Reef Fishes of Bali, Indonesia

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Chapter 3

Reef Fishes of Bali, Indonesia

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SUMMARY

- A list of fishes was compiled for 29 survey sites. The survey involved approximately 80 hours of scuba diving by G. Allen and M. Erdmann to depths of 70 m.
- A total of 805 species was recorded for the survey.
- Combined with previous survey efforts by the authors, primarily at nearby Nusa Penida in 2008, the current total for the Bali region is 977 species in 320 genera and 88 families.
- A formula for predicting the total reef fish fauna based on the number of species in six key families (Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, and Acanthuridae) indicates that as many as 1,312 species can be expected to occur in the Bali region.
- Wrasses (Labridae), damselfishes (Pomacentridae), gobies (Gobiidae), cardinalfishes (Apogonidae), groupers (Serranidae), butterflyfishes (Chaetodontidae), and surgeonfishes (Acanthuridae) are the most speciose families on Bali reefs with 114, 96, 84, 59, 54, and 39 species respectively.
- Species numbers at visually sampled sites during the survey ranged from 42 to 248 with an average of 153.
- Sites with the most fish diversity included Anchor Wreck, Menjangan (site 26–248 species), Batu Kelibit, Tulamben (site 18–246 species), Kepa, Amed (site 17 - 230 species), Jemeluk, Amed (site 16–220 species), and Bunutan, Amed (site 15–217 species).
- The majority of Bali fishes have broad distributions in the Indo-Pacific (56.4%) or western Pacific (25.3%). Minority categories of special interest involve species that are mainly distributed in the Indian Ocean (3%) and Indonesian endemics (3.3%).
- A total of 16 species recorded from Bali are currently known only from the Nusa Tenggara Islands.
- At least thirteen undescribed reef fish species were recorded and collected during the survey, including two fang blennies (*Meiacanthus*), two jawfish (*Opistognathus*), three dottybacks (*Pseudochromis* and *Manonichthys*), a clingfish (*Lepidichthys*), a grubfish (*Parapercis*), a dartfish (*Ptereleotris*), a cardinalfish (*Siphamia*), and two gobiids (*Grallenia* and *Priolepis*). Though most of these undescribed species have been previously recorded from surrounding regions, five were recorded for the first time during the two MRAP surveys.
- Bali is conveniently divisible into four major zones or areas, based on components of the marine fauna in combination with broad-scale physical oceanographic features: Nusa Penida, east coast or Lombok Strait, north coast, and Secret Bay (Gilimanuk).

- Though Bali hosts an astounding diversity of fishes for its size, we also found strong signs of overfishing at nearly every site, with large reef fishes of commercial value nearly absent. Indeed, in over 350 man-hours of diving, the survey team only recorded a grand total of 3 reef sharks (only at Gili Selang and Menjangan), 3 Napoleon wrasse (*Cheilinus undulatus*; observed only at Gili Selang and Tulamben), and 4 coral trout of the genus *Plectropomus*. Equally concerning, the team only recorded a grand total of 5 marine turtles observed during the survey.

- Potential conservation sites based on remarkable fish diversity and excellent habitat conditions include Batu Tiga, Gili Selang, Taka Pemuteran, Sumber Kima, and Secret Bay (Gilimanuk).

3.1 INTRODUCTION

The Indonesia Archipelago is the world's richest region for coral reef fishes (Allen, 2008). Allen and Adrim (2003) provided a comprehensive checklist that included 2057 species. Recent additions (Allen, unpublished data) have since raised the overall total to about 2,250 species. Despite our increasing knowledge of the Indonesian region there is still considerable need for accurate local documentation, particularly for conservation purposes.

Comprehensive documentation of the reef fish fauna based on results of Conservation International's RAP survey during April–May, 2011 are presented in this chapter. The background of this project and detailed descriptions of the survey sites are provided elsewhere in this report. Although this report is focused on the 2011 survey, we have also provided a summary of the combined results of this survey and the 2008 Nusa Penida RAP, with some additional records also included from follow-on dives executed in the months just after the survey.

