



## Reef fish in the southern coastal waters of Ambon Island, Maluku Province, Indonesia

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**Abstract.** Research to study reef fish was carried out at coastal waters of seven villages in the southern Ambon Island on November 2015. Reef fish in the area was observed by using underwater visual census method at a belt transect of 250 m<sup>2</sup> (50 m length, 5 m width) in 19 stations. Reef fish encountered in every transect, when possible, was identified to the species level using reference literature. Totally, there were 42 families of reef fish which consist of 116 genera and 293 species found during the study. Those species found can be categorized into target species (83 species), major species (183 species) and indicator species (27 species). Coral Fish Diversity Index (CFDI) determined based on six main families indicated that relative diversity of reef fish in the area can be classified into very poor to moderate categories. Based on CFDI value, estimated number of reef fish in the southern coastal waters of Ambon Island was 539 species.

**Key Words:** reef fish, species composition, coral fish diversity index, Ambon Island.

**Introduction.** Maluku Province has important and strategic role for marine fishery in Indonesia. Three out of 11 Fisheries Management Area (Wilayah Pengelolaan Perikanan - WPP) in Indonesia occur in Maluku Province territory i.e. WPP 718 (Arafura sea), WPP 715 (Seram sea) and WPP 714 (Banda sea) with estimated fish potential around 1.64 million tonnes year<sup>-1</sup> (Manapa 2014).

Ambon is a small island belonging to Maluku Province that has an area of 775 km<sup>2</sup>. The island lies along the northern border of the Banda Sea. It is divided into a Northern part (Leihitu) and a Southern part (Leitimur) with Ambon Bay in between, separating the two. Eventhough the island is small, it has great potential of marine resources such as molluscs, echinoderms, lobster and fish (Pattikawa & Ferdinandus 2009; Tuapattinaja et al 2014; Ongkers et al 2014; Rijoly et al 2016). The variety of marine resources in Ambon Island waters is not surprising because the island has three tropical ecosystems, i.e., mangrove, seagrass and coral reef. Coral reefs are more concentrated in the outer part of the island and inhabited by variety of fish.

Ambon Island has been visited by scientists since 16<sup>th</sup> century to study reef fish. For example, G. E. Rumpf (also known as Rumphius) since 1653, M. Weber in 1900, V. G. Springer & M. Gomon in 1973-1974 and J. E. Randall in 1975 (Peristiwadi 2012). Reef fish in Ambon Island has also been studied by Hukom et al (1987), Syahailatua (2010) and Rijoly (2015).

According to Randall as cited by Peristiwady (2012), the number of species of reef fish will certainly increase with additional collection and continuation of investigation. Therefore, this research was conducted with the main objectives to study species composition and relative diversity of reef fishes in southern coastal waters of Ambon Island.

**Material and Method.** This research was carried out on November 2015 at 19 stations of seven villages namely Hutumuri (station 1), Rotong (station 2 to station 7), Leahari

(station 8 to station 10), Hukurila (station 11), Seri (station 12 to station 17), Pintu Kota (station 18) and Latuhalat/Namalatu (station 19) in the southern coastal waters of Ambon island (Figure 1).

