



SHORT COMMUNICATION

Temporal of reef fish communities in the coastal water of Krueng Raya, Aceh Besar Regency, Indonesia

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ABSTRACT

Krueng Raya waters have a big potency on coral reef fish; However, there was no study was conducted to document this biodiversity. This data are crucial for the conservation plan. Therefore, the objective of the study was to examine the community structure of reef fish in the Krueng Raya coastal waters, Mesjid Raya Subdistrict, Aceh Besar, Indonesia. The sampling was conducted from January 2014 to December 2016. The data were collected at three stations by the Visual Census method with a depth of 3-4 meters. The research found the average amount of reef fish was 1743 individuals that were consisted of 93 species and comprised of 26 families. The dominating families were Pomacentridae, Acanthuridae, Chaetodontidae, and Labridae. The distribution level of reef fish individually was influenced by the environmental conditions of the coral reef ecosystem. The severe condition of the coral ecosystem in the Krueng Raya coastal waters was caused by two factors. Firstly, fishing activities of the locals and tourists who unintentionally stepping on the coral colonies and using unfriendly tools to catch the fish (speargun). Another factor was the occurrence of coral bleaching in 2016, of which almost 80% of the coral ecosystem in the Krueng Raya coastal waters was exposed to this phenomenon (bleaching).

Keywords: Reef Fish, Acanthurida, Communities Structure, Krueng Raya

INTRODUCTION

Aceh Province has 18 regencies that have coastal and marine areas. Aceh Province has the sea territory about 12 miles from the coastline it has covered an area of 43,079.49 km² (Muchlisin *et al.*, 2012); Muchlisin, 2015. The area has both abiotic and biotic resources of coastal and marine ecosystem. Krueng Raya is one of areas in Aceh Province having coral reefs and reef fish (Fadli *et al.*, 2014; Ulfah *et al.*, 2018; Najmi *et al.*, 2016). Krueng Raya is located in Mesjid Raya Subdistrict, Aceh Besar Regency, Aceh Province, Indonesia. There are three locations of coral reef ecosystems in the Krueng Raya waters, namely Benteng Inong Balee, Ahmad Rhang Manyang, and Lhokme. The Benteng Inong Balee and Ahmad Rhang Manyang area are less visited by marine tourism. In contrast, Lhokme beach is always visited by tourists. Coral reefs in Krueng Raya waters are believed to have high productivity and biodiversity, so it becomes a place as feeding ground, as a nursery ground area and place of spawning for reef fish (Maduppa, 2006; Setiawan *et al.*, 2017).

The unfriendly fishing practices for example using potassium (poison) are frequently occurring in the Krueng Raya waters. The use of potassium can damage and polluted the area around the waters, especially the reef area. It also triggers the fish mortality and other biota inhabiting a coral reef ecosystem (Supriharsono, 2007). Another factor that can damage the coral reef ecosystem is the presence of anglers who stepping on

coral colonies so that cause severe damage to coral reef ecosystems. This is believed to have an economic impact on the local coastal communities. Ecologically, the ecosystem will be an instability experience process and gradually many biota will be lost, and in the end there are many species of biota will experience extinction due to irresponsible coastal community activities (Bengen, 2000).

Considering the importance of coral reef ecosystems both ecologically and economically, the condition of Krueng Raya coastal waters needs to be maintained and monitored for the waters ecosystem continuity. This is important to assess the condition of coral reef ecosystems and reef fish systematically and measurably. The data can be used as an initial step in understanding the current conditions. It is expected to produce special policies in maintaining the coral reef ecosystems in Krueng Raya waters. Moreover, in this case, the government and the community must also cooperate to raise awareness and concernment about the importance of maintaining coral reef ecosystems. Study on the biodiversity of marine fish especially coral fish was limited available. There were two reports from Simeulue Island Batubara *et al.*, 2017) and Weh Island (Fadli *et al.*, 2019; Nur *et al.*, 2019) This is an interesting topic to study and conduct on coral reef ecosystems in Krueng Raya coastal waters, especially regarding the temporal study of reef fish. Therefore, the objective of the study was to examine the community structure of reef fish in the Krueng Raya coastal waters, Mesjid Raya Subdistrict, Aceh Besar, Indonesia.

