

Report on Ecological Assessment



**From Pejarakan, Sumber Kima and Penyabangan,
Gerokgak sub-district, Buleleng, Bali**

*Prepared by Marine Aquarium Council
Based on MATRAQ report prepared by the Reef Check team*



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A. Introduction

In general, the types of coral reefs found in the waters off Pejarakan, Sumber Kima and Penyabangan village are patch reefs, fringing reefs which consist of reef flats and reef slopes. Coral reefs grow on a bed of sand, broken reefs and dead reefs at a depth of 1 to 40 metres. In some areas reefs can be found at a depth of more than 40 metres.

The marine ornamental collection areas in Pejarakan village have borders with:

- Sumber Klampok village and West Bali National Park in the west
- Sumber Kima village in the East
- The Bali Sea in the North
- The Jembrana Regency national forest in the South

The marine ornamental collection areas in Sumber Kima village have borders with:

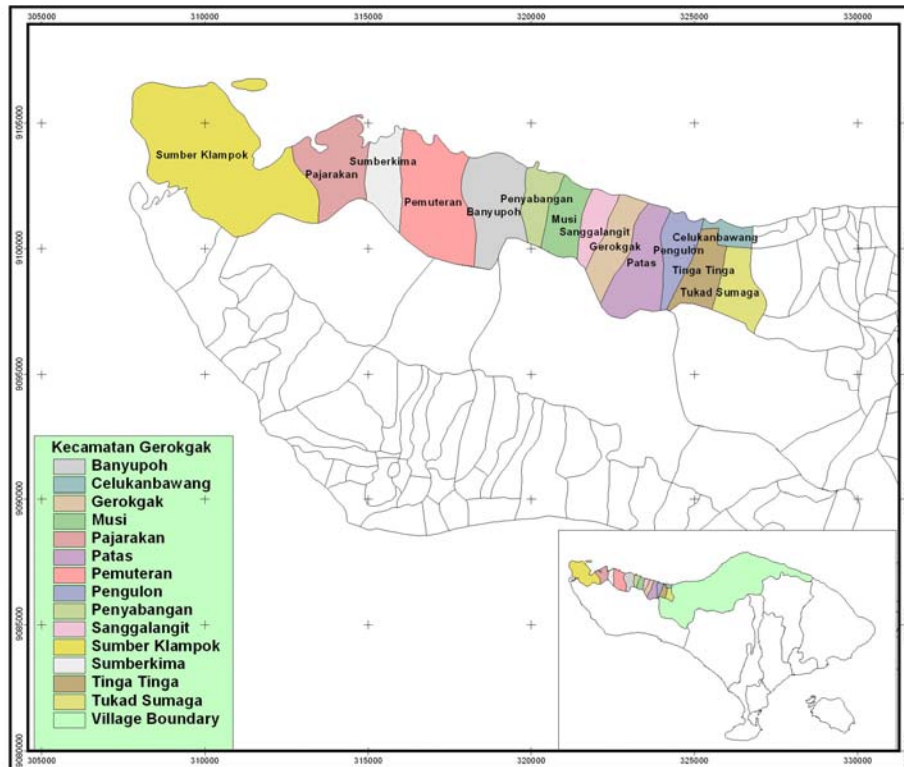
- Pejarakan village in the West
- Pemuteran village in the East
- The Bali Sea in the North
- The Jembrana Regency in the South

The marine ornamental collection areas in Penyabangan village have borders with:

- Banyupoh village in the west
- Musi village in the east
- The Bali Sea in the North
- Jembrana regency in the south

Collections of ornamental fish are carried out in:

- Cempaluk Bay (Teluk Cempaluk)
- The Burung Promontory (Tanjung Burung)
- Bajul Bay (Teluk Bajul)
- Gebang Bay (Teluk Gebang)
- Puskopad (The Indonesian Army Cooperative Centre)
- Batu Ampar
- Takad Kedis
- Takad Samasi
- Penyabangan



The State Decree No 22, 1999 regarding regional autonomy provides that the management over the district waters (defined to extend up to 4 miles of the coastline) is given to the district government (Kabupaten). Under the National Fisheries law No. 31, 2004, artisanal fishermen who fish for livelihood, are allowed to fish within Indonesian waters. In other word Indonesian applies an open access system. The Indonesian fishermen allow to fish cross districts, as long as they obey local, district, provincial and national law.

Pejarakan and Sumber Kima village contain a mangrove ecosystem, with mangroves growing in the north of Banyu Wedang Bay and spreading thinly along the Goris coast up to the border of Sumberkima Bay. (Source: Ecology Features, Tabanan, Jembrana and Buleleng Regencies, October 2000). There are different types of mangrove in Pejarakan and Sumber Kima village. A lot of *Avicenia*, *Sonneratia*, *Brugiera* and *Rhizophora* grow on the Goris coast, west of Sumberkima Bay. There are *Rhizophora*, *Avicennia* and *Bruguiera* in Banyu Wedang (Source: Ecology Features, Tabanan, Jembrana and Buleleng Regencies, October 2000).

Pejarakan, Sumber Kima and Penyabangan village have a fairly high potential for fishing, both for food and ornamental fish. The waters off Sumber Kima village are a site for the farming of fish of high economic value, such as grouper.

B. The History of Ornamental Fish Collection in the Collection Area

The collection of ornamental fish from the coral reefs in the waters off Pejarakan village started around 1964. while in Sumber Kima it started around 1978. Simple equipment was used then. Around 1970, collectors started to use boats and compressors to collect fish. Each boat had 5 to 15 collectors, depending on the size of the boat.

At that time, the most sought after fish was the beautiful two-colour dottyback (*Pseudochromis paccagnellae*), and bait shrimp (*Lysmata amboinensis*).

Around the mid 70's, ornamental fish collectors started to collect fish outside the Pejarakan village area, i.e in other waters off Buleleng regency such as the waters off Sumber Kima, Patas, Gerokgak, Musi, Celukan Bawang Seririt, Banyupoh Banjar Asem and other villages.

Owners of bigger boats which were usually manned by 15 collectors even went outside Bali, i.e. to waters off Madura, Flores, Celebes, and Kalimantan islands.

Cyanide, referred to as potas by local fishermen, had been used by collectors since the beginning of 1970. It could be bought in jewellers selling gold for around Rp. 1,500 to Rp. 3,000 per kg. The latest data, from 2004, indicated that the price of cyanide had reached Rp 50,000/kg to Rp. 60,000/kg

The use of cyanide for a period of more than 30 years in the waters off Pejarakan, sumber Kima, Penyabangan and their surrounding areas has resulted in the scarcity of certain species, such as Piama (Angelfish species), Blustone (juvenile of Angelfish species), Enjel Noplelon (Angelfish species), Bronkely, Niles, Night Star, and Barong. The conditions of the coral reefs also seem to have become worse as a result of collectors using cyanide and explosives to catch food fish.

In around 1990, fishermen from Pejarakan village were trained to use nets for collecting fish. The training was given by fishermen from Bangsring, Banyuwangi. However, nets were not used for long because it was felt that collecting ornamental fish by using nets only brought small catches. Moreover, not all fishermen used nets; a lot of them continued to use cyanide. Other reasons included the absence of officials stopping them from using cyanide. These were the excuses used by the fishermen for going back to using cyanide.

Ornamental fish collectors in Pejarakan, Sumber Kima and Penyabangan do not generally rely solely upon collecting ornamental fish as their source of income. They also farm and raise cattle.

In early 2000, the government started to carry out law enforcement in this area, banning the use of cyanide. Given tighter enforcement of the law, and the increasing price of cyanide, Pejarakan, Sumber Kima and Penyabangan fishermen wanted an alternative method of collection that was environmentally friendly and in accordance with government regulations.

On 29th June 2004, a marine ornamental fishermen's group called Kelompok Nelayan Ikan Hias Laut Lestari (KNIH-LL / Lestari Marine Ornamental Fishermen's Group) was established in Pejarakan. The group was established because, among other things, the marine ornamental fishermen's community of Pejarakan village did not want to use cyanide anymore in collecting the fish, and they wanted to restore the coral reefs in (the waters off) Pejarakan village. Fishermen from Sumber Kima also established a marine ornamental fishermen's group.

After the fishermen's groups were established, the group carried out training programmes to improve fish collection and handling techniques, and the committee members's organisational skills. The Pejarakan village fishermen's group wishes to take part in the MAC Standar and Best Practice programmes in order to obtain Marine Aquarium Council certification.

