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# Study on coral reef fishes diversity of Kambing Island, Madura Strait, East Java, Indonesia

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**Abstract**—Research on diversity of coral reef fishes of Kambing Island, Madura Strait, East Java, Indonesia was conducted in July 2002. The coral reef fishes are divided into three categories; major fishes consisted of 63 species of 13 families, target fishes 29 species of eight families, and indicator fishes eight species of only one family (Chaetodontidae). In general, the average abundance of the coral reef fishes in the study site is six individuals per square meter. The dominant indicator species are *Chaetodon adiergastos* and *C. octofasciatus*. The number of *C. octofasciatus* indicates that the coral reefs habitat is in bad condition with very poor coverage of live coral ranging from 7.13 to 11.74% hosting 28 species of stony corals. Bombing traces were found in many spots of each site where sea urchin (*Diadema setosum*) becomes abundant.

**Key words:** coral reef fishes, diversity, Kambing Island

## Introduction

Indonesia is well known to have developed coral reefs covering about 85,707 km<sup>2</sup> occupying approximately 15% of the world's coral reefs.

Coral reef fishes are one of the most important fishes in Indonesian coastal fisheries as important sources of food and trade ornamental fish, which enhance the welfare of the coastal communities. Recently, coral reef fishes are facing serious depletion due to increased fishing as the increasing demand from Japan, Singapore, China including Hong Kong, Netherlands, France, and USA. Coral reef fishes play an important role to Indonesian marine tourism either as attraction in the big city aquarium or for divers. For example, the Bunaken National Park with its sheer coral walls and high marine biodiversity generates US\$ 12 million a year in revenue, with visitors increasing approximately 27% annually. Live coral fishes are important for the restaurant dishes, markets and a premium live coral fish such as Napoleon wrasse (*Cheilinus undulatus*) is traded at US\$ 50–200 per kg. (PARPOSTEL 1994).

Some of the coral fishes are very common in Indonesian coral reefs, namely groupers (Serranidae), snappers (Lutjanidae) and (Lethrinidae), rabbit fishes (Siganidae), fusiliers (Caesionidae), and Napoleon wrasse (Labridae). Chaetodontidae, Zanclidae, Pomacentridae, Serranidae, Labridae, Platacidae, Scorpaenidae, and Acanthuridae are the most common ornamental fishes in Indonesia.

The study was conducted at Kambing Island, Madura

Strait, East Java, to observe the abundance of coral reef fish species and the condition of their habitats. In fisheries management of Indonesian Department of Marine Affairs and Fisheries, Madura Strait is regarded as a part of Java Sea region. According to the National Committee of Fisheries Stock Assessment in 1998 (Widodo et al. 1998), the potency of coral fishes in Java Sea was approximately 9,500 ton/year. Meanwhile the potency of ornamental fish in Indonesian waters was assessed as much as 1.5 billion individuals.

## Materials And Methods

The study was conducted at coral reefs of Kambing Island, Madura Strait, East Java, particularly in southern and eastern parts. (07<12.795'S, 110<19.6071'E) from 9 to 17 July 2002 (Fig. 1) using SCUBA for visual census method which was modified by Dartnal & Jones (1986). The transect line (50 m) parallel with the coastline, each covering an area 500 m<sup>2</sup> with 5 m interval at both left and right side. The transects were conducted 6 times. Collecting was done with three repetitions at each site at a depth of about 10 m. Number of fish species and individuals were estimated for each transect. In the analysis, the coral fishes are grouped into three categories: indicator, target, and major.

Indicator fish is a group of fish, which strongly associated with coral reef. In this study, we suggested that Chaetodontidae could be used as indicator species.

