COMMUNITY STRUCTURE OF CHAETODONTIDAE IN THE WEST OF BANDA SEA

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ABSTRACT

Distribution and composition of Indonesian Chaetodontid species may vary among different locations. However, illegal fishing practices such as bombing and poisoning on reef ecosystems have significant contribution to environmental degradation and can change the community structure of fish especially that of Chatodontids that act as indicator species in in the given areas. Therefore, it is important to do periodic surveys to know the current condition and their changing. A study on community structure of Chaetodontidae has been conducted from July to August 2011 on coral reef ecosystems of the Banda Sea and its adjacent waters including Banggai, Kendari, and Lamalera Islands. Scuba equipment was used and underwater visual census method was applied for collecting the data at 21 stations. A total of 1399 individual Chaetodontid fishes was observed, belonging to thirty species and seven genera, i.e. *Chaetodon* (20 species), *Heniochus* (4 species), *Forcipiger* (2 species), *Chelmon* (1 species), *Coradion* (1 species), *Hemitaurichthys* (1 species), and *Parachaetodon* (1 species). *Chaetodon kleinii* was the most dominant species in the Banggai (74,38%) and Lamalera (71,71%). Kendari was characterized by the presence of *C. octofasciatus* that contributed 55,20%. There were two dominant groups of Chaetodontidae based on the feeding guild. Facultative coral feeder was the most abundance in Banggai and Lamalera, while the most common Chaetodontidae in Kendari belonged to obligate coral feeder. Chaetodontid diversity in Banggai was the lowest compared to that of in other studied areas. Anthropogenic pressure may become a major factor causing the low diversity and studied species richness in the coral reef ecosystem of Banggai waters.

Keywords: Chaetodontidae, species composition, feeding guild, Banda Sea.

INTRODUCTION

Chaetodontidae is one of the most important fish group in coral reef ecosystem. Their diversity and abundance are highly associated with the diversity and condition of coral reefs (Reese, 1981). Most of species within the group depend their life on reef as a place for permanent shelter, breeding, and feeding ground. Based on these reasons, Chaetodontidae has been used as a bio-indicator of coral reef health condition (Reese, 1981). A coral reef ecosystem with high reliance and good health condition usually has high species richness of Chaetodontidae. Thus, there was strong association between coral reef condition and Chaetodontid fish assemblage (Navaro and Bouchon, 1989). Many species feed on life tissues of coral (Hourigan et al*.,* 1988). There are four groups of Chaetodontidae based on their feeding habits, i.e. obligate coral feeder, facultative coral feeder, zooplankton feeder and non-coralline vertebrate feeder (Sano, 1989).

Indonesia is one of the countries that are located at coral triangle region. Specific predictions based on area of overlap, area of accumulation, and area of refuge hypotheses suggest that eastern Indonesia should be the center of marine biodiversity (Carpenter and Springer, 2004). According to Al-

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len and Adrim (2003), the Family Chaetodontidae is included in the ten most prominent families of Indonesian marine fishes, consisting of 59 species. Indonesia has high variability of habitat types, hence the distribution and composition of Chaetodontid species may vary among different locations. On the other hand, illegal fishing like blasting (Mous et al., 2000) and cyanide fishing (Soede and Erdman, 1998) has responsibility in the degradation of the environment. It may change the community structure of habitat-dependent species, such as the group of Chaetodontid. Regarding to that issue, the objective of this research is to study a community structure of Chaetodontid at three different locations: Banggai, Kendari, and Lamalera.

MATERIAL AND METHODS

Study area

This study was conducted at Banggai, Kendari and Lamalera from July to August 2012. Data were collected from 21 stations: 8 stations at Banggai, 5 stations at Kendari, and 8 stations at Lamalera Islands (Fig. 1), using underwater visual census following that of Dartnall and Jones (1986) and English et al. (1997) with several modifications. Species assessments were made on a line transect of 50 m length and 5 m width with three replications for each station. Only individuals within the quadrate were counted. Water depth was between 5–15 m. Video recordings and photos were taken for the validity of the census. Fish identification was done using guides from Kuiter (1992), Allen et al. (2009), Allen and Adrim (2003) and Masuda et al. (1984) up to species level. Feeding guild was determined following Fishbase (2012).

Data analysis

Data were analyzed using Bray-Curtis Similarity Index based on species composition and feeding guild composition. Similarity percentage (SIMPER) was used to determine each fish species contribution within the group and among stations.