MATERIALS AND METHODS

Site and Time

This research was conducted at Krueng Raya coastal waters, using secondary data during 2014 and 2015, then conducted primary data retrieve in 2016, with a geographical position (95° 32' 25.87" N dan 5° 35' 59.54" E). The tools and materials used in this research are roll meters (50 m), secchi disks, hand refractometers, pH meters, underwater writing instruments, GPS (Global Positioning System), under water cameras, diving equipment, and reef fish identification books.

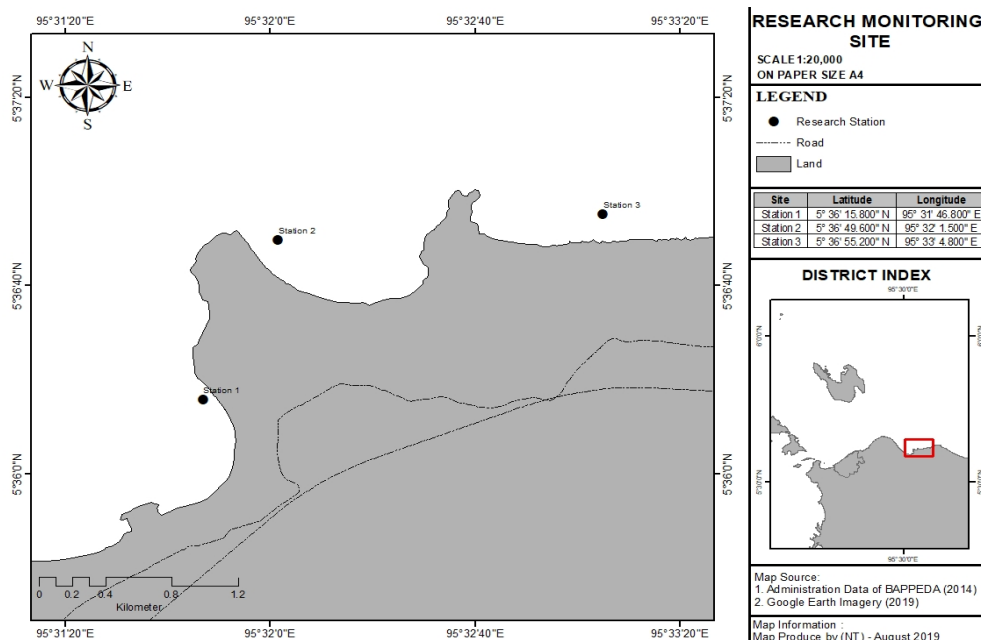


Figure 1. The map of Krueng Raya waters showing the sampling locations

Selection of Sampling Locations and Data Retrieval

The research location was determined by purposive sampling method. An initial survey was conducted to ensure the right location as a representation on the ecological side of the entire coastal ecosystem in Krueng Raya waters and in order to facilitate researchers in planning dives and to save more time for data retrieval. The research used two type of data, namely secondary and primary data. Secondary data was obtained from Base Reef Check data in 2014 and 2015 and the primary data was taken in the last year, 2016. There are two stages of data retrieval in this research, namely direct observation of reef fish in data retrieval of reef fish diversity and measurements of water quality parameters.

Data Retrieval Procedure

Placement of transects

A transect (roll meter) was installed at a predetermined location on a GPS device with a shallow depth of 3-4 meters. The transect was stretched to follow the coastline by 150 m transect length, which is divided into 3 replicated, each 50 m long and interval 5 m.

Recorded data

Data retrieval of reef fish using the belt transect method by a visual census, recording and estimation of the reef fish size by coverage area of 3 (2 x 50 m) for reef fish size categories <10 cm command for the coverage area of 3 (5 x 50 m) by reef fish size > 10 cm. Recorded all the fish seen. Small area (2 x 50 m) was used for reef fish size <10 cm, because fish of this size do not easily run but hiding between the reefs so that their existence can be easily identified. However, reef fish size > 10 cm which moves freely were recorded in a bigger area to make it easier in the identification process when recording data on the number of fish.