Target fish is a group of fish which economically important and they lived in association with coral reef. Three fami-

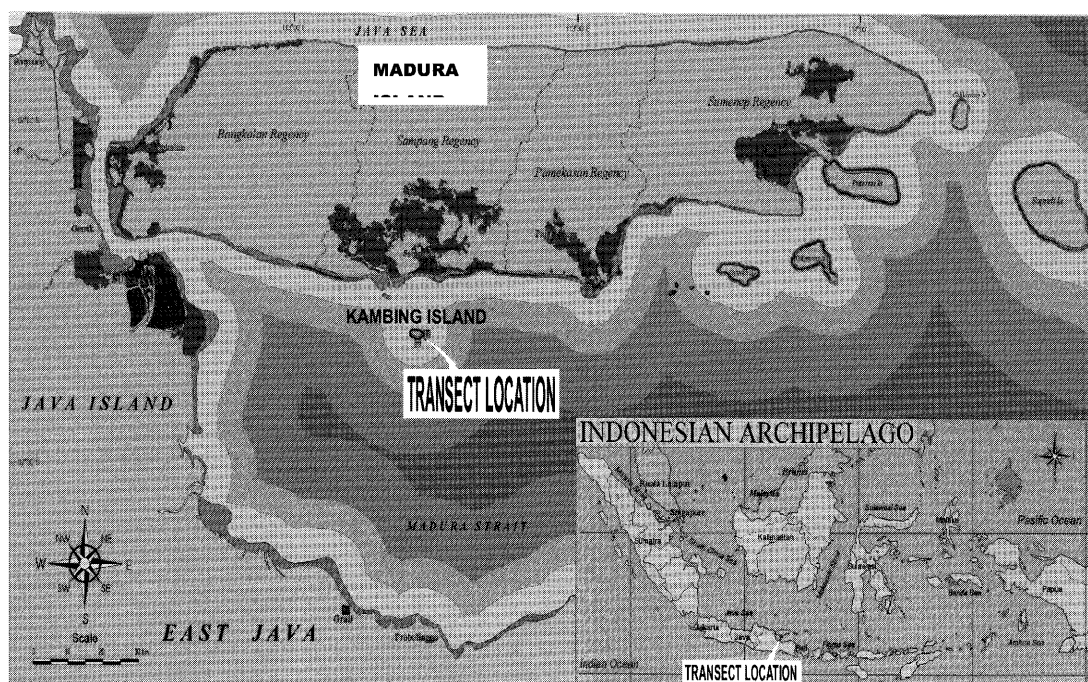


Fig. 1. Study sites in Kambing Island, Madura Strait, East Java.

lies of this group i.e. Caesionidae, Acanthuridae, and Siganidae are the most abundance.

The major fish is a group of fish that is neither belongs to indicator nor target. This group forms big school, and its role in the coral reef ecosystem is not much known, except as component of the food chain. Many species of this group are valuable ornamental fish.

The identification of coral fishes was made by using the "Micronesian reef fishes" of Myers (1991), while stony corals based on Veron (1986) and English et al. (1997).

## Results and Discussions

### Major fishes

A total of 63 species belonging to 13 families of major fishes were collected from Kambing Island. Major fishes were dominated by Pomacentridae (25 species) and Labridae (20 species) (Table 1). Pomacentridae was primarily presented by *Abudefduf sexfasciatus*, *A. curacao*, *A. tematensis* and *Dascyllus reticulatus*, with the average number of individuals per squaremeter about 18, 23, 33 and 18, respectively. Labridae was represented by *Halichoeres gymnocephalus*, *Chaetodon anchorago*, and *Hemigymnus melapterus*, respectively with average number of about 9, 7, and 7 individuals. Apogonidae was dominated by *Apogon quenquelineata* and *Archamia fucata*, respectively with average number of about 36 and 19 individuals. Scaridae was dominated by *Scarus sp.* and *Scarus ghobban* respectively with average number of about 11 and 5 individuals.

### Target fishes

The target fishes were composed of 29 species of 9 families, namely Caesionidae (2 species), Serranidae (6 species), Lutjanidae (7 species), Siganidae (2 species), Scolopsidae (5 species), Mullidae (3 species), Sphyraenidae (1 species), Nemipteridae (1 species), and Acanthuridae (2 species) (Table 1). Serranidae was dominated by *Epinephelus fasciatus* and *Cephalopholis pachycentron*. *Plectropoma maculatum*, *E. fasciatus*, and *C. boenak* are potential species for mariculture. Lutjanidae and Siganidae are very potential for mariculture, particularly *Lutjanus biguttatus*, *L. decussatus*, and *Siganus guttatus*.