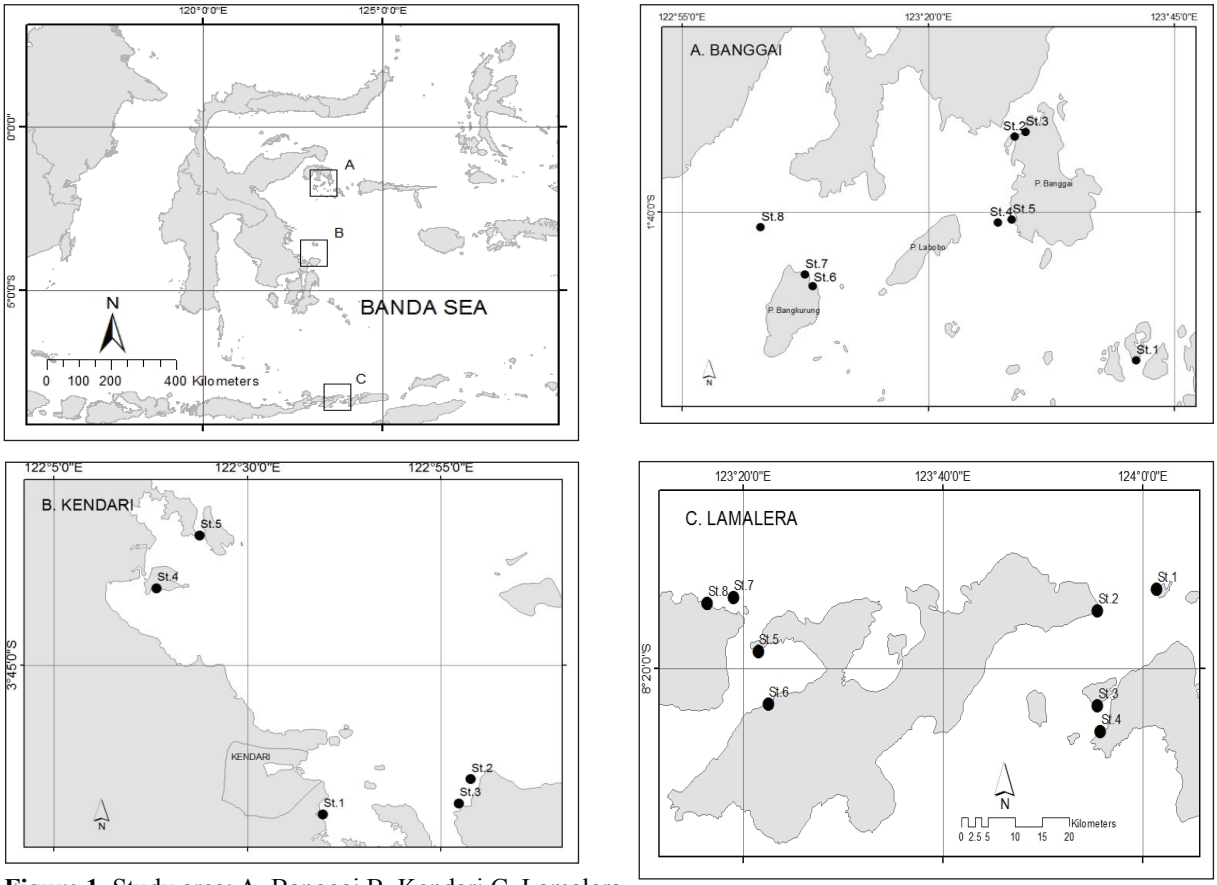

Figure 1. Study area: A. Banggai B. Kendari C. Lamalera.

The data were transformed using Square root and Cut-off percentage on 90%. Clustering and SIMPER were performed using Primer Software 5.0 (Clarke and Warwick, 1994).