C. Ecological Assessment Survey

Location: Pejarakan Sumberkima and Penyabangan/Banyapo Villages, North Bali

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Appendix 2: List of species based on survey records

I Summary Sheet for the MAQTRAC Survey

Total Coral Reef Area Surveyed	<i>10,500 m²</i>
TAC set for fish	<i>161 species</i>
TAC set for invertebrates	<i>8 species</i>
No collection areas	<i>adjacent West Bali National Park</i>
New no-collection areas	<i>1 (Pemuteran ~ 7 km² reef area)</i>
Coral Cover over the whole survey	<i>28% live coral cover</i>
Fish Density over whole area	<i>Average of 1200 individuals per 500m²</i>
Number of species requiring further research during next survey and careful monitoring of catch-per-unit-effort	<i>19 fish species</i>

II MAQTRAC RESURVEY REPORT: Northwestern Bali

Area name:

Northwestern Bali (Pejarakan, Sumberkima, Penyabangan and Banyapo)

Size of coral reef area: 8 km²

(An estimate which undergoes "ground truthing" during survey with the information ascertained using Geographic Information System (GIS) with Landsat maps as base maps)

MAQTRAC Team conducting resurvey:

Domingo Ochavillo, Yunaldi, Putu Widyastuti & Andre

Resurvey period:

June 25 to 30, 2005

MAQTRAC Team conducting survey:

Yunaldi, Putu Widyastuti & Yahmantoro

Original survey period:

July 2003

General Description of the Area:

Pejarakan is located very adjacent to the West Bali National Park. It is a fringing reef with the flat area almost twice as large as the slope (1 km² and 0.7 km², respectively). The reef flat is more degraded than the reef slope. The degradation is most probably a combination of natural and human-induced disturbances. Dynamite fishing has been blamed by local fishermen as the main cause of the damage. Pejarakan reefs were also hit by the coral bleaching event in 1998 and the crown-of-thorn epidemic in January 2005. The epidemic hit first the West Bali National Park before Pejarakan. Ironically, this is an indication that recruitment spillovers are highly probable for fish and other invertebrates from the park (as a no-take zone) to the neighboring collection sites. Siltation is prevalent.

Sumberkima is a large shoal reef around 3.5 km² area. The reef actually has two reef flats that are mostly sand and dead corals. The other reef slopes are similar in configuration to Pejarakan from which it is separated by a channel. The Sumberkima shoal reef twists to form an embayment on the western side. There are pearl farms in the reefs.

Banyupoh and Penyabangan has relatively smaller reefs, (1.6 km² and 1.3 km², respectively), compared to Pejarakan's and Sumberkima's. The fringing reefs in Banyupoh are the very narrow. Ornamental collection is mostly concentrated on a few (four) and small submerged reefs. Siltation is a problem in the fringing reefs in both Banyupoh and Penyabangan.

Ornamental collectors are mostly concentrated in Pejarakan and Sumberkima. However, there are much fewer local collectors. Most of the collectors are rovers. There is a problem of poaching by outside collectors.

Aquarium collectors work the whole year round except from the months of December to March because of big waves.

Methods used to collect the data

All of the marine aquarium target organisms were surveyed using the MAQTRAC method (refer to the MAQTRAC manual for details in field operations and data analysis and interpretation) in various sites indicated by the collectors.

The main objectives of MAQTRAC are:

1. to determine the status of resources;
2. to set total allowable catch; and
3. to recommend sites for no-take zones.

III MAQTRAC Survey Results

- 1.) The MAQTRAC team survey in 2005 covered 10,500 m² of coral reef area. The extent of the coral reef and the collection area is in the map in appendix 1.
- 2.) A total of 164 target ornamental fish species were recorded during the surveys in 2005. Similarly, around 160 fish ornamentals were recorded in 2003. Pejarakan had 123 fish species recorded while Sumberkima had 108 fish species and Penyabangan/Banyupoh had 85 species total.
- 3.) In general, wrasses damselfishes and the wrasses were the most abundant fish ornamentals in the areas surveyed. However, the areas are notably characterized by the abundance of the wrasse *Cirrhilabrus cyanopleura*, the fairy basslet *Pseudanthias squammipinnis* and the royal dottyback *Pseudochromis paccagnellae*. The latter species is particular abundant in the survey. However, the sizes recorded were similar possibly indicating an unusual cohort strength.
- 4.) Around 123 fish ornamentals were recorded in Pejarakan reefs. Fifteen of these ornamentals are highly in-demand. These include the surgeonfishes *Acanthurus pyroferus* and *Naso lituratus*; the angelfishes *Centropyge bicolor* and *Pygoplites diacanthus*; the parrotfish *Cetoscarus bicolor*; the damselfishes *Chromis viridis*

and *Dascyllus trimaculatus*; the wrasses *Gomphosus varius*, *Halichoeres chloropterus*, *Halichoeres chrysus* and *Halichoeres hortulanus*; the triggerfish *Odonus niger*; the batfishes *Platax orbicularis* and *Platax pinnatus*, and the Moorish idol *Zanclus cornutus*.

- 5.) Around 107 fish ornamentals were recorded in Sumberkima reefs. Five of these ornamentals are highly in-demand. These include the surgeonfish *Acanthurus pyroferus*; the angelfish *Centropyge bicolor*; the damselfishes *Chromis viridis* and *Dascyllus trimaculatus*; and the wrasse *Pseudocheilinus hexataenia*.
- 6.) Around 85 fish ornamentals were recorded in Banyupoh and Penyabangan reefs. Thirteen of these ornamentals are highly in-demand. These include surgeonfish *Acanthurus pyroferus*; the clownfish *Amphiprion clarkii*; the angelfishes *Centropyge bicolor* and *Pygoplites diacanthus*; the butterflyfishes *Chaetodon ephippium*, *Heniochus monoceros* and *Heniochus varius*; the damselfishes *Chromis viridis* and *Dascyllus trimaculatus*; the wrasses *Halichoeres chrysus* and *Halichoeres hortulanus*; the triggerfish *Odonus niger*; and parrotfish *Cetoscarus bicolor*.
- 7.) Around 8 invertebrate ornamental target species/species groups were recorded during the MAQTRAC surveys. The highly collected seastar *Linkia laevigata* and the nudibranches were abundant.

IV Table of MAQTRAC results (total number of individuals that may be collected annually)

The following table shows the TAC per species

Pejarakan	10%TAC	upper limit 10% TAC
Species		
1 <i>Abudefduf saxatilis</i>	333	1020
2 <i>Abudefduf septemfasciatus</i>	998	3059
3 <i>Abudefduf sexfasciatus</i>	2328	5884
4 <i>Abudefduf vaigiensis</i>	67	204
5 <i>Acanthurus fowleri</i>	266	816
6 <i>Acanthurus lineatus</i>	33	102
7 <i>Acanthurus pyroferus</i>	732	1563
8 <i>Acanthurus tennentii</i>	399	1224
9 <i>Aeoliscus strigatus</i>	1962	4107
10 <i>Amblyglyphidodon aureus</i>	1031	3161
11 <i>Amblyglyphidodon curacao</i>	1397	2908
12 <i>Amblyglyphidodon leucogaster</i>	4257	9289
13 <i>Anampses melanurus</i>	67	204

14	<i>Apogon lineatus</i>	466	1354
15	<i>Apogon compressus</i>	665	2039
16	<i>Arothron nigropunctatus</i>	33	102
17	<i>Aspidontus taeniatus</i>	33	102
18	<i>Atrosalarias fuscus</i>	33	102
19	<i>Balistapus undulatus</i>	1197	2258
20	<i>Balistoides viridescens</i>	33	102
21	<i>Bodianus diana</i>	133	408
22	<i>Bodianus mesothorax</i>	67	158
23	<i>Canthigaster solandri</i>	67	204
24	<i>Canthigaster valentini</i>	67	204
25	Centropyge bicolor	166	377
26	<i>Centropyge vroliki</i>	1497	2801
27	<i>Cephalopholis urodela</i>	100	246
28	Cetoscarus bicolor	67	204
29	<i>Chaetodon adiergastos</i>	200	351
30	<i>Chaetodon baronessa</i>	2228	3587
31	<i>Chaetodon kleini</i>	432	704
32	<i>Chaetodon melannotus</i>	33	102
33	<i>Chaetodon trifasciatus</i>	366	645
34	<i>Chaetodon vagabundus</i>	233	439
35	<i>Chaetodontoplus mesoleucus</i>	166	377
36	<i>Cheilinus celebicus</i>	133	343
37	<i>Cheilinus fasciatus</i>	366	626
38	<i>Cheilinus trilobatus</i>	166	510
39	<i>Cheilodipterus quinquelineatus</i>	67	158
40	<i>Chromis analis</i>	5188	11749
41	<i>Chromis margaritifer</i>	732	1968
42	<i>Chromis opercularis</i>	1995	6118
43	<i>Chromis retrofasciata</i>	6552	13545
44	Chromis viridis	1064	2548
45	<i>Chromis weberi</i>	233	714
46	<i>Chromis xanthurus</i>	133	285
47	<i>Chrysiptera rollandi</i>	2594	4747
48	<i>Chrysiptera talboti</i>	1164	2329
49	<i>Cirrhilabrus cyanopleura</i>	22117	58748
50	<i>Cirrhilabrus ryukyuensis</i>	399	1224
51	<i>Cirrhilabrus solorensis</i>	33	102
52	<i>Cirrhitichthys falco</i>	200	612
53	<i>Coradion melannopus</i>	100	306
54	<i>Dascyllus aruanus</i>	432	1252
55	<i>Dascyllus reticulatus</i>	7383	12521
56	Dascyllus trimaculatus	732	1612
57	<i>Diproctacanthus xanthurus</i>	299	538
58	<i>Ecsenius laudandus</i>	166	401
59	<i>Ecsenius sp. (brown)</i>	166	377
60	<i>Epibulus insidiator</i>	200	351
61	Gomphosus varius	33	102
62	<i>Halichoeres argus</i>	100	306
63	Halichoeres chloropterus	133	408