### Indicator fishes

In this study the family Chaetodontidae is regarded as indicator fishes to assess the ecological condition of coral reef ecosystem at Kambing Island. A total of eight species of this family were collected (Table 1). The dominant species are *Chaetodon octofasciatus* and *Chaetodon adiergastos* with average number of individuals 10 and 7 respectively. The very low number of species as well as individuals and the abundance of *Chaetodon octofasciatus* could be interpreted that the ecological condition of coral reefs in this area is bad or damaged.

### Density of coral reef fishes

A total of 1,786 individuals of coral reef fishes were collected during this study comprises of 542 individuals from south site and 1,244 individuals from east site (Table 1). Result of six times transects each with three repetitions showed that the average of density of coral fishes is approximately

**Table 1.** Number of fish individuals observed in Kambing Island, Madura Strait, East Java.

No	Fish groups	South site				East site			
		I	II	III	Average	I	II	III	Average
Major fishes									
Pomacentridae									
1	<i>Abudefduf saxatilis</i>	6		4	3		15	15	10
2	<i>Abudefduf sexfasciatus</i>		30		10	10	10	7	8
3	<i>Amblyglyphidodon curacao</i>	10	8		6	20	10	10	13
4	<i>Amphiprion ocellaris</i>		2		1			2	1
5	<i>Chromis atripes</i>		10		3	10	15	10	12
6	<i>Chromis ternatensis</i>		30		10	15	20	30	23
7	<i>Chromis viridis</i>					15	10	20	15
8	<i>Chromis weberi</i>	20	5		8	15	10	10	12
9	<i>Chrysiptera cyanea</i>			7	2	5	6	8	6
10	<i>Dascyllus reticulatus</i>		10		3	10	15	20	15
11	<i>Dascyllus trimaculatus</i>					10	5	2	6
12	<i>Dischistodus chrysopoecilus</i>	7	8	3	6	5	4	7	5
13	<i>Dischistodus perspicillatus</i>					9	10	12	10
14	<i>Dischistodus prosopotaeniatus</i>	2	4	1	2	3	6	4	4
15	<i>Hemiglyphidodon plagiometopon</i>	2			1			2	1
16	<i>Neopomacentrus anabatooides</i>					30	30	20	27
17	<i>Neopomacentrus cyanomos</i>					10	5	10	8
18	<i>Paraglyphidodon melas</i>		2		1		2		1
19	<i>Pomacentrus alexanderae</i>					10	5	20	12
20	<i>Pomacentrus bankanensis</i>	4	2		2	7	2	2	4
21	<i>Pomacentrus margaritifer</i>	2	4		2				
22	<i>Pomacentrus mollucensis</i>	3	2	2	2	5	4	4	4
23	<i>Pomacentrus nigromarginatus</i>	3			1	3	2	4	3
24	<i>Pomacentrus sp.</i>								
25	<i>Pomacentrus tripunctatus</i>	10	3		4	5	2	2	3
Labridae									
26	<i>Cheilinus fasciatus</i>		2	2	1	3	2	2	2
27	<i>Cheilinus trilobatus</i>			1	1	2	1	2	2
28	<i>Choerodon anchorago</i>					7	8	6	7
29	<i>Epibulus insidiator</i>	3			1	2	1	1	1
30	<i>Gomphosus varius</i>							2	1
31	<i>Halichoeres argus</i>	5	4	3	4	2	1	1	1
32	<i>Halichoeres chrysus ?</i>							1	1
33	<i>Halichoeres gymnocephalus</i>	6	7	2	5	5	3	4	4
34	<i>Halichoeres hortulanus</i>	1	1	1	1	1	3	1	2
35	<i>Halichoeres marginatus</i>					3		2	2
36	<i>Halichoeres melanurus</i>	2	1		1	2	1		1
37	<i>Halichoeres scapularis</i>	2	5	2	3	1	2	2	2
38	<i>Halichoeres spp.</i>								
39	<i>Hemigymnus melapterus</i>	3	2	4	3	5	2	6	4
40	<i>Labroides dimidiatus</i>		2		1	2	1	2	2
41	<i>Paracirrhites sp.</i>	2	3	2	2				
42	<i>Stethojulis albovittata</i>		3		1			2	1
43	<i>Thalassoma hardwicki</i>	3	1		1	2	1		1
44	<i>Thalassoma lunare</i>	6	3		3	5	7	6	6
45	<i>Thaliurus chlorurus</i>					1	2		1
Muraenidae									
46	<i>Muraena sp.</i>							1	1
Holocentridae									
47	<i>Holocentrus rubrum</i>			3	1		2		1
Apogonidae									
48	<i>Apogon compressus</i>	10	3						
49	<i>Apogon macrodon</i>					3	5	5	4

