.00	0.01	0.45	0.02	0.01	0.86	0.06
Acanthurus thompsoni	0.00	0.01	0.44	0.03	0.00	0.87	0.04
Lutjanus lutjanus	0.00	0.01	0.26	0.00	0.02	0.87	1.00
Oxycheilinus bimaculatus	0.00	0.01	0.38	0.01	0.01	0.87	0.39
Calotomus carolinus	0.00	0.01	0.61	0.01	0.02	0.88	1.00
Labroides sp.	0.00	0.01	0.53	0.03	0.00	0.88	0.00
Zebrasoma sp.	0.00	0.01	0.50	0.02	0.00	0.89	0.02
Thalassoma hardwicke	0.00	0.01	0.42	0.03	0.00	0.89	0.00
Chaetodon guttatissimus	0.00	0.01	0.48	0.01	0.02	0.89	0.82
Dascyllus aruanus	0.00	0.01	0.32	0.03	0.00	0.90	0.00
Chromis weberi	0.00	0.01	0.30	0.01	0.02	0.90	0.95
Bodianus diana	0.00	0.01	0.42	0.01	0.02	0.90	1.00
Lethrinus mahsena	0.00	0.01	0.34	0.01	0.02	0.91	0.99
Pterocaesio sp.	0.00	0.01	0.29	0.02	0.01	0.91	0.23
Aprion virescens	0.00	0.01	0.44	0.01	0.01	0.91	0.97
Canthigaster bennetti	0.00	0.01	0.39	0.02	0.00	0.92	0.00
Anampses meleagrides	0.00	0.01	0.41	0.02	0.00	0.92	0.04
Balistapus undulatus	0.00	0.01	0.54	0.01	0.01	0.92	0.58
Melichthys indicus	0.00	0.01	0.34	0.00	0.02	0.93	1.00
Priacanthus hamrur	0.00	0.01	0.43	0.02	0.00	0.93	0.07
Bodianus axillaris	0.00	0.00	0.56	0.01	0.01	0.93	0.97
Siganus stellatus	0.00	0.01	0.39	0.02	0.01	0.94	0.17
Anampses twistii	0.00	0.01	0.52	0.02	0.00	0.94	0.05
Novaculichthys taeniourus	0.00	0.01	0.42	0.01	0.02	0.94	1.00
Apolemichthys trimaculatus	0.00	0.01	0.32	0.01	0.01	0.94	1.00
Epibulus insidiator	0.00	0.00	0.49	0.01	0.01	0.95	0.15
Lutjanus gibbus	0.00	0.01	0.44	0.01	0.02	0.95	1.00
Cephalopholis argus	0.00	0.00	0.45	0.01	0.01	0.95	0.97

Cheilinus undulatus	0.00	0.01	0.33	0.02	0.00	0.95	0.00
Platax orbicularis	0.00	0.01	0.41	0.02	0.00	0.96	0.00
Bodianus anthioides	0.00	0.00	0.53	0.00	0.02	0.96	0.96
Coris formosa	0.00	0.00	0.46	0.02	0.00	0.96	0.05
Chaetodon trifascialis	0.00	0.01	0.32	0.02	0.00	0.96	0.00
Hemigymnus melapterus	0.00	0.01	0.37	0.01	0.00	0.97	0.11
Scarus frenatus	0.00	0.00	0.44	0.01	0.01	0.97	0.37
Mulloidichthys ayliffe	0.00	0.01	0.30	0.00	0.02	0.97	1.00
Caesio teres	0.00	0.01	0.31	0.01	0.01	0.97	0.26
Hemigymnus fasciatus	0.00	0.00	0.39	0.01	0.01	0.98	0.30
Myrichthys maculosus	0.00	0.01	0.32	0.01	0.00	0.98	0.00
Pomacanthus semicirculatus	0.00	0.00	0.39	0.01	0.00	0.98	0.13
Chaetodon lineolatus	0.00	0.01	0.31	0.01	0.01	0.98	0.89
Myripristis sp.	0.00	0.01	0.29	0.00	0.02	0.98	1.00
Sargocentron diadema	0.00	0.00	0.35	0.01	0.00	0.98	0.11
Lethrinus rubrioperculatus	0.00	0.01	0.29	0.00	0.01	0.99	1.00
Pomacanthus imperator	0.00	0.00	0.39	0.00	0.01	0.99	1.00
Chaetodon vagabundus	0.00	0.00	0.29	0.00	0.01	0.99	0.94
Scarus russelii	0.00	0.00	0.31	0.01	0.01	0.99	0.36
Chaetodon interruptus	0.00	0.00	0.30	0.01	0.00	0.99	0.23
Chlorurus atrilunula	0.00	0.00	0.32	0.01	0.00	0.99	0.00
Chaetodon madagaskariensis	0.00	0.00	0.31	0.00	0.01	1.00	1.00
Scarus tricolor	0.00	0.00	0.31	0.01	0.01	1.00	0.91
Chaetodon falcula	0.00	0.00	0.31	0.00	0.01	1.00	0.88
Pristiapogon kallopterus	0.00	0.00	0.31	0.00	0.00	1.00	0.27