64	Halichoeres chrysus	100	306
65	Halichoeres hortulanus	1264	2403
66	<i>Halichoeres marginatus</i>	33	102
67	<i>Halichoeres melanurus</i>	1962	4235
68	<i>Halichoeres ornatissimus</i>	466	1000
69	<i>Halichoeres prosopeion</i>	898	1809
70	<i>Hemigymnus fasciatus</i>	67	204
71	<i>Hemigymnus melapterus</i>	200	383
72	<i>Heniochus chrysostomus</i>	133	316
73	<i>Heniochus varius</i>	399	780
74	<i>Labrichthys unilineatus</i>	100	246
75	<i>Labroides dimidiatus</i>	1064	2258
76	<i>Labrosis xanthonota</i>	33	102
77	<i>Lutjanus decussatus</i>	33	102
78	<i>Macolor niger</i>	33	102
79	<i>Macropharyngodon meleagris</i>	133	316
80	<i>Meiacanthus atrodorsalis</i>	233	714
81	<i>Meiacanthus grammistes</i>	266	744
82	Naso lituratus	33	102
83	<i>Neoniphon sammara</i>	233	714
84	<i>Novaculichthys taeniourus</i>	33	102
85	Odonus niger	67	204
86	<i>Paracirrhites arcatus</i>	33	102
87	<i>Parupeneus barberinus</i>	200	493
88	<i>Parupeneus indicus</i>	33	102
89	<i>Parupeneus multifasciatus</i>	67	158
90	<i>Plagiotremus rhinorhynchus</i>	200	433
91	Platax orbicularis	100	306
92	Platax pinnatus	33	102
93	<i>Plectroglyphidodon lacrymatus</i>	266	686
94	<i>Plectroglyphidodon dickii</i>	100	306
95	<i>Pomacentrus amboinensis</i>	3459	7105
96	<i>Pomacentrus coelestis</i>	4889	9596
97	<i>Pomacentrus lepidogenys</i>	1763	5181
98	<i>Pomacentrus moluccensis</i>	2927	6021
99	<i>Pseudanthias huchtii</i>	67	204
100	<i>Pseudanthias squammipinnis</i>	49056	113879
101	<i>Pseudobalistes fuscus</i>	33	102
102	<i>Pseudocheilinus hexataenia</i>	100	246
103	<i>Pseudocheilinus octotaenia</i>	33	102
104	<i>Pseudochromis fuscus</i>	100	246
105	<i>Pseudochromis paccagnellae</i>	5185	10383
106	Pygoplites diacanthus	67	204
107	<i>Rhinecanthus verrucosus</i>	299	918
108	<i>Sargocentron caudimaculatum</i>	133	343
109	<i>Sargocentron kuntee</i>	233	714
110	<i>Siganus corallinus</i>	299	597
111	<i>Siganus puellus</i>	67	204
112	<i>Siganus virgatus</i>	200	433
113	<i>Siganus vulpinus</i>	133	316

114	<i>Stethojulis bandanensis</i>	466	1073
115	<i>Stethojulis trilineata</i>	133	316
116	<i>Sufflamen bursa</i>	200	493
117	<i>Sufflamen chrysopterus</i>	333	702
118	<i>Thalassoma amblycephalum</i>	333	802
119	<i>Thalassoma hardwicke</i>	2594	5408
120	<i>Thalassoma lunare</i>	2760	5344
121	<i>Thalassoma quinquevittatum</i>	33	102
122	Zanclus cornutus	532	1131
123	<i>Zebrasoma scopas</i>	366	806

Sumberkima		upper limit	
		10% TAC	10% TAC
Species			
1	<i>Acanthurus fowleri</i>	1599	3948
2	<i>Acanthurus leucocheilus</i>	100	296
3	Acanthurus pyroferus	200	591
4	<i>Aeoliscus strigatus</i>	1698	3387
5	<i>Amblyglyphidodon aureus</i>	5695	16407
6	<i>Amblyglyphidodon curacao</i>	2798	5728
7	<i>Amblyglyphidodon leucogaster</i>	69578	187367
8	<i>Amblygobius phalaena</i>	100	296
9	<i>Anampses meleagrides</i>	100	296
10	<i>Apogon aureus</i>	200	591
11	<i>Apogon compressus</i>	3497	7984
12	<i>Apogon lineata</i>	1199	2829
13	<i>Arothron nigropunctatus</i>	200	591
14	<i>Atrosalarias fuscus</i>	100	296
15	<i>Balistapus undulatus</i>	2198	3676
16	<i>Balistoides viridescens</i>	100	296
17	<i>Bodianus mesothorax</i>	200	453
18	<i>Canthigaster solandri</i>	699	1368
19	<i>Canthigaster valentini</i>	200	591
20	Centropyge bicolor	200	453
21	<i>Centropyge nox</i>	100	296
22	<i>Centropyge tibicen</i>	200	453
23	<i>Centropyge vroliki</i>	1399	3267
24	<i>Cephalopholis fasciatus</i>	200	591
25	<i>Chaetodon baronessa</i>	1798	2637
26	<i>Chaetodon kleini</i>	699	1691
27	<i>Chaetodon lineolatus</i>	100	296
28	<i>Chaetodon melannotus</i>	200	453
29	<i>Chaetodon octofasciatus</i>	2198	5356
30	<i>Chaetodon oxycephalus</i>	200	591
31	<i>Chaetodon trifasciatus</i>	1898	3260
32	<i>Chaetodon ulietienseis</i>	100	296
33	<i>Chaetodontoplus mesoleucus</i>	699	1858

34	<i>Cheilinus celebicus</i>	1599	3708
35	<i>Cheilinus fasciatus</i>	1798	3131
36	<i>Cheilinus trilobatus</i>	699	2070
37	<i>Chromis analis</i>	1639	4420
38	<i>Chromis atripes</i>	2198	5356
39	<i>Chromis margaritifer</i>	599	1774
40	<i>Chromis opercularis</i>	4396	13012
41	<i>Chromis retrofasciata</i>	13188	26453
42	<i>Chromis ternatensis</i>	500	1479
43	<i>Chromis viridis</i>	15986	47317
44	<i>Chromis xanthura</i>	3057	7212
45	<i>Chrysiptera cyanea</i>	719	2129
46	<i>Chrysiptera rollandi</i>	16845	42384
47	<i>Chrysiptera talboti</i>	919	2318
48	<i>Cirrhilabrus cyanopleura</i>	275056	757100
49	<i>Cirrhilabrus ryukyensis</i>	11730	28526
50	<i>Cirrhilabrus solorensis</i>	11310	23300
51	<i>Coradion chrysozonus</i>	100	296
52	<i>Coradion melannopus</i>	500	1149
53	<i>Dascyllus aruanus</i>	2997	7391
54	<i>Dascyllus melanurus</i>	1499	4436
55	<i>Dascyllus reticulatus</i>	2198	5135
56	<i>Dascyllus trimaculatus</i>	11070	24556
57	<i>Diademichthys lineatus</i>	100	296
58	<i>Diproctacanthus xanthurus</i>	1256	2560
59	<i>Epibulus insidiator</i>	1556	3639
60	<i>Halichoeres hortulanus</i>	799	2366
61	<i>Halichoeres marginatus</i>	357	866
62	<i>Halichoeres melanurus</i>	1299	2265
63	<i>Halichoeres prosopeion</i>	400	987
64	<i>Halichoeres purpureescens</i>	257	760
65	<i>Halichoeres prosopeion</i>	100	296
66	<i>Hemigymnus fasciatus</i>	100	296
67	<i>Hemigymnus melapterus</i>	100	296
68	<i>Heniochus chrysostomus</i>	100	296
69	<i>Heniochus varius</i>	2398	4164
70	<i>Labrichthys unilineatus</i>	1627	3783
71	<i>Labroides dimidiatus</i>	1927	3767
72	<i>Labropsis australis</i>	100	296
73	<i>Macropharyngodon meleagris</i>	100	296
74	<i>Meiacanthus atrodorsalis</i>	100	296
75	<i>Meiacanthus grammistes</i>	400	807
76	<i>Myripristis murdjan</i>	100	296
77	<i>Myripristis violacea</i>	300	887
78	<i>Novaculichthys taeniourus</i>	100	296
79	<i>Parupeneus barberinus</i>	200	591
80	<i>Parupeneus multifasciatus</i>	699	1122
81	<i>Pervagor alternans</i>	100	296
82	<i>Pervagor melanocephalus</i>	300	707
83	<i>Platax orbicularis</i>	100	296