Data analysis

The number of individual fish in the unity of the area of observation is said to be the fish abundance. According to Odum (1993), abundance can be calculated using the formula:

$$\text{Fish abundance (K)} = \frac{\text{Number of Individual}}{\text{Transect}}$$

RESULTS

Composition and Abundance of Reef Fish

The results for three years of reef fish identification at Krueng Raya waters averaged 1743 individuals consisting of 93 species and 26 families. The families that mostly appear at all stations are the family Pomacentridae, Acanthuridae, Chaetodontidae, and Labridae. These families are able to withstand the changes of the aquatic environment, thus turn the families as fish native to coral reefs (Allen, 2009; Octavina *et al.*, 2018; Odum, 1993). The abundance of reef fish for 3 years (2014-2016) in Krueng Raya waters ranged from 313 - 2710 ind ha⁻¹. At station 1, the Benteng Inong Balee waters, the abundance of reef fish was 2710 ind ha⁻¹, 1201 ind ha⁻¹, 465 ind ha⁻¹ in 2014, 2015, and 2016, respectively. At Station 2 of Ahmad Rhang Manyang waters, the abundance of reef during three years were 1164 ind ha⁻¹, 989 ind ha⁻¹, and was 353 ind ha⁻¹. At Station 3, namely Lhokmee waters, the total abundance of reef was 530 ind ha⁻¹ in 2014 571 ind ha⁻¹ in 2015, and 313 ind ha⁻¹ in 2016 (Figure 3).

Table 1. List of the number of coral fish families in the waters of Krueng Raya (ind/750 m²).

Family	Benteng Inong Balee			Ahmad Rhang Manyang			Lhokmee			*F K (%)
	2014	2015	2016	2014	2015	2016	2014	2015	2016	
Acanthuridae	0	22	86	52	126	27	269	278	170	88
Anthiinae	100	15	0	0	0	0	0	0	0	22
Apogonidae	0	30	0	0	0	0	0	0	0	11
Aulostomidae	1	0	0	0	1	0	0	0	0	22
Caesionidae	0	0	0	0	0	5	0	0	0	11
Centriscidae	60	0	0	0	0	0	0	0	0	11
Chaetodontidae	15	18	130	77	37	42	40	73	44	100
Ephippidae	0	6	8	0	0	0	0	0	0	22
Haemulidae	1	0	0	1	1	0	0	0	0	33
Holocentridae	0	0	0	34	2	0	16	1	0	44
Labridae	0	3	20	44	15	12	24	34	27	88
Lutjanidae	15	0	0	29	1	0	4	0	0	44
Mullidae	0	2	0	0	0	0	8	6	0	33
Muraenidae	1	0	0	0	0	0	0	0	0	11
Nemipteridae	0	2	23	4	10	4	4	4	4	88
Pempheridae	0	0	0	150	118	2	8	0	0	44
Pinguipedidae	0	2	0	0	0	3	0	0	0	22
Plotosidae	0	0	0	0	30	0	0	0	0	11
Pomacanthidae	0	4	6	23	22	2	4	0	0	66
Pomacentridae	616	427	200	523	517	101	77	100	0	88
Scaridae	4	0	4	0	5	0	10	2	2	66
Scorpaenidae	10	1	0	0	1	0	0	0	0	33
Serranidae	3	5	5	4	0	0	48	0	3	66
Siganidae	0	0	4	0	10	0	22	1	0	44
Tetraodontidae	5	1	0	1	0	0	0	0	0	33
Zanclidae	0	5	30	0	2	7	9	25	18	77
Number of Family	12	15	11	12	16	10	14	10	7	
Total Individual	831	543	516	902	898	205	533	524	278	

*FK: Frequency%

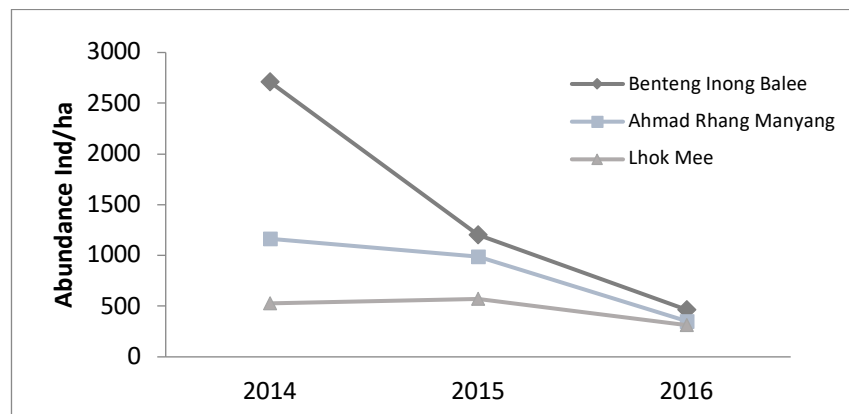


Figure 2. Reef fish abundance on Krueng Raya waters during three years (2014-2016)