I SIMPER results - Commercial species

Table: Results from SIMPER analysis of commercial fish communities between shallow (ava) and deep (avb) strata. The results are rounded to the nearest hundredth.

Species	average	sd	ratio	ava	avb	cumsum	p-value
Dascyllus trimaculatus	0.04	0.06	0.65	0.15	0.15	0.04	0.97
Lethrinus harak	0.03	0.03	0.91	0.14	0.13	0.07	0.94
Thalassoma hebraicum	0.03	0.04	0.67	0.16	0.01	0.10	0.00
Parupeneus pleurostigma	0.02	0.04	0.61	0.04	0.14	0.13	0.96
Parupeneus macronemus	0.02	0.02	1.02	0.14	0.13	0.16	0.89
Mulloidichthys flavolineatus	0.02	0.03	0.64	0.08	0.10	0.18	0.99
Lutjanus fulviflamma	0.02	0.03	0.60	0.11	0.03	0.20	0.01
Gomphosus caeruleus	0.02	0.04	0.52	0.12	0.02	0.23	0.00
Parupeneus barberinus	0.02	0.02	0.82	0.11	0.06	0.25	0.16
Chaetodon kleinii	0.02	0.03	0.67	0.03	0.12	0.27	0.96
Naso brevirostris	0.02	0.03	0.61	0.07	0.06	0.29	0.97
Lethrinus borbonicus	0.02	0.03	0.51	0.05	0.07	0.31	0.99
Centropyge multispinis	0.02	0.02	1.02	0.11	0.04	0.33	0.01
Scarus ghobban	0.02	0.02	0.66	0.10	0.01	0.34	0.00
Fistularia commersonii	0.01	0.02	0.60	0.06	0.05	0.36	0.96
Halichoeres hortulanus	0.01	0.01	1.10	0.09	0.07	0.38	0.77
Chaetodon trifasciatus	0.01	0.01	1.07	0.10	0.04	0.39	0.02
Canthigaster valentini	0.01	0.02	0.87	0.07	0.06	0.41	0.78
Scolopsis bimaculata	0.01	0.04	0.36	0.00	0.07	0.42	0.99
Parapercis hexophtalma	0.01	0.02	0.67	0.05	0.06	0.44	0.99
Echeneis naucrates	0.01	0.03	0.44	0.01	0.06	0.45	0.99
Monotaxis grandoculis	0.01	0.02	0.59	0.08	0.03	0.47	0.04
Scolopsis ghanam	0.01	0.01	0.94	0.06	0.08	0.48	1.00
Hipposcarus harid	0.01	0.02	0.70	0.10	0.00	0.50	0.00
Chlorurus sordidus	0.01	0.02	0.79	0.08	0.03	0.51	0.03
Cheilio inermis	0.01	0.02	0.83	0.08	0.02	0.53	0.01
Thalassoma lunare	0.01	0.02	0.78	0.07	0.04	0.54	0.14
Lethrinus microdon	0.01	0.02	0.68	0.00	0.08	0.55	0.15
Siganus luridus	0.01	0.03	0.40	0.03	0.05	0.57	0.98
Chaetodon lunula	0.01	0.01	0.71	0.07	0.02	0.58	0.04
Zanclus cornutus	0.01	0.01	0.83	0.06	0.04	0.59	0.15
Gymnocranius grandoculis	0.01	0.02	0.47	0.02	0.06	0.60	1.00
Caesio xanthalytos	0.01	0.03	0.35	0.06	0.00	0.61	0.00