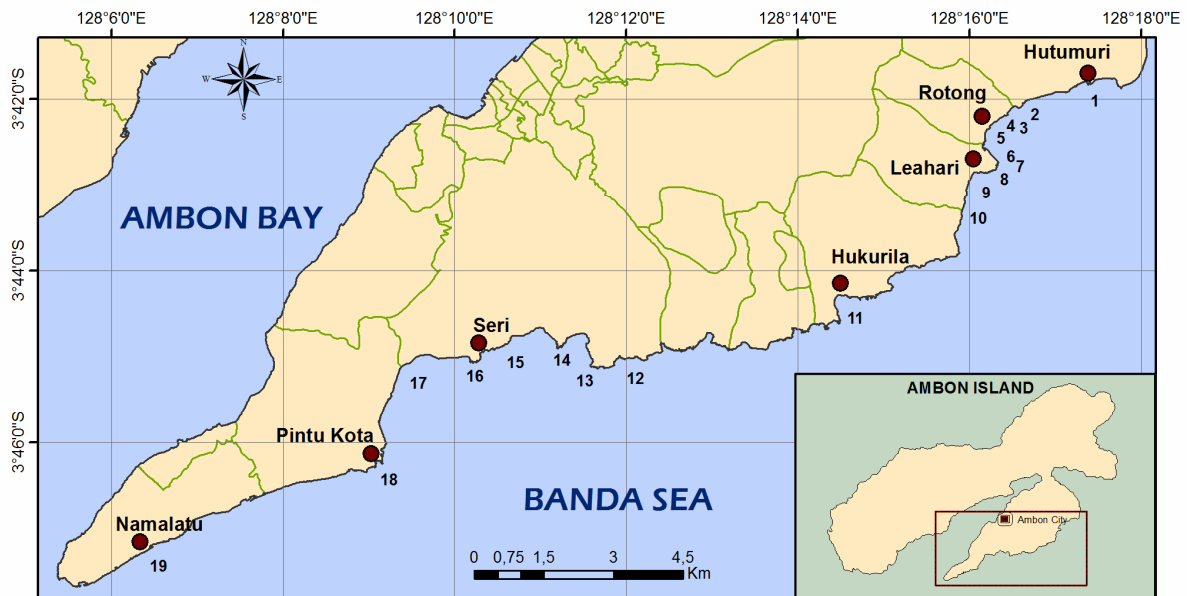


Figure 1. The map showing sampling sites.

Data of reef fish were collected by using Underwater Visual Census (UVC) according to English et al (1994) at 250 m<sup>2</sup> transect (50 m length and 5 m width). Reef fishes found in the transect were identified to the species level as possible based on Kuitert (1992), Allen (2000), Kuitert & Tonzozuka (2001), Allen et al (2003), Kuitert & Debelius (2006) and Allen & Erdmann (2012). Furthermore, identified species was grouped into target species, major species and indicator species according to English et al (1994).

Total species of reef fish in the area was estimated by using Coral Fish Diversity Index (CFDI) for restricted small areas (< 2,000 km<sup>2</sup>) proposed by Allen (1998) and Allen & Erdmann (2012):

$$\text{Estimated total species (< 2,000 km}^2\text{)} = (3.39 \times \text{CFDI}) - 20.595.$$

CFDI was also used to classify relative diversity of reef fish (Allen 1998) as presented in Table 1.

Table 1

Relative diversity of reef fish based on CFDI

Category	CFDI value		
	Sampling site	Local region	National region
Extraordinary	> 150	> 330	> 400
Excellent	130-149	260-329	330-339
Good	100-129	200-259	220-329
Moderate	70-99	140-199	160-219
Poor	40-69	50-139	80-159
Very poor	< 40	< 50	< 80

## Results and Discussion

**Composition of taxa.** Totally, there were 293 species in 116 genera and 42 families of reef fish found during the study in the southern waters of Ambon Island (Table 2). Those species can be categorized into target species (83 species), major species (183 species) and indicator species (27 species). It can be seen in Table 2 that station 14 represented the highest number of species and genera while the highest family belonged to stations 7, 12 and 16. On the contrary, station 5 had the lowest species while station 2 had the lowest genera and families. The number of species found in this study (293 species) is higher than the number of species found in previous study by Rijoly (2015) in Ambon island waters (229 species). The higher number of species found in this study could be due to more station observed (19 stations) compare to 11 stations studied by Rijoly (2015). Meanwhile, Halford (2002) and Mulyadi & Rijoly (2013) recorded 500 species at 19 stations and 433 species of reef fish at 20 stations in Banda islands, respectively. Rijoly (2015) compiled data of Halford (2002) and Mulyadi & Rijoly (2013) and reported that the number of reef species in Banda Island were 592 species. The higher number of species reported by those authors compared to present study might be due to different method used. In the present study, observation was restricted to the transect area (250 m<sup>2</sup>) for each station at 3 m and 10 m deep while Halford (2002) as well as Mulyadi & Rijoly (2013) conducted their research by using free scuba diving UVC method at the depth of 1 m to 30 m.

Table 2

Taxa composition of reef fish in southern Ambon Island

Station	Taxa					
	Species			Sub Total	Genera	Family
TS	MS	IS				
1	10	56	10	76	47	24
2	6	41	5	52	33	16
3	22	47	9	78	48	25
4	19	40	6	65	41	18
5	9	38	3	50	34	18
6	17	50	3	70	46	22
7	21	51	6	78	51	26
8	8	51	8	67	46	22
9	16	57	7	80	50	21
10	32	55	12	99	52	24
11	15	38	6	59	40	19
12	29	68	10	107	64	26
13	13	37	8	58	39	18
14	32	68	12	112	64	25
15	23	53	10	86	55	21
16	21	74	7	102	61	26
17	20	47	8	75	47	21
18	23	39	10	72	45	23
19	15	48	12	75	44	19
Total	83	183	27	293	116	42

Notes: TS = target species; MS = major species; IS = indicator species.