84	<i>Pomacentrus alexanderae</i>	21981	51201
85	<i>Pomacentrus amboinensis</i>	8093	21609
86	<i>Pomacentrus bankanensis</i>	1399	4140
87	<i>Pomacentrus coelestis</i>	12489	24722
88	<i>Pomacentrus moluccensis</i>	16385	34773
89	<i>Pseudanthias huchtii</i>	599	1774
90	<i>Pseudanthias squammipinnis</i>	85524	251782
91	<i>Pseudobalistes fuscus</i>	200	591
92	<i>Pseudocheilinus hexataenia</i>	100	296
93	<i>Pseudochromis fuscus</i>	100	296
94	<i>Pseudochromis paccagnellae</i>	12109	30603
95	<i>Siganus corallinus</i>	200	591
96	<i>Siganus puellus</i>	1499	3094
97	<i>Siganus virgatus</i>	1299	2894
98	<i>Stethojulis bandanensis</i>	100	296
99	<i>Stethojulis red (dot in caudal)</i>	771	2281
100	<i>Stethojulis trilineata</i>	100	296
101	<i>Sufflamen bursa</i>	200	591
102	<i>Sufflamen chrysopterus</i>	200	591
103	<i>Thalassoma amblycephalum</i>	200	591
104	<i>Thalassoma hardwicke</i>	7493	21507
105	<i>Thalassoma lunare</i>	5695	9124
106	<i>Zanclus cornotus</i>	799	1765
107	<i>Zebrasoma scopas</i>	300	707

Banyupoh & Penyabangan		upper limit	
Species	10% TAC	10% TAC	
1	<i>Acanthurus fowleri</i>	116	342
2	<i>Acanthurus leucocheilus</i>	2312	6843
3	<i>Acanthurus maculiceps</i>	116	342
4	<i>Acanthurus pyroferus</i>	2081	5337
5	<i>Amblyglyphidodon aureus</i>	70632	181222
	<i>Amblyglyphidodon leucogaster</i>	155482	429490
6	<i>Amphiprion clarkii</i>	116	342
8	<i>Apogon compressus</i>	2774	8212
9	<i>Balistapus undulatus</i>	925	1502
10	<i>Bodianus diana</i>	578	1456
11	<i>Bodianus mesothorax</i>	925	1773
12	<i>Canthigaster valentini</i>	231	684
13	<i>Centropyge bicolor</i>	347	1027
14	<i>Centropyge tibicen</i>	116	342
15	<i>Centropyge vroliki</i>	1850	3255
16	<i>Cephalopholis urodela</i>	116	342
17	<i>Chaetodon adiergastos</i>	462	1017
18	<i>Chaetodon baronessa</i>	4162	6779
19	<i>Chaetodon ephipium</i>	231	684

20	<i>Chaetodon kleini</i>	1734	3489
21	<i>Chaetodon oxycephalus</i>	347	800
22	<i>Chaetodon trifascialis</i>	116	342
23	<i>Chaetodon trifasciatus</i>	1734	2747
24	<i>Chaetodon vagabundus</i>	462	1017
25	<i>Chaetodontoplus mesoleucus</i>	809	2130
26	<i>Cheilodipterus artus</i>	116	342
27	<i>Chromis analis</i>	1850	5475
28	<i>Chromis atripes</i>	231	684
29	<i>Chromis margaritifer</i>	2959	7709
30	<i>Chromis opercularis</i>	15144	44825
31	<i>Chromis retrofasciata</i>	96757	261916
32	<i>Chromis ternatensis</i>	18727	51350
33	<i>Chromis viridis</i>	99878	295636
34	<i>Chrysiptera rollandi</i>	15375	35545
35	<i>Chrysiptera talboti</i>	2774	5241
36	<i>Cirrhilabrus cyanopleura</i>	327379	714626
37	<i>Cirrhilabrus ryukyensis</i>	138720	410606
38	<i>Cirrhilabrus solorensis</i>	1040	2810
39	<i>Coradion chrysozonus</i>	116	342
40	<i>Coradion melannopus</i>	116	342
41	<i>Dascyllus aruanus</i>	3468	9200
42	<i>Dascyllus reticulatus</i>	237581	465684
43	<i>Dascyllus trimaculatus</i>	6474	13974
44	<i>Diproctacanthus xanthurus</i>	2312	5064
45	<i>Ecsenius laudandus</i>	116	342
46	<i>Ecsenius namiyei</i>	231	684
47	<i>Epibulus insidiator</i>	231	509
48	<i>Epinephelus ongus</i>	116	342
49	<i>Halichoeres chrysus</i>	1040	2577
50	<i>Halichoeres hortulanus</i>	347	800
51	<i>Halichoeres ornatissimus</i>	1040	3080
52	<i>Halichoeres prosopeion</i>	1734	2809
53	<i>Heniochus monoceros</i>	231	684
54	<i>Heniochus varius</i>	231	684
55	<i>Labrichthys unilineatus</i>	231	684
56	<i>Labroides dimidiatus</i>	809	1262
57	<i>Labropsis australis</i>	231	684
58	<i>Macropharyngodon meleagris</i>	462	1369
59	<i>Meiacanthus grammistes</i>	694	2053
60	<i>Neoglyphidodon melas</i>	347	1027
61	<i>Odonus niger</i>	116	342
62	<i>Paracirrhites forsteri</i>	231	684
63	<i>Parupeneus barberinus</i>	116	342
64	<i>Parupeneus indicus</i>	231	509
65	<i>Parupeneus multifasciatus</i>	462	886
66	<i>Pomacentrus amboinensis</i>	22658	49967
67	<i>Pomacentrus bankanensis</i>	231	684
68	<i>Pomacentrus coelestis</i>	176244	344476
69	<i>Pomacentrus moluccensis</i>	2543	5617

70	<i>Pseudanthias squammipinnis</i>	215247	619774
71	<i>Pseudanthias tuka</i>	3468	10265
72	<i>Pseudobalistes fuscus</i>	116	342
73	<i>Pseudochromis paccagnellae</i>	10288	25815
74	<i>Ptereleotris heteroptera</i>	347	1027
75	<i>Pygoplites diacanthus</i>	347	800
76	<i>Cetoscarus bicolor</i>	116	342
77	<i>Scolopsis bilineatus</i>	116	342
78	<i>Siganus puellus</i>	231	684
79	<i>Siganus virgatus</i>	578	1711
80	<i>Sufflamen bursa</i>	925	2470
81	<i>Sufflamen chrysopterus</i>	347	800
82	<i>Thalassoma amblycephalum</i>	694	2053
83	<i>Thalassoma lunare</i>	14126	29792
84	<i>Zanclus cornutus</i>	694	1354
85	<i>Zebraosoma scopas</i>	1503	3640

Legend: Species in bold letters are highly in-demand and most are priced from Rp 5,000 and above (mid to high-end species).

All Areas		10%	Upper
Invertebrate Ornamentals		TAC	Limit
		TAC	TAC
1	Black Long Spine Sea Urchin	16000	29669
2	<i>Linckia laevigata</i>	9067	21122
3	Nudibranch	8000	14528
4	<i>Panulirus</i> sp	533	1579
5	Purple Spine Sea Urchin	3200	9472
6	Sea Cucumber	533	1579
7	<i>Stenopus hispidus</i>	1067	3157
8	Udang Air (Shrimps)	533	1579

Table 1: Total allowable catch (TAC) on an annual basis

Note: The total allowable catch is set at 10% of the standing stocks of target species.

V No-take areas within the Collection area

1. There are no marine sanctuaries or no-take zones in the collection areas in Pejarakan, Sumberkima, Banyupoh and Penyabangan. West Bali National Park is the largest marine sanctuary in northwest Bali. However, the entire coastline of Pemuteran has been declared as a no-take zone by the village. Pemuteran is located between Sumberkima and Banyupoh (see map in Appendix 1) and the

area of its coral reef is around 7 km². If encompassed in a larger CAMP, this translates to almost 50% no-take zone area.

VI List of species requiring further research and careful monitoring of collection rates

The timing of MAQTRAC surveys is critical. Ideally, surveys are conducted during recruitment periods to obtain information on population replenishment rates. Data on the distribution of different size classes on a target ornamental species is important to infer population growth and mortality rates. The latter population demographic information are critical in determining sustainable levels of collection.

The MAQTRAC survey might also miss specific habitats of certain species where they are more abundant. In this connection, recommendation total allowable catch might be more conservative. It should also be kept in mind that underwater visual surveys generate generally conservative estimates of population abundance. Surveys can only account for the highly visible species and even only to an extent because of the niches provided by the structural complexity of coral reefs. The cryptic species will be highly difficult to document in MAQTRAC surveys. Therefore, there might be discrepancies on the results of the MAQTRAC surveys and the perceived abundance of target ornamentals by the collectors themselves. The latter case might only be true to a limited number of ornamentals out of hundreds. However, there should be careful monitoring of catch-per-unit effort in this case especially when collection starts to approach or even go beyond the suggested total allowable catch. Catch-per-unit effort will be the only monitoring tool for the cryptic species.

The following species especially require careful monitoring of catch-per-unit effort (expressed as number of fish individuals per hour of collection per collector) information because they are highly targeted:

- the surgeonfishes *Acanthurus pyroferus* and *Naso lituratus*;
- the triggerfish *Odonus niger*;
- the angelfishes *Centropyge bicolor* and *Pygoplites diacanthus*;
- the parrotfish *Cetoscarus bicolor*;
- the wrasses *Gomphosus varius* and *Halichoeres chrysus*;
- the batfishes *Platax orbicularis* and *Platax pinnatus*; and
- the butterflyfishes *Chaetodon ephippium*, *Heniochus monoceros* and *H. varius*

The following species were recorded during the first MAQTRAC survey in 2003 but not in 2005. Their CPUE should be carefully monitored as well.