DISCUSSION

The fewest families were found are the Aulostomidae, Muraenidae, and Pinguipidae. These families tend to swim solitary rather than huddle, hide in chunks of coral (Muraenidae). The Pinguipidae is a family attracted to sandy substrate compared to the Muraenidae family (Chabanet *et al.*, 2006; Hastuty *et al.*, 2014). It is looking for food in the sand, Therefore, it is rarely found swimming in groups (Allen *et al.*, 2003; Arifin, 2003; Ulfah *et al.*, 2018).

According to Table 1, it was found 831 reef fish from 22 species and 12 families at station 1 of Benteng Inong Balee in 2014. In 2015, it was found 543 individual reef fish derived from 15 families and 26 species. In 2016, there were 11 families distributed into 33 species and 516 individual of reef fish. During 2014-2016, Benteng Inong Balee waters are dominated by the Pomacentridae family with numbers ranging from 200-616 individuals. The Pomacentridae family has decreased from 2015-2016 ranging from 189-227 individuals. The lowest number of reef fish families is from the families Aulostomidae, Haemulidae, and Muraenidae, the number of each was 1 individual, and only found in year 2014.

In 2014, 902 reef fish, 34 species and 12 families were found at station 2 of Ahmad Rhang Manyang waters. There were 16 families of 37 species, amounting to 898 individual reef fish in 2015. The next year, there were 20 species of 10 families totaling 205 reef fish. Ahmad Rhang Manyang waters are dominated by the family Pomacentridae ranging from 101-523 individuals. The Pomacentridae family has experienced a decline in year 2015-2016 ranging from 6-416 individuals. The least number of reef fish families found were the Tetraodontidae family which was found only 1 individual in 2014, 1 individual of Aulostomidae family and 1 individual of the Scorpaenidae family in 2015. The number of reef fish identified at station 3 of Lhokmee waters in 2014 were 533 individuals from 27 species and 14. in 2015, there were 10 families found in 9 species totaling of 524 individuals. In 2016, 268 individuals of 14 species and 7 families were found. For three years of research, Lhokmee waters were dominated by the Acanthuridae family ranging from 170-278 individuals and the least found were the Holocentridae and Siganidae families which was found only 1 individual in 2015. The distribution of individual reef fish is influenced by environmental conditions such as condition of coral reef ecosystems, which occurred in waters of Benteng Inong Balee, Ahmad Rhang Manyang, and Lhokmee.

The results revealed the abundance of reef fish decreased for each year, especially at station 1, Benteng Inong Balee. The abundance decrease at Benteng Inong Balee might be caused it is used as a main fishing site by local fishermen. The damage of coral ecosystems is a major factor in the reduction of fish number at station 1. The Ahmad Rhang Manyang and Lhokmee waters also experienced the similar condition but not as bad as in Benteng Inong Balee waters. The Ahmad Rhang Manyang and Lhokmee waters are dominated by tourists who carry out activities that can damage the environment of the coral ecosystem such as fishing by stepping on coral colonies, and catching fish with spearguns. The regional head (Panglima Laot) of Krueng Raya called for a ban on fishing activities that caused damage to coral ecosystems. Recently, there are still several people catch fish by using poisons done without being noticed by the head of the region (Panglima Laot) Krueng Raya.

CONCLUSIONS

The Krueng Raya waters have a stable diversity index average 2.31, stable uniformity 0.72, low dominance level 0.18 for 3 years (2014-2016). The abundance of coral fish is ranging from 530-2710 ind/ha in 2014, 571-1201 ind/ha in 2015, and 13-465 ind/ha in 2016.

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