Table 1. (Continued)

No	Fish groups	South site				East site			
		I	II	III	Average	I	II	III	Average
50	<i>Apogon quenquelineata</i>		40		13	20	30	20	23
51	<i>Apogon</i> sp.						2	3	2
52	<i>Archamia fucata</i> Platacidae		20		7	10	15	10	12
53	<i>Platax orbicularis</i> Pomacanthidae					6		2	3
54	<i>Chaetodontoplus mesoleucus</i>	1		1					
55	<i>Centropyge tibicens</i> Scaridae							1	1
56	<i>Scarus dimidiatus</i>		2	3	2	2	2	1	2
57	<i>Scarus ghoban</i>		2	5	2	3	2	3	3
58	<i>Scarus</i> spp. Tetraodontidae			6	2	12	10	6	9
59	<i>Arothron immaculatus</i> Diploprionidae					1			1
60	<i>Diploprion bifasciatus</i> Malacanthidae					2	6	2	3
61	<i>Malacanthus</i> sp. Monacanthidae			2	1				
62	<i>Monacanthus</i> sp. Syngnathidae		1		1				
63	<i>Corythoichthys</i> sp.			2	1				
Target fishes									
Caesionidae									
1	<i>Caesio teres</i>	30		5	12	50	30	10	30
2	<i>Pterocaesio trilineata</i> Serranidae	10			3				
3	<i>Cephalopholis argus</i>	2			1	1			1
4	<i>Cephalopholis boenak</i>					1		1	1
5	<i>Cephalopholis pachycentron</i>	1	2	2	2	2	3		2
6	<i>Epinephelus fasciatus</i>	2	3	3	3	3	2	7	4
7	<i>Epinephelus merra</i>	1		1	1	1	2	2	2
8	<i>Plectropoma maculatum</i> Lutjanidae			1	1	1		1	1
9	<i>Lutjanus biguttatus</i>	3		4	3				
10	<i>Lutjanus carponotatus</i>		2		1	2	2	3	2
11	<i>Lutjanus decussates</i>		1	3	1	2	4	1	2
12	<i>Lutjanus fulviflamma</i>							3	1
13	<i>Lutjanus fulvus</i>					1		1	1
14	<i>Lutjanus russelli</i>							3	1
15	<i>Lutjanus vitta</i> Siganidae					1	1		1
16	<i>Siganus guttatus</i>	4		12	5	2	1	1	1
17	<i>Siganus virgatus</i> Scolopsidae			2	1	5	4	3	4
18	<i>Scolopsis bilineatus</i>	8	2		3	10	5	2	6
19	<i>Scolopsis ciliatus</i>					4	8	5	6
20	<i>Scolopsis lineatus</i>			1	1	10	15	20	15
21	<i>Scolopsis margaritifer</i>	2			1	2	4	4	3
22	<i>Scolopsis monogramma</i> Mullidae					1	2		1
23	<i>Parupeneus barberinus</i>			2	1	3	2	2	2
24	<i>Parupeneus indicus</i>							1	1
25	<i>Upeneus tragula</i> Sphyraenidae		1		1	2		1	1
26	<i>Sphyraena</i> sp. Nemipteridae		1		1				
27	<i>Pentapodus caninus</i> Acanthuridae	5			2	6	4	11	7
28	<i>Acanthurus</i> sp.						1	2	1
29	<i>Ctenochaetus striatus</i>		2	5	2			2	1