- the angelfishes *Pomacanthus imperator*, *P. navarchus*,
- the wrasses *Labroides bicolor*
- the butterflyfishes *Heniochus singularis*, *Chaetodon adiergastos*; and
- the batfish *P. teira*.

It is recommended that CPUE should be analyzed quarterly for these species. Any significant decline in CPUE should translate to a proportional decrease in collection effort.

VII Recommendations and Conclusions

- 1.) Collection within the Pejarakan CAMP collection area can continue, as long as the TAC's are observed and the catch-per-unit effort closely monitored for some species and that the CAMP committee consider the data presented in this document accordingly.
- 2.) We recommend that the Pejarakan CAMP be expanded to include the coral reef areas in Sumberkima, Banyupoh and Penyabangan. The reef areas in these four villages are quite small (range from 1.3 to 3.5 km²). The coastline in Pemuteran has been declared as a no-take zone by the village. An all-encompassing CAMP with Pemuteran as a no-take zone translates to a 50% area of no-collection.

VIII Documentation Details:

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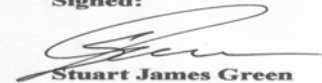
Prepared by MAQTRAC team

Yunaldi, Putu Widyastuti & Yahmantoro



Domingo Ochavillo, Ph.D. Reef Check Chief Scientist

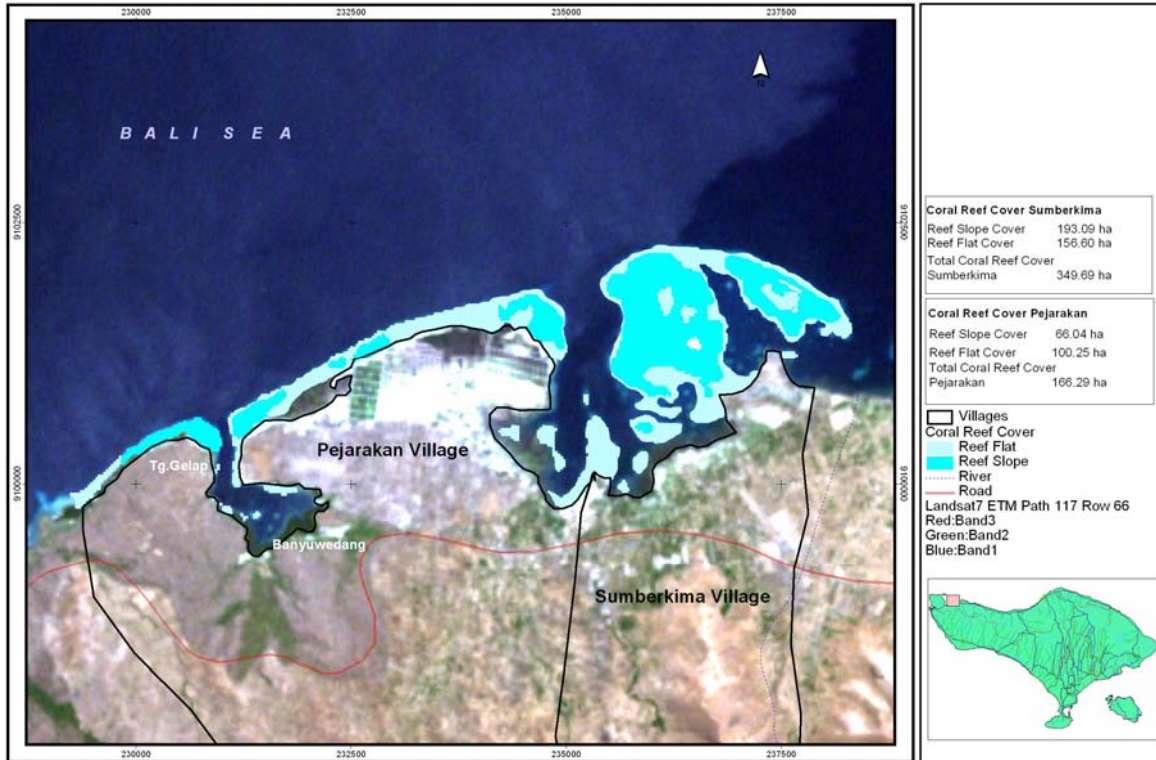
Signed:



Stuart James Green

Approved: Stuart Green, Program Manager Reef Check

Appendix 1. Map of collection area Pejarakan and Sumber Kima Village



Appendix 2. List of species based on survey records

**Table 1. List of species and quantity found in each sites at Pejarakan Area
Area : Pejarakan
Site: Tanjung Burung**

NO	NAME	COMMON NAME	LOCAL NAME	QUANTITY
	<i>Acanthurus fowleri</i>	Fowler's Surgeonfish	Botana podi	8
	<i>Acanthurus pyroferus</i>	Chocolate Surgeonfish	Botana mimik kuning (sulawesi)/Model	5
	<i>Acanthurus tennentii</i>	#N/A	#N/A	12
	<i>Amblyglyphidodon aureus</i>	Lemon Damsel	Betok bule kuning /Betok Layang-layang	31
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	8
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	66
	<i>Apogon lineatus</i>	#N/A	#N/A	1
	<i>Apogon compressus</i>	Ochre-striped Cardinalfish	Capungan strip merah	20
	<i>Auliscus strigatus</i>	#N/A	#N/A	15
	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger liris	1
	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger liris	12
	<i>Canthigaster valentini</i>	#N/A	#N/A	2
	<i>Canthigaster solandri</i>	Ocellated Toby	Buntel hijau (spot tanduk)/mata palsu/susu	2
	<i>Centropyge bicolor</i>	Bicolor Angelfish	Angel BK (Biru Kuning)	3
	<i>Centropyge vrolicki</i>	#N/A	#N/A	17
	<i>Chaertodontoplus mesoleucus</i>	#N/A	#N/A	1
	<i>Chaetodon kleini</i>	#N/A	#N/A	2
	<i>Cheatodon boronessa</i>	#N/A	#N/A	4
	<i>Cheilinus trilobatus</i>	Tripletail wrasse	Lambe trio	5
	<i>Chelinus celebicus</i>	#N/A	#N/A	3
	<i>Chromis retrofasciatus</i>	#N/A	#N/A	35
	<i>Chromis viridis</i>	Blue Green Chromis	Betok hijau/Jae-Jae	11
	<i>Chromis weberi</i>	#N/A	#N/A	7
	<i>Chromis xanthura</i>	Black Chromis	Betok laut ekor	2

			putih panjang	
	<i>Chryseptera rollandi</i>	#N/A	#N/A	20
	<i>Cirrhilabrus cyanopleura</i>	Bluehead/Redheaded Fairy Wrasse	KKO jakarta	45
	<i>Cirrhilabrus ryukyuensis.</i>	#N/A	#N/A	12
	<i>Dascyllus reticulatus</i>	#N/A	#N/A	45
	<i>Helichoeres argus</i>	#N/A	#N/A	3
	<i>Helichoeres melanarus</i>	#N/A	#N/A	5
	<i>Helichoeres ornatissimus</i>	#N/A	#N/A	4
	<i>Helichoeres prosopeion</i>	#N/A	#N/A	2
	<i>Heniochus chrysostomus</i>	Three Banded Bullfish	Layaran kambing Asli/tanduk	2
	<i>Heniochus varius</i>	Heniochus Butterfly - Cheifan	Kambingan	2
	<i>Labrosis xanthonota</i>	#N/A	#N/A	1
	<i>Lutjanus decussatus</i>	Checkered Snapper	Lucanus keranjang/Bendera US/Tanda2 Batu	1
	<i>Macropharyngodon meleagris</i>	Leopard Wrasse	Keling Batik	2
	<i>Meiacanthus atrodorsalis</i>	Forktail Blenny	Sampiran Ekor Panjang	7
	<i>Parapercis cylindrica</i>	#N/A	#N/A	2
	<i>Parupeneus barberinus</i>	Dash-and-Dot Goatfish	Jenggot model	2
	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	60
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	5
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	31
	<i>Pomacentrus bankanensis</i>	Speckled Damsel fish	Betok Merah	15
	<i>Pomacentrus coelestis</i>	Neon Damsel fish	Kapondangan palsu/Neon	11
	<i>Pomacentrus indicus</i>	#N/A	#N/A	55
	<i>Pomacentrus molucensis</i>	#N/A	#N/A	30
	<i>Pseudanthias squamipinnis</i>	Lyretail Anthias	Rainbow Biasa/mata	80

			ungu/laki	
	<i>Pseudochromis fuscus</i>	Brown Dottyback	Panter campur biasa	2
	<i>Pseudochromis paccagnellae</i>	Gramma Pigmy Basslet - False	Panter Cantik/Cantik	9
	<i>Scarus bicolor</i>	#N/A	#N/A	2
	<i>Siganus corallinus</i>	Blue-spotted Spinefoot	Sadar kuning	2
	<i>Stegastes nigrican</i>	#N/A	#N/A	12
	<i>Stethojulis bandanensis</i>	Orange-axil Wrasse	Timunan	2
	<i>Sufflamen bursa</i>	Boomerang Triggerfish	Trigger Bursa	2
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	16
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	3
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	6
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	12
	<i>Zanclus cornotus</i>	#N/A	#N/A	2
	<i>Zebrasoma scopas</i>	Brown Tang	Burung laut	6