The highest number of species of reef fish so far in Indonesia occur in Bird's Head Peninsula (Raja Ampat Islands, Fakfak-Kaimana coast, and Cenderawasih Bay), West Papua as reported by Allen & Erdmann (2009); i.e. 1,511 species in 451 genera and 111 families. This figure is far higher than the number of species found in this study. However, the species listed by Allen & Erdmann (2009) was a compilation of data from other researchers prior to 1950 that were summarized by Weber and de Beaufort in 1921-1962, Munro in 1958 and their own data in 1997-2009 (cited in Allen & Erdmann

2009). In addition, the higher number of species of reef fish found in Bird's Head Peninsula than present study could be due to higher number of sampling sites, wider area covered and different method used. In Raja Ampat, for example, Allen & Erdmann (2009) observed 1,320 species of reef fish by using free scuba diving UVC up to 60 m deep which covered an area of 50,000 km<sup>2</sup>. Repeated sampling can also increase the number of species found as reported by Allen & Erdmann (2009) and Allen & Erdmann (2012) for reef fish in Raja Ampat, i.e., 236 to 1,102 to 1,320 to 1,437 species for the year 2001, 2002, 2009 and 2012, respectively.

**Relative diversity.** Relative diversity of reef fish based on CFDI value in southern Ambon Island is presented in Table 3. As a whole, CFDI value for waters of southern Ambon Island was 165 and it can be categorized as moderate (see Table 1 for its criteria). It can be seen in Table 3 that CFDI value for each station ranged from 27 (station 5) to 70 (station 14) and it can be categorized into very poor (6 stations), poor (12 stations) and moderate (1 station). Allen (1998) and Allen & Erdmann (2012) used CFDI value to determine relative diversity of reef fish based on the number of species observed which belonged to six main families namely Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, and Acanthuridae.

Table 3

CFDI values, number of species and category of reef fish

<i>Station</i>	<i>CFDI</i>	<i>Observed species</i>	<i>Estimated species</i>	<i>Category</i>
1	48	76	142	Poor
2	29	52	78	Very poor
3	49	78	146	Poor
4	39	65	112	Very poor
5	27	50	71	Very poor
6	39	70	112	Very poor
7	42	78	122	Poor
8	41	67	118	Poor
9	48	80	142	Poor
10	57	99	173	Poor
11	39	59	112	Very poor
12	66	107	203	Poor
13	36	58	101	Very poor
14	70	112	217	Moderate
15	62	86	190	Poor
16	66	102	203	Poor
17	54	75	162	Poor
18	43	72	125	Poor
19	54	75	162	Poor
<b>Total</b>	<b>165</b>	<b>293</b>	<b>539</b>	<b>Moderate</b>

Result presented in Table 3 showed that the number of reef fish found during the study is 293 species while the number of species estimated by CFDI value is 539 species. This figure indicates that more species, i.e., 246 species (45.6%) of reef fish is expected to be found if repetitive sampling is done in the southern coastal waters of Ambon Island.

In general, CFDI value of reef fish in southern Ambon Island is lower than CFDI values in other areas in Indonesia except for those values in Bintan Island (Riau), Buru Island (Maluku) and Western Seram in Maluku (Table 4). Species richness of reef fish in southern Ambon Island is also lower except those at Central Maluku, Buru Island and Westren Seram in Maluku Province.

Table 4

CFDI values of reef fishes in several regions of Indonesia

No.	Region	CFDI	Number of species observed	Number of species estimated
1	Raja Ampat Islands, West Papua	373	1437	1465
2	Maumere Bay, Flores	333	1111	1108
3	Fak. Fak-Triton Bay, West Papua	322	1005	1249
4	Halmahera	327	974	1271
5	Bali and Nusa Penida	337	977	1312
6	Cenderawasih Bay, West Papua	302	965	1165
7	Berau District, East Kalimantan	316	875	1050
8	Togean and Banggai Islands	308	819	1190
9	Komodo Islands	280	750	928
10	Weh Island, Sumatra	196	533	644
11	Bintan Island	97	304	308
12	Banda Islands, 2002	263	500	871
13	Banda Islands, 2013	211	433	695
14	Banda Islands, 2015	284	592	942
15	Southeast Maluku	198	356	651
16	Southwest Maluku	195	346	640
17	Ambon Island + Lucipara	176	331	576
18	Central Maluku	167	272	546
19	Buru Island	158	261	515
20	Western Seram	93	170	295
21	Southern coastal waters of Ambon Island	165	293	539

Source: No. 1-11 = Allen & Erdmann (2012); No. 12 = Halford (2002); No. 13 = Muljadi & Rijoly (2013); No. 14 -20 = Rijoly (2015).

It can be seen also in Table 4 that the number of species observed by using free diving UVC method (data no. 1-14) is far higher than those using belt transect UVC method (data no. 5-21). Rijoly (2015) stated that observers using free diving UVC method encountered more species because they spent more time underwater and covered more area up to the depth of 60 m.

**Conclusions.** Reef fish observed during the study in the southern waters of Ambon Island consists of 293 species which belong to 116 genera and 42 families. Most of the fish are major species (183 species) while the rest are target species (83 species) and indicator species (27 species). In general, relative diversity of reef fish in the waters of southern Ambon Island is categorized as moderate based on coral fish diversity index. However, at some stations they are categorized as very poor to poor.

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