RESULTS

A total of 1,399 individuals of Chaetodontidae were counted belonging to 30 species from 7 genera. The genera consisted of *Chaetodon* (20 species), *Heniochus* (4 species), *Forcipiger* (2 species), *Chelmon* (1 species), *Coradion* (1 species), *Hemitaurichthys* (1 species), and *Parachaetodon* (1 species) (Appendix 1). Lamalera was the most diverse of Chaetodontid fishes (19 species), followed by Kendari (16 species) and Banggai (14 species). *Chaetodon kleinii* was the most abundant and widely distributed species, with 1041 individuals. It formed 74% of the total individuals and found at 18 out of 21 stations (86% of the total stations). *C. kleinii* was the most dominant species in all locations except at three stations in Kendari, which were dominated by *C. octofasciatus.* From the data gathered during this study, *C. octofasciatus* was the second most abundant species (7.93%). The third most abundant species was *C. trifasciatus* (about 5%). In general, the five most abundant species were *C. kleinii, C. octofasciatus, C. trifasciatus, Heniochus varius,* and *C. melannotus*, while the five most widely distributed species were *C. kleinii, C.trifasciatus, C. baronessa, H. varius,* and *C. melannotus* (Appendix 1).

The most diverse species station was st. 2 in Lamalera with 11 species. In contrast, st. 5 also located in Lamalera showed lowest diversity as well as abundance, with only 1 individual. Lamalera at st. 3 was the highest species abundance with 322 individuals. Seven highest position in diversity and abundance, were found in 5 stations at Lamalera (st. 1, st. 2, st. 3, st. 6, st. 9), 1 station at Kendari (st. 3), and 1 station at Banggai (st. 7), while the seven stations most abundance of Chaetodontid fishes were in Lamalera at st. 2, st. 3, st. 4, and st. 6; in Banggai at st. 2 and st. 3 and in Kendari at st.

Table 1. Three species with highest contributions in each sampling site resulting from Primer SIMPER analyses (Similarity Percentages: species contributions and feeding guild).

Species per locations	Av. Abundance	Av. Similarity	Stand. deviasi	(%) Contribution	(%) Cumulative
Base on species contributions					
BGG, average similarity 36.97					
Chaetodon klenii	32.13	27.5	1.32	74.38	74.38
Chaetodon baronessa	1.25	2.52	0.48	6.81	81.19
Heniochus varius	1.50	2.24	0.49	6.07	87.26
KND, average similarity 29.58					
Chaetodon octofasciatus	18.4	16.33	1.02	55.2	55.2
Chaetodon klenii	2.60	5.36	0.60	18.11	73.31
Chaetodon trifasciatus	5.60	2.51	0.32	8.5	81.81
LML, average similarity 40.14					
Chaetodon klenii	96.38	28.78	1.99	71.71	71.71
Chaetodon vagabundus	1.50	3.48	0.90	8.68	80.39
Chaetodon trifasciatus	1.00	2.28	0.69	5.68	86.06
Base on feeding guild					
BGG, Average similarity: 58.56					
Facultative coral feeder	35.25	44.81	2.31	76.51	76.51
Obligate coral feeder	8.25	13.39	0.82	22.86	99.37
KND, Average similarity: 71.56					
Obligate coral feeder	30.4	45.04	2.24	62.93	62.93
Facultative coral feeder	5	23.25	3.98	32.49	95.43
LML, Average similarity: 54.79					
Facultative coral feeder	100.38	41.95	2.17	76.57	76.57
Obligate coral feeder	6.25	11.89	1.34	21.7	98.26

1. Mostly, the diversity and abundance of stations at Lamalera were much higher than those of at Banggai and Kendari (Appendix 1).

Similarity percentage (SIMPER) analysis based on species contribution showed that Banggai and Lamalera were characterized by the presence of *C. kleinii* (74.38% and 71.71%). On the other hand, *C. octofasciatus* (55.2%), and *C. kleinii* (18.11%) dominated Chaetodontid fishes in Kendari (Table 1). Analysis based on feeding guild showed that facultative coral feeder (76.51%) was a common character for Chaetodontid fishes in Banggai, while obligate coral feeder (62.93%) was common in Kendari. Lamalera was characterized by facultative coral feeder (76.57%) (Table 1) represented by *C. kleinii, C. vagabundus ,* and *Heniochus varius*, while some obligate coral feeder found in this study were *C. octofasciatus, C. trifasciatus* and *C. baronessa* (Fish Base, 2012).

Species composition among 21 stations was compared using Bray Curtis Similarity index with a similarity level of 42% (Fig. 2A). A low similarity index indicated that species composition of Chaetodontidae in each research area had high heterogenity. Stations at the same location were not in the same group. Based on feeding guild there were 3 groups (Fig. 2B). Group A consisted of stations from Kendari, Lamalera, and Banggai. Group B consisted of stations from Banggai and Lamalera. Group C consisted of one station from Lamalera st. 5. (Fig. 2B).