Halichoeres scapularis	0.01	0.02	0.48	0.05	0.02	0.62	0.30
Chlorurus strongylocephalus	0.01	0.02	0.57	0.06	0.01	0.63	0.01
Scarus psittacus	0.01	0.02	0.51	0.06	0.01	0.64	0.02
Sufflamen chrysopterum	0.01	0.01	0.71	0.03	0.05	0.65	0.99
Aulostomus chinensis	0.01	0.01	0.80	0.06	0.02	0.66	0.01
Zebrasoma scopas	0.01	0.01	0.60	0.06	0.01	0.67	0.01
Oxycheilinus digramma	0.01	0.01	0.77	0.04	0.04	0.68	0.39
Lutjanus kasmira	0.01	0.02	0.44	0.00	0.07	0.69	1.00
Chaetodon auriga	0.01	0.01	0.66	0.05	0.01	0.70	0.03
Lethrinus variegatus	0.01	0.03	0.26	0.00	0.05	0.71	0.99
Aethaloperca rogaa	0.01	0.01	0.74	0.05	0.02	0.72	0.16
Lethrinus lentjan	0.01	0.03	0.31	0.00	0.05	0.73	0.99
Labroides bicolor	0.01	0.01	0.60	0.03	0.04	0.74	0.99
Lutjanus bohar	0.01	0.01	0.62	0.03	0.03	0.75	0.95
Pterocaesio marri	0.01	0.03	0.26	0.01	0.04	0.76	0.99
Lutjanus lutjanus	0.01	0.03	0.25	0.00	0.04	0.77	0.99
Cephalopholis boenak	0.01	0.01	0.50	0.01	0.04	0.77	1.00
Caesio xanthonota	0.01	0.02	0.33	0.01	0.04	0.78	1.00
Caranx papuensis	0.01	0.02	0.29	0.04	0.00	0.79	0.01
Meiacanthus mossambicus	0.01	0.01	0.48	0.04	0.01	0.80	0.13
Parupeneus cyclostomus	0.01	0.01	0.46	0.04	0.00	0.80	0.00
Bodianus diana	0.01	0.01	0.39	0.01	0.03	0.81	1.00
Gymnothorax griseus	0.01	0.01	0.54	0.04	0.00	0.82	0.00
Macolor niger	0.01	0.01	0.45	0.03	0.01	0.82	0.30
Acanthurus triostegus	0.01	0.01	0.39	0.04	0.00	0.83	0.01
Coris caudimacula	0.01	0.01	0.44	0.03	0.00	0.83	0.00
Abudefduf sexfasciatus	0.01	0.01	0.40	0.04	0.00	0.84	0.01
Cheilinus fasciatus	0.00	0.01	0.40	0.04	0.00	0.84	0.00
Acanthurus thompsoni	0.00	0.01	0.42	0.03	0.00	0.85	0.02
Chaetodon guttatissimus	0.00	0.01	0.50	0.02	0.02	0.86	0.96
Calotomus carolinus	0.00	0.01	0.61	0.02	0.03	0.86	1.00
Oxycheilinus bimaculatus	0.00	0.01	0.38	0.01	0.01	0.87	0.77
Abudefduf vaigiensis	0.00	0.01	0.46	0.03	0.01	0.87	0.09
Thalassoma hardwicke	0.00	0.01	0.44	0.03	0.00	0.88	0.01
Balistapus undulatus	0.00	0.01	0.55	0.02	0.02	0.88	0.54
Lethrinus mahsena	0.00	0.01	0.36	0.01	0.02	0.89	0.98
Bodianus axillaris	0.00	0.01	0.57	0.02	0.02	0.89	1.00
Aprion virescens	0.00	0.01	0.44	0.02	0.02	0.90	0.98
Priacanthus hamrur	0.00	0.01	0.43	0.03	0.01	0.90	0.06