The principle aim of the fish survey was to provide a comprehensive inventory of the reef fishes of Bali. This segment of the fauna includes fishes living on or near coral reefs to depths of approximately 70 m. Survey activities therefore excluded estuarine species, deepwater fishes and offshore pelagic species such as flyingfishes, tunas, and billfishes.

The results of this survey facilitate a comparison of the reef fish fauna of Bali with other parts of Indonesia as well as other locations in the tropical Indo-Pacific. However, the list of fishes from the survey area is still incomplete, due to the time restriction and the cryptic nature of many small reef species.

3.2 METHODS

The current survey involved a combined total of approximately 80 hours of scuba diving by G. Allen and M. Erdmann to a maximum depth of 70 m. A comprehensive list of fishes was compiled for 29 sites (Appendix 3.1) between 29 April and 11 May 2011. The basic method consisted of underwater observations made during a single dive (rarely two dives) at each site with an average single dive duration of about 80 minutes. The name of each observed species was recorded in pencil on waterproof paper attached to a clipboard. The technique usually involved rapid descent to 30–70 m, then a slow, meandering ascent back to the shallows. The majority of time was spent in the 2–15 m depth zone, which consistently contains the highest number of species. Each dive included all major bottom types and habitat situations in the immediate vicinity.

Fishes were photographed underwater while scuba diving with a Nikon digital SLR camera and 105 mm lens in aluminium housing. Photographs were obtained of approximately 200 species.

Visual surveys were supplemented by collections of mainly cryptic species with the use of clove-oil, rotenone, and spear. Both chemical substances were used in small amounts. Cryptic gobies and other secretive fishes were individually targeted with a clove oil-alcohol mixture by squirting this chemical into caves and crevices. Rotenone was employed primarily in caves or under overhangs, or in some cases along the lower edge of slopes near the coral and sand/rubble interface.

3.3 SURVEY RESULTS

A total of 805 species were collected during the present survey (Lampiran 3.1). Combined with our results of 2008 for Nusa Penida and the first author's previous records of Bali fishes, the reef fish fauna of the Bali region includes 977 species belonging to 320 genera and 88 families. Allen (1997), Kuiter and Tonozuka (2001), and Allen et al (2007) provided illustrations for the majority of species. In addition, detailed coverage of all species is provided by the present authors in their recently-published *Reef Fishes of the East Indies* (Allen and Erdmann, 2012).

3.3.1 ANALYSIS OF SITE DATA

The number of species found at each site is indicated in Table 3.1. The number of species at each site ranged from 42 to 248, with an average of 153 species per site.

Coral and rocky reefs were by far the richest habitat in terms of fish biodiversity. The best sites for fishes (Table 3.2) were invariably locations containing a mixture of substrates including scleractinian corals, soft corals, and rock with algae, seawhips, gorgonians, and sponges. Strong currents were also a contributing factor to species enrichment, particularly the numerous species that feed predominately on current-borne zooplankton. Areas dominated by sand, silt, or rubble substrates were comparatively poor for fishes.

Table 3.1. Number of species observed at each site (note: fishes were not surveyed at sites 6, 8 and 27).

Site	Species	Site	Species	Site	Species
1	96	**13**	197	**23**	56
2	162	**14**	190	**24**	191
3	157	**15**	217	**25**	171
4	91	**16**	220	**26**	248
5	131	**17**	230	**28**	212
7	187	**18**	246	**29**	109
9	115	**19**	189	**30**	85
10	183	**20**	99	**31**	113
11	143	**21**	114	**32**	139
12	117	**22**	42		

Table 3.2. Richest sites for fishes during 2011 Bali survey.