Area: Pejarakan
Site: Puskopat

NO	NAME	COMMON NAME	LOCAL NAME	QUANTITY
	<i>Acanthurus pyroperus</i>	#N/A	#N/A	12
	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	4
	<i>Amblyglyphidodon curacao</i>	Staghorn Damsel	Betok bule strip	16
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	20
	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger liris	12
	<i>Centropyge bicolor</i>	Bicolor Angelfish	Angel BK (Biru Kuning)	1
	<i>Centropyge vrolickii</i>	#N/A	#N/A	5
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	4
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	4
	<i>Chaetodon kleini</i>	#N/A	#N/A	2
	<i>Chaetodon trifasciatus</i>	Melon Butterflyfish	Kepe Bundar/susu/Roti	2

	<i>Cheilinus celebicus</i>	Celebes wrasse	Lambe hidung panjang	1
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	1
	<i>Chromis margariifer</i>	#N/A	#N/A	4
	<i>Chromis retrofasciatus</i>	#N/A	#N/A	15
	<i>Chryseptera rollandi</i>	#N/A	#N/A	16
	<i>Chrysiptera talboti</i>	Talbot's demoiselle	Bintang Malam	5
	<i>Cirrhilabrus cyanopleura</i>	Bluehead/Redheaded Fairy Wrasse	KKO jakarta	80
	<i>Cirrhitichthys falco</i>	Falco Hawkfish	Krapu Loncat	6
	<i>Dascyllus reticulatus</i>	#N/A	#N/A	22
	<i>Dascyllus reticulatus</i>	#N/A	#N/A	15
	<i>Dascyllus trimaculatus</i>	Three spot damsel	Dakocan Hitam	4
	<i>Diproctacanthus xanthurus</i>	Wandering Cleaner Wrasse	Dokter Timunan/ Pencil	2
	<i>Epibulus insidiator</i>	Slingjaw Wrasse	Lambe/Trompet kuning /coklat/asli	1
	<i>Halichoeres hortulanus</i>	Checkered Wrasse	Keling Perak / Mata / Cagak	2
	<i>Halichoeres hortulanus</i>	Checkered Wrasse	Keling Perak / Mata / Cagak	3
	<i>Halichoeres melanurus</i>	Tailspot wrasse	Keling jantan/warna	4
	<i>Halichoeres melanurus</i>	Tailspot wrasse	Keling jantan/warna	26
	<i>Halichoeres chrysus</i>	#N/A	#N/A	3
	<i>Halichoeres ornatissimus</i>	#N/A	#N/A	3
	<i>Hemigymnus melapterus</i>	Blackedge Thicklip Wrasse	Tikusan biasa	1
	<i>Labroides dimidiatus</i>	Cleaner Wrasse	Dokter biasa	1
	<i>Macropharyngodon meleagris</i>	Leopard Wrasse	Keling Batik	2
	<i>Meiacanthus grammistes</i>	Striped Fang Blenny	Sampiran (Kuning/hitam)	7
	<i>Parapercis millepuntata</i>	#N/A	#N/A	6
	<i>Parupeneus barberinus</i>	Dash-and-Dot Goatfish	Jenggot model	4
	<i>Plectroglyphidodon</i>	#N/A	#N/A	2

	<i>lacrymatus</i>			
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	12
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	20
	<i>Pomacentrus bankanensis</i>	Speckled Damselfish	Betok Merah	3
	<i>Pomacentrus brachialis</i>	Chacoal damsel	Betok laut	47
	<i>Pomacentrus chrysurus</i>	Whitetail damsel	Betok merah palsu	12
	<i>Pomacentrus coelestis</i>	Neon Damselfish	Kapondangan palsu/Neon	25
	<i>Pomacentrus lepidogenys</i>	#N/A	#N/A	3
	<i>Pomacentrus coelestis</i>	#N/A	#N/A	30
	<i>Pseudanthias huchtii</i>	Redcheek Anthias	Rainbow Biasa/nona manis hijau	2
	<i>Pseudanthias squamipinnis</i>	Lyretail Anthias	Rainbow Biasa/mata ungu/laki	105
	<i>Pseudocheilinus hexataenia</i>	Pyjama Wrasse	Keling liris enam	2
	<i>Pseudocheilinus octanea</i>	#N/A	#N/A	1
	<i>Pseudochromis paccagnellae</i>	Gramma Pigmy Basslet - False	Panter Cantik/Cantik	4
	<i>Scarus ghoban</i>	#N/A	#N/A	1
	<i>Scolopsis bilineatus</i>	Twolined Spinecheek	Buarmata (garis dua)	11
	<i>Scolopsis bilineatus</i>	Twolined Spinecheek	Buarmata (garis dua)	2
	<i>Stethojulis bandanensis</i>	Orange-axil Wrasse	Timunan	1
	<i>Stethojulis trilineata</i>	Three-lined Wrasse	Timunan coklat/abu2/strip biru	2
	<i>Sufflamen bursa</i>	Boomerang Triggerfish	Trigger Bursa	4
	<i>Thalassoma hardwicke</i>	Hardwick's Wrasse	Talasoma tembok	2
	<i>Thalassoma hardwicke</i>	Hardwick's Wrasse	Talasoma tembok	17
	<i>Thalassoma hardwicke</i>	Hardwick's Wrasse	Talasoma tembok	2
	<i>Thalassoma lunare</i>	#N/A	#N/A	16

	<i>Thalassoma lunare</i>	#N/A	#N/A	5
	<i>Zanclus cornotus</i>	#N/A	#N/A	1

Area: Pejarakan
Site: Batu Ampar

NO	NAME	COMMON NAME	LOCAL NAME	QUANTITY
	<i>Abudefduf septemfasciatus</i>	Banded Sergeant	Sersan mayor	30
	<i>Abudefduf sexfasciatus</i>	Scissor-tail Sergeant	Sersan mayor	50
	<i>Abudefduf vaginensis</i>	#N/A	#N/A	2
	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	8
	<i>Amblyglyphidodon curacao</i>	Staghorn Damsel	Betok bule strip	16
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	6
	<i>Anampses melanurus</i>	Yellow Tailband Wrasse	Keling model kuning (Ekor strip kuning)	2
	<i>Apogon lineata</i>	#N/A	#N/A	13
	<i>Auliscus strigatus</i>	#N/A	#N/A	26
	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger liris	4
	<i>Centropyge vrolickii</i>	#N/A	#N/A	12
	<i>Chaetodon adiergastros</i>	#N/A	#N/A	2
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	10
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	12
	<i>Chaetodon trifasciatus</i>	Melon Butterflyfish	Kepe Bundar/susu/Roti	2
	<i>Chaetodon vagabundus</i>	Vagabond Butterflyfish	Kepe putih / Kepe Tikar	2
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	1
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	3
	<i>Chromis margariifer</i>	#N/A	#N/A	12
	<i>Chromis margariifer</i>	#N/A	#N/A	6
	<i>Chromis opercularis</i>	Doublebar Chromis	Betok strip dua	60
	<i>Dascyllus</i>	#N/A	#N/A	66

	<i>reticulatus</i>			
	<i>Dischistodus prosopotaenia</i>	Honey head damsel	Betok Kepala madu	5
	<i>Hegyminus melapterus</i>	#N/A	#N/A	2
	<i>Helichoeres cloropterus</i>	#N/A	#N/A	4
	<i>Helichoeres hortulanus</i>	#N/A	#N/A	2
	<i>Helichoeres hortulanus</i>	#N/A	#N/A	12
	<i>Helichoeres hortulanus</i>	#N/A	#N/A	3
	<i>Helichoeres marginatus</i>	#N/A	#N/A	1
	<i>Helichoeres melanurus</i>	#N/A	#N/A	20
	<i>Helichoeres ornatissimus</i>	#N/A	#N/A	7
	<i>Hemigymnus fasciatus</i>	Barred thicklip	Tikusan/kenari model	2
	<i>Labroides dimidiatus</i>	Cleaner Wrasse	Dokter biasa	2
	<i>Labroides dimidiatus</i>	Cleaner Wrasse	Dokter biasa	4
	<i>Parapercis millepunctata</i>	#N/A	#N/A	3
	<i>Plectrographidodon dikii</i>	#N/A	#N/A	3
	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	12
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	25
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	11
	<i>Pomacentrus bankanensis</i>	Speckled Damselfish	Betok Merah	7
	<i>Pomacentrus brachialis</i>	Chacoal damsel	Betok laut	60
	<i>Pomacentrus chrysurus</i>	Whitetail damsel	Betok merah palsu	21
	<i>Pomacentrus coelestis</i>	Neon Damselfish	Kapondangan palsu/Neon	14
	<i>Pomacentrus coelestis</i>	Neon Damselfish	Kapondangan palsu/Neon	13
	<i>Pomacentrus molucensis</i>	#N/A	#N/A	26
	<i>Pseudanthias squamipinnis</i>	Lyretail Anthias	Rainbow Biasa/mata	25

			ungu/laki	
	<i>Pseudobalistes fuscus</i>	Blue and Gold Triggerfish	Triger macan	1
	<i>Rhinecanthus verrucosus</i>	Blackbelly Triggerfish	Triger motor	3
	<i>Rhinecanthus verrucosus</i>	Blackbelly Triggerfish	Triger motor	5
	<i>Rhinecanthus verrucosus</i>	Blackbelly Triggerfish	Triger motor	1
	<i>Scarus niger</i>	Dusky Parrotfish	Kakatua Merah	1
	<i>Scarus sordidus</i>	Bulledhead Parrotfish	Kakatua kepala biru/ kakatua Hijau	2
	<i>Stethojulis bandanensis</i>	Orange-axil Wrasse	Timunan	9
	<i>Stethojulis trilineata</i>	Three-lined Wrasse	Timunan coklat/abu2/strip biru	2
	<i>Thalassoma amlycephalum</i>	#N/A	#N/A	6
	<i>Thalassoma hardwicke</i>	Hardwick's Wrasse	Talasoma tembok	2
	<i>Thalassoma jenseni</i>	#N/A	#N/A	
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	8
	<i>Zanclus cornotus</i>	#N/A	#N/A	6
	<i>Zanclus cornotus</i>	#N/A	#N/A	2