DISCUSSION

From this study, the record of 14 species of Chaetodontid in Banggai, 16 species in Kendari, and 19 species in Lamalera was perhaps considered relatively low compared to that of at other site of

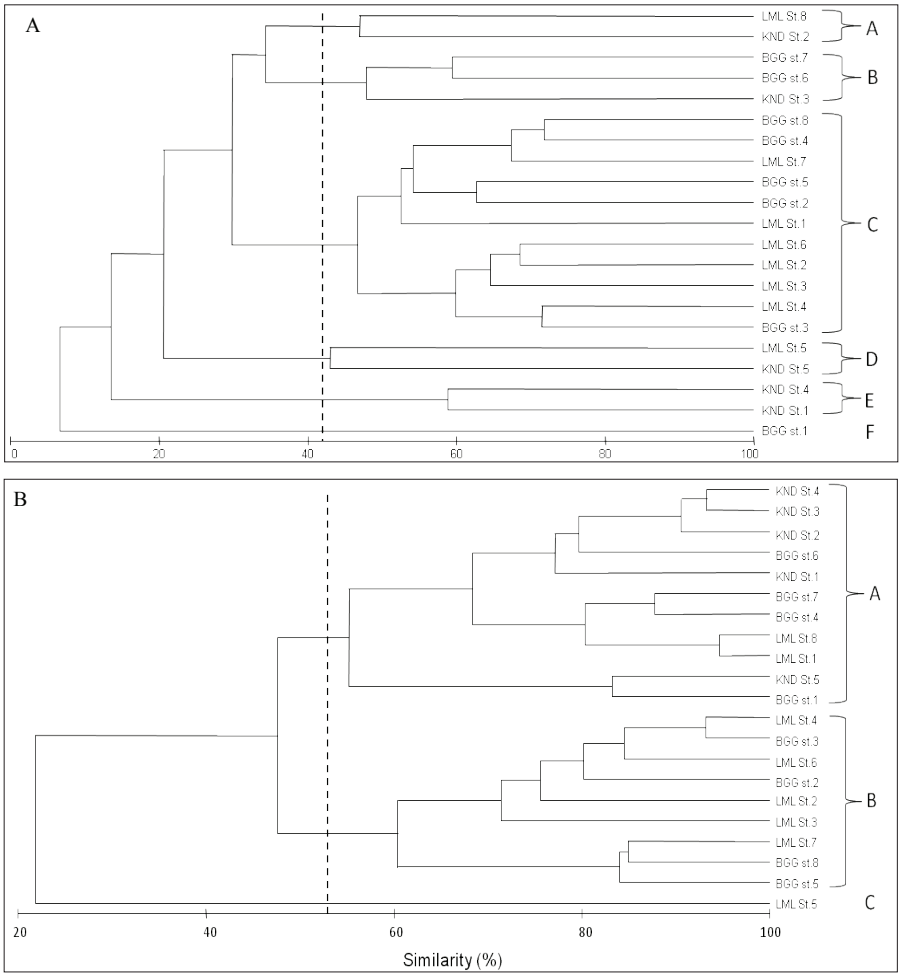

Figure 2. Dendogram of the 21 stations using group average clustering from Bray-Curtis similarities with square root transformation: (A) based on species composition and abundance, (B) based on feeding guild.

Indonesian coral reefs. Flores Sea, a closest area from Banda Sea has 23 species of Chaetodontidae (Adrim and Hutomo, 1989). Similar condition appeared when it was compared with that of in other location such as Seribu Islands (19 species) (Adrim et al., 1991), Sunda Strait Reef (32 species) (Hutomo et al., 1991), and Enggano Islands, Bengkulu Province (30 species) (Adrim, 2007). The diversity of Chaetodontid in Banda was determined by the high diversity of coral reefs in the region. As many as 194 species of coral were found in the waters of Banggai (Siringoringo and Hadi, 2013) and more than 300 species of coral counted from Lamalera (Abrar et al., 2012). Nevertheless, a threat on Banda Sea and the adjacent ecosystem has been occurring, especially a threat due to the use of dynamite on fishing. Moreover, pressure such as illegal fishing and pollution caused by mining and domestic activities gave influences on the community structure of fishes in those areas. According to Soede and Erdman (1998), blast fishing has been widespread and most fishermen in Spermonde (Sulawesi) use this technique. These practices are not only drastically declining fish population, but also destroying the coral reefs.