**Table 1.** (Continued)

No	Fish groups	South site				East site			
		I	II	III	Average	I	II	III	Average
Indicator fishes									
Chaetodontidae									
1	<i>Chaetodon adiergastos</i>	4	8	3	5	8	3		4
2	<i>Chaetodon baronessa</i>	2		2	1		2		1
3	<i>Chaetodon octofasciatus</i>	2	3		2	8	10	6	8
4	<i>Chaetodon trifasciatus</i>		2		1				
5	<i>Chaetodon vagabundus</i>			2	1				
6	<i>Chelmon rostratus</i>		2		1	2	2	4	3
7	<i>Coradion chrysozonus</i>		2	1					
8	<i>Heniochus accuminatus</i>							2	1
Number of species		178	259	105		429	402	413	
Number of individuals		35	45	35		66	64	73	

six individuals per square meter. The study conducted around Situbondo, Madura Strait which is about 24 miles SE of Kambing Island showed that the density of coral fishes was 1.3 individuals per square meter (Hartati & Wahyuni 1994). Comparing the two locations, Kambing Island and Situbondo, that the fish density of the earlier mentioned location is very much higher than the latter. This is probably due to lesser exploitation at Kambing Island which is located not too close to community settlement compared to Situbondo although the coral reef condition of Kambing Island is already deteriorated. According to the National Committee on Fisheries Stock Assessment in 1998, the potency of coral fishes in Java Sea was approximately 9,5001 ton/year. Meanwhile the potency of ornamental fish in Indonesian waters was assessed as much as 1.5 billion individuals.

**Coral reefs condition**

The percent cover of the living coral ranging from 7.13 to 11.74% covering 28 species of stony corals. The stony coral are dominated by branching species of genera *Acropora*, *Euphyllia*, *Heliopora*, *Montipora*, *Platygyra*, *Pocillopora*, and *Porites* (Table 2). This result indicated that the coral reefs condition is very poor at Kambing Island. In some places are many spots of bombing traces where sea urchin (*Diadema setosum*) becomes abundant. However, Kambing Island has 17 species of stony corals belong to the branching corals which are fastest growing corals. The destruction of living coral could lead to the changing of the fish species composition from carnivore species to herbivore species. The abundance of sea-urchin is one indicator that the coralreefs has been already damaged. If they are growing to recover, the coralreefs will be then dominated by opportunistic species which are mostly the branching-corals.

**Table 2.** Species of Stony Corals in Kambing Island, Madura Strait, East Java.

Species	Station 1 (South)	Station 2 (East)
<i>Acropora hyacinthus</i>	+	-
<i>Acropora palifera</i>	+	+
<i>Acropora</i> sp.	+	+
<i>Alveopora</i> sp.	+	+
<i>Coelocoris mayeri</i>	+	-
<i>Cyphastrea</i> sp.	-	+
<i>Diploastrea heliopora</i>	+	-
<i>Euphyllia glabrescens</i>	-	+
<i>Favites abdita</i>	+	+
<i>Fungia</i> sp.	+	-
<i>Galaxea fascicularis</i>	-	+
<i>Goniastrea pectinata</i>	+	-
<i>Goniopora columna</i>	+	+
<i>Heliopora coerulea</i>	+	-
<i>Hydnophora microconos</i>	+	-
<i>Montipora digitata</i>	+	+
<i>Montipora</i> sp.	+	+
<i>Platygyra daedalea</i>	-	+
<i>Plerogyra sinuosa</i>	-	+
<i>Pocillopora damicornis</i>	+	-
<i>Porites cylindrical</i>	+	+
<i>Porites nigrecens</i>	+	+
<i>Porites lobata</i>	+	+
<i>Porites lutea</i>	+	+
<i>Porites rus</i>	+	+
<i>Psammocora contigua</i>	+	-
<i>Seriatopora hystrix</i>	+	+
<i>Turbinaria</i> sp.	+	-
Average percent cover of living corals	7.13%	11.74%

Notes: +, present ; -, absent

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