Table 2. List of Species found in each sites at Sumber Kime Area

Area: Sumber Kima

Site: Tanjung Kedis reef

NO	Name	Common name	Local name	QUANTITY
	<i>Acanthurus fowleri</i>	Fowler's Surgeonfish	Botana podi	12
	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	4
	<i>Amblyglyphidodon aureus</i>	Lemon Damsel	Betok bule kuning /Betok Layang-layang	2
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	36
	<i>Apogon lineata</i>	#N/A	#N/A	8
	<i>Auliscus strigatus</i>	#N/A	#N/A	5
	<i>Bodians mesothorax</i>	#N/A	#N/A	1
	<i>Canthigaster solandri</i>	Ocellated Toby	Buntel hijau (spot tanduk)/mata palsu/susu	2
	<i>Canthigaster valentini</i>	Saddled Toby	Buntel valentini	2
	<i>Centropyge bicolor</i>	Bicolor Angelfish	Angel BK (Biru Kuning)	1
	<i>Centropyge nox</i>	Midnight Angel	Angel hitam Polos	1
	<i>Centropyge tibicen</i>	Keyhole Angelfish	Angel Biru	1
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	2
	<i>Chaetodon lineolatus</i>	Lined Butterflyfish	Kepe mata hitam/biasa/piramit palsu/Putih	1
	<i>Chaetodon octofasciatus</i>	Eightbanded Butterflyfish	Kepe Zebra/Z. Emas Sulawesi/strip 8	4
	<i>Chaetodon octofasciatus</i>	Eightbanded Butterflyfish	Kepe Zebra/Z. Emas Sulawesi/strip 8	2
	<i>Chaetodon trifasciatus</i>	Melon Butterflyfish	Kepe Bundar/susu/Roti	4
	<i>Chaetodontoplus mesoleucus</i>	Vermiculated Angelfish	Kepe marmut/angel kalong	6
	<i>Cheilinus celebicus</i>	Celebes wrasse	Lambe hidung panjang	6
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	1
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	3
	<i>Chromis atripes</i>	#N/A	#N/A	16
	<i>Chromis retrofasciatus</i>	#N/A	#N/A	30
	<i>Chromis ternatensis</i>	Ternate Cromis	Betok ternate	5
	<i>Chromis xanthurus</i>	Black Chromis	Betok laut ekor putih panjang	2
	<i>Chryseptera rollandi</i>	#N/A	#N/A	64
	<i>Cirrhilabrus cyanopleura</i>	Bluehead/Redheaded Fairy Wrasse	KKO jakarta	25
	<i>Cirrhilabrus solorensis</i>	#N/A	#N/A	55
	<i>Coradion chrysozonus</i>	Orange Banded carlfish	Kepe spot/Antik	1
	<i>Dascyllus melanurus</i>	Blacktail Dascyllus	Zebra ekor hitam	15
	<i>Dascyllus trimaculatus</i>	Theree spot damsel	Dakocan Hitam	40
	<i>Dascylus aruanus</i>	#N/A	#N/A	4
	<i>Diademichthys lineatus</i>	Yellowstripe Clingfish	Bajulan ungu	1
	<i>Epibulus insidiator</i>	Slingjaw Wrasse	Lambe/Trompet kuning	2

			/coklat/asli	
	<i>Heniochus varius</i>	Heniochus Butterfly - Cheiftan	Kambangan	1
	<i>Heniochus varius</i>	Heniochus Butterfly - Cheiftan	Kambangan	3
	<i>Lutjanus decusatus</i>	#N/A	#N/A	2
	<i>Myripristis violacea</i>	Violet Soldierfish	Brajanata violet	3
	<i>Parupeneus multifasciatus</i>	Manybar Goatfish	Jenggot Biasa	1
	<i>Pervagor melanocephalus</i>	Redtail Filefish	Sonang ekor merah / Api/ Kipas merah	1
	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	50
	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	90
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	11
	<i>Pomacentrus coelestis</i>	Neon Damsel fish	Kapondangan palsu/Neon	16
	<i>Pomacentrus molucensis</i>	#N/A	#N/A	10
	<i>Pseudanthias squamipinnis</i>	Lyretail Anthias	Rainbow Biasa/mata ungu/laki	6
	<i>Pseudobalistes fuscus</i>	Blue and Gold Triggerfish	Triger macan	2
	<i>Pseudochromis paccagnellae</i>	Gramma Pigmy Basslet - False	Panter Cantik/Cantik	14
	<i>Scarus ghoban</i>	#N/A	#N/A	4
	<i>Scarus niger</i>	Dusky Parrotfish	Kakatua Merah	2
	<i>Scolopsis bilineatus</i>	Twolined Spinecheek	Buarmata (garis dua)	4
	<i>Stethojulis bandanensis</i>	Orange-axil Wrasse	Timunan	1
	<i>Sufflamen bursa</i>	Boomerang Triggerfish	Trigger Bursa	2
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talassoma hijau/Keling Cagak	12
	<i>Zanclus cornotus</i>	#N/A	#N/A	2

Area: Sumber Kima
Site: Takad Samasi reef

	Name	Common name	Local name	QUANTITY
	<i>Acanthurus binotatus</i>	#N/A	#N/A	1
	<i>Acanthurus fowleri</i>	Fowler's Surgeonfish	Botana podi	4
	<i>Acanthurus pyroperus</i>	#N/A	#N/A	2
	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	3
	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	21
	<i>Amblyglyphidodon aureus</i>	Lemon Damsel	Betok bule kuning /Betok Layang- layang	25
	<i>Amblyglyphidodon aureus</i>	Lemon Damsel	Betok bule kuning /Betok Layang- layang	30
	<i>Amblyglyphidodon curacao</i>	Staghorn Damsel	Betok bule strip	12

	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	14
	<i>Amblyglyphidodon leucogaster</i>	#N/A	#N/A	60
	<i>Anamnes meleagrides</i>	#N/A	#N/A	1
	<i>Apogon compressus</i>	Ochre-striped Cardinalfish	Capungan strip merah	20
	<i>Apogon lineata</i>	#N/A	#N/A	4
	<i>Arothron nigropunctatus</i>	Blackspotted Puffer	Buntel babi (biru dr Irian)	2
	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger liris	7
	<i>Canthigaster solandri</i>	Ocellated Toby	Buntel hijau (spot tanduk)/mata palsu/susu	2
	<i>Centropyge bicolor</i>	Bicolor Angelfish	Angel BK (Biru Kuning)	1
	<i>Centropyge vrolickii</i>	#N/A	#N/A	10
	<i>Cephalopholis fasciatus</i>	#N/A	#N/A	2
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	2
	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	2
	<i>Chaetodon klenii</i>	#N/A	#N/A	2
	<i>Chaetodon melannotus</i>	Blackback Butterflyfish	Kepe punggung hitam/ Strip empat	1
	<i>Chaetodon oxycephalus</i>	#N/A	#N/A	2
	<i>Chaetodon trifasciatus</i>	Melon Butterflyfish	Kepe Bundar/susu/Roti	4
	<i>Chaetodontoplus mesoleucus</i>	Vermiculated Angelfish	Kepe marmut/angel kalong	1
	<i>Cheilinus celebicus</i>	Celebes wrasse	Lambe hidung panjang	8
	<i>Cheilinus celebicus</i>	Celebes wrasse	Lambe hidung panjang	2
	<i>Cheilinus fasciatus</i>	Redbreasted wrasse	Lambe strip	2
	<i>Cheilinus trilobatus</i>	Tripletail wrasse	Lambe trio	7
	<i>Chromis atripes</i>	#N/A	#N/A	6
	<i>Chromis margariifer</i>	#N/A	#N/A	6
	<i>Chromis opercularis</i>	Doublebar Chromis	Betok strip dua	44
	<i>Chromis retrofasciatus</i>	#N/A	#N/A	65
	<i>Chryseptera rollandi</i>	#N/A	#N/A	41
	<i>Chryseptera rollandi</i>	#N/A	#N/A	6
	<i>Chrysiptera talboti</i>	Talbot's demoiselle	Bintang Malam	2
	<i>Cirrhilabrus cyanopleura</i>	Bluehead/Redhead Fairy Wrasse	KKO jakarta	250
	<i>Cirrhilabrus ruykensis</i>	#N/A	#N/A	85
	<i>Cirrhilabrus solorensis</i>	#N/A	#N/A	12
	<i>Dascyllus reticulatus</i>	#N/A	#N/A	15
	<i>Dascyllus trimaculatus</i>	Theree spot	Dakocan Hitam	2