Chaetodon kleinii was the most common species in almost all locations. In this research, *C. kleinii* was mostly found in stations of Banggai and Lamalera which have clear water condition and high percentage of living coral. So, the presence of *C. kleinii* can be considered as indicator for good condition of coral reef. Such good coral condition explained the most diverse and abundance of Chaetodontid fish in Lamalera. In contrast, *C. octofasciatus* was the most dominant species in Kendari that has turbid water. This species is often present in degraded reef caused by low salinity, turbidity and sedimentation (Adrim et al., 1991; Manthachitra et al., 1991; Bawole, 1998). The turbidity in the sites were caused by tailing from nickel mining located nearby the area. The interesting fact was that *C. octofasciatus* in this research was not found in Lamalera waters. This finding was also supported by Adrim and Hutomo (1989) that they did not find this species in Flores Sea, the nearest sea from Lamalera. Madduppa (2006) stated that commonly *C. octofasciatus* lives in the habitat dominated by *Acropora* spp. Furthermore, Bawole (1998) argued that *C. octofasciatus* positively associates with turbid water, and it can be considered as bioindicator of coral reef that has been depressed by sedimentation due to which the condition of the coral reef changes or being under pressure. This kind of habitat was not found in Lamalera waters. On the other word, the absence of *C. octofasciatus* was evidence that the reef condition in Lamalera water was better than the reef condition in Kendari and Banggai waters.

The analysis of similarity percentage and feeding guild showed that *C. kleinii* as a facultative coral feeder was the species that characterized Banggai and Lamalera, while *C. octofasciatus* as an obligate coral feeder characterized a location like Kendari. Even though the coral reef in Lamalera was in the best condition *C. octofasciatus* as an obligate coral feeder was absent. In general, this species was widely distributed in Indonesia, but it is not found in many small islands located far away from mainlands such as Wetar Island (Molucca), Semelu Island (Aceh), Tiga Island (North Sulawesi), Buton Island (South Sulawesi) and the islands of East Nusa Tenggara (Flores, Adonara, Lamalera and Timor) (perscomm. Adrim, 2013). Moreover, referring to Fishbase (2012), *C. octofasciatus* is common in lagoon and inshore, and Adrim (2005) informed that the populations decreases to absence in the locations far away from mainland. It is suggested that the distribution of the species is affected by salinity.

Reese (1981), Navaro and Bouchon (1989), and Bozec et al. (2005) reported that living coral cover has a positive correlation with Chaetodontidae community. Furthermore, branching and foliose corals were dominant in Banggai (Siringoringo and Hadi, 2013) and Lamalera (Abrar et al., 2012) while encrusting form was dominated in the Kendari waters (Siringoringo et al., 2012). In the present study the abundance of both obligate and facultative corallivorous Chaetodontid species were used to detect a disturbance gradient affecting live corals and topographic complexity (Bozec et al., 2005).

Six groups were formed in dendogram analysis based on species composition. Group C was the largest group, composed of 11 stations, in Lamalera (6 stations) and Banggai (5 stations). These stations shared environment similarity in terms of high diversity of coral reefs, high

percentage of coral cover, and having more number of both Acropora and non-Acropora. Thus, this group indicated that Lamalera and Banggai were more similar in terms of species composition and abundance than those of in Kendari. On the other hand, Kendari and the remaining stations of Lamalera and Banggai have different community structure that were separated in 5 groups. Each group was characterized by environment similarity such as high percentage of rubble, turf algae, and good condition of coral reef.

Grimsditch and Rodney (2006) stated that the destruction of coral reefs will reduce the reproductive capacity, community composition and distribution capabilities of fishes. So, the above grouping was strongly influenced by the condition of coral reefs and waters. Lamalera (Abrar et al., 2012) and Banggai (Siringoringo and Hadi, 2013) have higher diversity of coral species than Kendari (Siringoringo et al., 2012) and the condition and cover percentage was pretty good. Furthermore, Banggai and Lamalera waters showed clearer visibility, compare to Kendari.