Anampses meleagrides	0.00	0.01	0.42	0.03	0.00	0.91	0.05
Melichthys indicus	0.00	0.01	0.36	0.01	0.03	0.91	1.00
Anampses twistii	0.00	0.01	0.53	0.02	0.01	0.91	0.04
Siganus stellatus	0.00	0.01	0.39	0.02	0.01	0.92	0.16
Novaculichthys taeniourus	0.00	0.01	0.42	0.01	0.02	0.92	1.00
Cephalopholis argus	0.00	0.01	0.46	0.01	0.02	0.93	0.99
Lutjanus gibbus	0.00	0.01	0.45	0.01	0.02	0.93	1.00
Platax orbicularis	0.00	0.01	0.41	0.02	0.00	0.93	0.01
Epibulus insidiator	0.00	0.01	0.51	0.02	0.01	0.94	0.17
Cheilinus undulatus	0.00	0.01	0.33	0.02	0.00	0.94	0.00
Turrum coeruleopinnatum	0.00	0.01	0.22	0.00	0.02	0.94	0.99
Bodianus anthioides	0.00	0.01	0.54	0.00	0.03	0.95	0.63
Scarus frenatus	0.00	0.01	0.45	0.01	0.01	0.95	0.51
Hemigymnus melapterus	0.00	0.01	0.39	0.02	0.01	0.95	0.18
Apolemichthys trimaculatus	0.00	0.01	0.34	0.01	0.01	0.96	1.00
Caesio teres	0.00	0.01	0.32	0.01	0.01	0.96	0.96
Chaetodon trifascialis	0.00	0.01	0.32	0.02	0.00	0.96	0.01
Coris formosa	0.00	0.01	0.46	0.02	0.00	0.97	0.05
Hemigymnus fasciatus	0.00	0.01	0.39	0.01	0.01	0.97	0.44
Pomacanthus semicirculatus	0.00	0.01	0.39	0.01	0.01	0.97	0.18
Chaetodon vagabundus	0.00	0.01	0.31	0.01	0.01	0.97	0.98
Chaetodon lineolatus	0.00	0.01	0.32	0.01	0.01	0.98	0.95
Sargocentron diadema	0.00	0.01	0.38	0.01	0.00	0.98	0.14
Chlorurus atrilunula	0.00	0.01	0.32	0.02	0.00	0.98	0.01
Pristiapogon kallopterus	0.00	0.01	0.31	0.01	0.01	0.98	0.37
Myrichthys maculosus	0.00	0.01	0.32	0.02	0.00	0.99	0.01
Scarus russelii	0.00	0.01	0.31	0.01	0.01	0.99	0.36
Pomacanthus imperator	0.00	0.00	0.40	0.00	0.02	0.99	1.00
Chaetodon falcula	0.00	0.01	0.32	0.01	0.01	0.99	0.97
Scarus tricolor	0.00	0.01	0.31	0.01	0.01	1.00	0.98
Lethrinus rubrioperculatus	0.00	0.01	0.31	0.00	0.01	1.00	1.00
Chaetodon madagaskariensis	0.00	0.00	0.32	0.00	0.01	1.00	1.00

J SIMPER results - Trophic groups

Table: Results from SIMPER analysis of trophic groups between shallow (ava) and deep (avb) strata. The results are rounded to the nearest hundredth.

Trophic group	average	sd	ratio	ava	avb	cumsum	p-value
Intermediate	0.28	0.18	1.56	53.45	36.57	0.51	0.03
High	0.13	0.10	1.31	21.20	21.61	0.74	0.99
Low	0.09	0.08	1.18	13.50	5.04	0.90	0.00
Top	0.05	0.07	0.78	6.50	5.26	1.00	0.35