		damsel		
	<i>Diproctacanthus xanthurus</i>	Wandering Cleaner Wrasse	Dokter Timunan/ Pencil	3
	<i>Diproctacanthus xanthurus</i>	Wandering Cleaner Wrasse	Dokter Timunan/ Pencil	4
	<i>Epibulus insidiator</i>	Slingjaw Wrasse	Lambe/Trompet kuning /coklat/asli	5
	<i>Epibulus insidiator</i>	Slingjaw Wrasse	Lambe/Trompet kuning /coklat/asli	6
	<i>Halichoeres hortulanus</i>	Checkered Wrasse	Keling Perak / Mata / Cagak	2
	<i>Halichoeres hortulanus</i>	Checkered Wrasse	Keling Perak / Mata / Cagak	6
	<i>Halichoeres melanurus</i>	Tailspot wrasse	Keling jantan/warna	3
	<i>Halichoeres prosopeion</i>	#N/A	#N/A	1
	<i>Heniochus varius</i>	Heniochus Butterfly - Cheifan	Kambingan	2
	<i>Labroides dimidiatus</i>	Cleaner Wrasse	Dokter biasa	3
	<i>Macropharyngodon meleagris</i>	Leopard Wrasse	Keling Batik	1
	<i>Meiacanthus grammistes</i>	Striped Fang Blenny	Sampiran (Kuning/hitam)	2
	<i>Parapercis cephalopunctata</i>	#N/A	#N/A	2
	<i>Parupeneus barberinus</i>	Dash-and-Dot Goatfish	Jenggot model	2
	<i>Pomacentrus alexandrae</i>	Alexander:s damsel	Betok Alex	80
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	40
	<i>Pomacentrus ambonensis</i>	#N/A	#N/A	30
	<i>Pomacentrus bankanensis</i>	Speckled Damsel	Betok Merah	14
	<i>Pomacentrus brachialis</i>	Chacoal damsel	Betok laut	85
	<i>Pomacentrus coelestis</i>	Neon Damsel	Kapondangan palsu/Neon	65
	<i>Pomacentrus molucensis</i>	#N/A	#N/A	52
	<i>Pomacentrus molucensis</i>	#N/A	#N/A	4
	<i>Pseudanthias huchtii</i>	Redcheek Anthias	Rainbow Biasa/nona manis hijau	6
	<i>Pseudanthias squamipinnis</i>	Lyretail Anthias	Rainbow Biasa/mata ungu/laki	85
	<i>Pseudochromis paccagnellae</i>	Gramma Pigmy Basslet - False	Panter Cantik/Cantik	10
	<i>Scolopsis bilineatus</i>	Twolined Spinecheek	Buarmata (garis dua)	2
	<i>Siganus corallinus</i>	Blue-spotted Spinefoot	Sadar kuning	2
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	12
	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talasoma hijau/Keling Cagak	2
	<i>Zebrasoma scopas</i>	Brown Tang	Burung laut	2

Table 3. Species list and abundance found during the Penyabangan survey

No	Number	Name	Common name	Local name	Price Category
1	130	<i>Cirrhilabrus cyanopleura</i>	Bluehead/Redheaded Fairy Wrasse	KKO jakarta	Low end
2	120	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	
3	110	<i>Dascyllus reticulatus</i>	Reticulated damsel / Damsel fish	Dakocan Putih	Low end
4	93	<i>Pomacentrus coelestis</i>	Neon Damsel fish	Kapondangan palsu/Neon	Low end
5	75	<i>Chromis opercularis</i>	Doublebar Chromis	Betok strip dua	Low end
6	207	<i>Chromis ternatensis</i>	Ternate Cromis	Betok ternate	Low end
7	92	<i>Chromis opercularis</i>	Doublebar Chromis	Betok strip dua	Low end
8	55	<i>Pomacentrus ambonensis</i>	Yellow damsel	Betok krem	Low end
9	45	<i>Amblyglyphidodon aureus</i>	Lemon Damsel	Betok bule kuning /Betok Layang-layang	Low end
10	80	<i>Thalassoma lunare</i>	Lyretail Wrasse	Talassoma hijau/Keling Cagak	Low end
11	72	<i>Amblyglyphidodon leucogaster</i>	White-breasted Damsel	Betok Layang-layang dasi kuning	
12	26	<i>Dascyllus aruanus</i>	White-Tailed Damsel	Betok Zebra Jakarta	Low end
13	23	<i>Chromis retrofasciatus</i>	Black bar Chromis	Betok albino	Low end
14	16	<i>Chryseptera rollandi</i>	Rolland's Demoiselle	Bluestar Putih hitam	Low end
15	15	<i>Acanthurus pyroperus</i>	Chocolate Surgeon	Botana Model	Middle end
16	12	<i>Dascyllus trimaculatus</i>	Theree spot damsel	Dakocan Hitam	Low end
17	12	<i>Pomacentrus alexanderae</i>	Alexander:s damsel	Betok Alex	
18	11	<i>Chrysiptera talboti</i>	Talbot's demoiselle	Bintang Malam	Low end
19	11	<i>Pseudochromis paccagnellae</i>	Gramma Pigmy Basslet - False	Panter Cantik/Cantik	
20	10	<i>Pomacentrus molucensis</i>	Lemon damsel	Betok kuning	Middle end
21	9	<i>Helichoeres ornatissimus</i>	Pinkface/zigzag Wrasse	Bayeman Campur/warna	Middle end
22	6	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	Middle end
23	6	<i>Meiacanthus grammistes</i>	Striped Fang Blenny	Sampiran (Kuning/hitam)	Low end
24	6	<i>Thalassoma amlycephalum</i>	Rainbow Wrasse	Talossoma merah (jantan dan betina)	Low end
25	4	<i>Chaetodon baronessa</i>	Baroness Butterflyfish	Kepe barones	Middle end
26	4	<i>Chaetodon trifasciatus</i>	Melon Butterflyfish	Kepe Bundar/susu/Roti	Middle end
27	4	<i>Chromis margaritifer</i>	Bicolor Chromis	Putri bali hitam	Low end
28	4	<i>Macropharyngodon meleagris</i>	Leopard Wrasse	Keling Batik	Middle end
29	3	<i>Balistapus undulatus</i>	Orangelined Triggerfish	Triger iris	Low end

30	3	<i>Neoglyphidodon melas</i>	Blue Fin Damsel	Dasi Biru/Betok laut hitam	
31	3	<i>Parapercis cephalopunctata</i>	Gubfish	Jabing/gobiodon campur	Low end
32	2	<i>Acanthurus sp</i>	Surgeonfish	Botana campur	
33	2	<i>Bodianus mesothorax</i>	Eclipse Hogfish	Hogfish titik emas (muda) / H. Biasa	Middle end
34	2	<i>Canthigaster valentini</i>	Saddled Toby	Buntel valentini	Middle end
35	2	<i>Centropyge vroliki</i>	Halfblack Angelfish	Angel abu polos	Low end
36	2	<i>Chaetodon kleinii</i>	Klein's Butterflyfish	Kepe coklat strip/Orange	Low end
37	2	<i>Chaetodon adiergastos</i>	Bantayan Butterflyfish	Kepe Roti	Low end
38	2	<i>Chromis atripes</i>	damsel	Betok coklat	Low end
39	2	<i>Diproctacanthus xanthurus</i>	Wandering Cleaner Wrasse	Dokter Timunan/ Pencil	Low end
40	2	<i>Ecsenius namiyei</i>	Yellow Tailed Blenny	Jabing Hitam	Low end
41	2	<i>Halichoeres prosopeion</i>	Twotone/Hogfish model	Keling Kepala ungu	Low end
42	2	<i>Heniochus varius</i>	Heniochus Butterfly - Cheifan	Kambingan	Middle end
43	2	<i>Labroides dimidiatus</i>	Cleaner Wrasse	Dokter biasa	Low end
44	2	<i>Pomacentrus bankanensis</i>	Speckled Damselfish	Betok Merah	Low end
45	1	<i>Acanthurus binotatus</i>	Two spot bristle tooth	Botana ekor kuning	
46	1	<i>Acanthurus maculiceps</i>	Black Eared Surgeonfish	Botana tanah Spesial	Low end
47	1	<i>Chaetodontoplus mesoleucus</i>	Vermiculated Angelfish	Kepe marmut/angel kalong	Middle end
48	1	<i>Parupeneus barberinus</i>	Dash-and-Dot Goatfish	Jenggot model	Low end
49	1	<i>Pentapodus caninus</i>	Small toothed whiptail	Buarmata	
50	1	<i>Cetoscarus bicolor</i>	Bicolor Parrotfish	Kepala haji/ Naakniing	Middle end
51	1	<i>Sufflamen bursa</i>	Boomerang Triggerfish	Trigger Bursa	Middle end