According to feeding guild dendogram analysis there were 3 groups of stations. Group A consisted of several stations from Kendari, Lamalera, and Banggai. According to the data of species list, this group was dominated by obligate coral feeder, such as *C. octofasciatus, C. trifasciatus* and *C. melannotus*. In contrast, facultative coral feeder such as *C. kleinii* and *C. vagabundus* were dominant species in group B which consisted of stations of Banggai and Lamalera. Only one station in group C (LML st. 5) with 1 species *Forcipiger flavissimus*. The rare Chaetodontid in station 5 of Lamalera due to the degradation of reef with the rubble reaches 56% and living coral cover was only around 13% (Abrar et al., 2012). There was different community structure based on feeding guild among three locations. The number of facultative coral feeder in Banggai was significantly different from those of in Kendari and Lamalera. It was due to difference in coral reef habitat and the condition of environment among locations.

CONCLUSION

Up to the date, Chaetodontidae in the west of Banda Sea was recorded of as many as 35 species belonging to seven genera. The populations in Banggai and Lamalera were characterized by *C. kleinii*, while in Kendari was characterized by *C. octofasciatus.* There were two dominant groups of Chaetodontidae based on the feeding guild. Facultative coral feeder was the most abundance in Banggai and Lamalera, while Kendari was dominated by obligate coral feeder. The condition of the water and living coral cover were assumed to play an important role in species composition and community structure.

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Appendix 1. List of species richness, the abundance and the percentage of occurrence of Chaetodontid in Banggai (BGG), Kendari (KND), and Lamalera (LML).

Species	BGG st.1	BGG st.2	BGG st.3	BGG st.4	BGG st.5	BGG st.6	BGG st.7	BGG st.8	KND St.1	KND St.2	KND St.3	KND St.4	KND St.5	LML St.1	LML St.2	LML St.3	LML St.4	LML St.5	LML St.6	LML St.7	LML St.8	% individual	% occurance
Chaetodon kleinii	-	+	+	+	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+	74.4	85.71
Chaetodon trifasciatus	-	-	-	+	-	+	+	-	-	+	+	-	-	+	-	+	+	-	+	+	-	4.5	47.62
Chaetodon baronessa	+	+	-	-	-	+	+	-	-	+	-	-	-	+	+	-	+	-	-	-	+	1.29	42.86
Chaetodon vagabundus	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	+	-	+	1	33.33
Chaetodon melannotus	-	-	+	-	-	-	+	-	-	+	-	-	-	+	+	+	-	-	+	-	-	1.43	33.33
Chaetodon octofasciatus	-	-	-	-	-	+	+	-	+	-	+	+	+	-	-	-	-	-	-	-	-	7.93	28.57
Chaetodon lunula	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	+	-	+	0.36	23.81
Chaetodon trifascialis	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	0.86	19.05
Chaetodon ocellicaudus	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	+	0.79	19.05
Chaetodon unimaculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	0.29	14.29
Chaetodon auriga	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	0.29	14.29
Chaetodon rafflesi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	0.21	9.52
Chaetodon punctatofasciatus	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.14	9.52
Chaetodon pelewensis	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.29	9.52
Chaetodon citrinellus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	0.36	9.52
Chaetodon speculum	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	4.76
Chaetodon ornatissimus	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	0.07	4.76
Chaetodon meyersi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	0.07	4.76
Chaetodon lunulatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	0.07	4.76
Chaetodon lineolatus	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	0.21	4.76
Heniochus varius	-	+	-	+	+	-	-	+	-	+	+	-	-	-	-	-	+	-	-	-	+	1.64	38.10
Heniochus chrysostomus	-	-	-	-	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	+	1.14	19.05
Heniochus acuminatus	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	0.07	4.76
Heniochus singularius	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	0.21	4.76
Forcipiger longirostris	-	+	-	-	+	-	-	-	-	+	-	-	-	+	+	-	-	-	-	-	-	0.79	23.81
Forcipiger flavissimus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	0.07	4.76
Chelmon rostratus	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	0.79	9.52
Coradion chrysozonus	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	0.21	9.52
Parachaetodon ocellatus	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	0.07	4.76
Hemitaurichthys polylepis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	0.36	4.76
Total individual	**5**	**74**	**93**	**44**	**42**	**23**	**43**	**28**	**55**	**42**	**35**	**43**	**7**	**33**	**183**	**322**	**100**	**1**	**162**	**39**	**25**	**-**	**-**
Total Species	**3**	**6**	**2**	**4**	**6**	**5**	**7**	**2**	**5**	**10**	**4**	**6**	**2**	**7**	**11**	**9**	**6**	**1**	**7**	**3**	**9**	**-**	**-**