Site No.	Location	Total fish spp.
26	Anchor Wreck, Menjangan	248
18	Batu Kelit, Tulamben	246
17	Kepa, Amed	230
16	Jemeluk, Amed	220
15	Bunutan, Amed	217
28	Pos 2, Menjangan	212

3.3.2 Coral Fish Diversity Index (CFDI)

In response to the need for a convenient method of assessing and comparing overall coral reef fish diversity between areas in the Indo-Pacific region the first author (see Allen and Werner, 2002) has devised a rating system based on the number of species present belonging to the following six families: Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, and Acanthuridae. These families are particularly good indicators of overall fish diversity for the following reasons:

- They are taxonomically well documented.
- They are conspicuous diurnal fishes that are relatively easy to identify underwater.
- They include the "core" reef species, which more than any other fishes characterize the fauna of a particular locality. Collectively, they usually comprise more than 50 percent of the observable fishes.
- The families, with the exception of Pomacanthidae, are consistently among the 10 most speciose groups of reef fishes inhabiting a particular locality in the tropical Indo-west Pacific region.
- Labridae and Pomacentridae in particular are very speciose and utilize a wide range of associated habitats in addition to coral-rich areas.

The method of assessment consists simply of counting the total number of species present in each of the six families. It is applicable at several levels:

- single dive sites
- relatively restricted localities (e.g. Bali)
- countries, major island groups, or large regions (e.g. Indonesia)

CFDI values can be used to make a reasonably accurate estimate of the total coral reef fish fauna of a particular locality by means of regression formulas. The latter were obtained after analysis of 35 Indo-Pacific locations for which reliable, comprehensive species lists exist. The data were first divided into two groups: those from relatively restricted localities (reefs and adjacent seas encompassing less than 2,000 km^2) and those from larger areas (reefs and adjacent seas encompassing more than 2,000 km^2). Simple regression analysis revealed a highly significant difference ($P = 0.0001$) between these two groups. Therefore, the data were separated and subjected to additional analysis. The Macintosh program Statview was used to perform simple linear regression analyses on each data set in order to determine a predictor formula, using CFDI as the predictor variable (x) for estimating the independent variable (y) or total coral reef fish fauna. The resultant formulae were obtained: 1. total fauna of areas with surrounding seas encompassing more than 2,000 $km^2 = 4.234(CFDI) - 114.446$ (d.f = 15; $R^2 = 0.964$; $P = 0.0001$); 2. total fauna of areas with surrounding seas encompassing less than 2,000 $km^2 = 3.39$ (CFDI) – 20.595 (d.f = 18; $R^2 = 0.96$; $P = 0.0001$).

CFDI is useful for short term surveys such as the present one because it is capable of accurately predicting the overall faunal total. The main premise of the CFDI method is that short term surveys of only 15–20 days duration are sufficient to record most members of the six indicator families due to their conspicuous nature. The CFDI for the Bali/Nusa Penida region is 337, composed of the following elements: Chaetodontidae (43), Pomacanthidae (21), Pomacentridae (96), Labridae (114), Scaridae (24), and Acanthuridae (39). The resultant predicted faunal total is 1,312 species. Comparison of this total with the actual number of species (977) currently recorded from the region indicates that at least 335 additional species of shallow reef fishes can be expected. This total includes many species that are not readily recorded by visual methods and small collections. Moray eels (Muraenidae), for example, are notoriously difficult to survey without the use of large quantities of rotenone (a chemical ichthyocide). Only 15 were seen during the surveys reported herein, but on the basis of expected distributions (Allen, unpublished data) at least 35 species should occur in the Bali region. The CFDI method is especially useful when time is limited and there is heavy reliance on visual observations, as was the case for the

present survey. The CFDI total indicates that about 75 percent of the fauna was actually recorded during the combined 2008 (Nusa Penida) and 2011 (Bali) surveys.

Table 3.3 presents a comparison of Bali with other Indonesian sites and various Indo-west and central Pacific locations that were surveyed by the author or various colleagues. The Bali/Nusa Penida CFDI value is exceeded only by The Raja Ampat Islands, which is indicative of its impressive reef fish diversity.

3.3.3 Analysis of the Bali reef fish fauna

The most abundant families in terms of number of species are wrasses (Labridae), damselfishes (Pomacentridae), gobies (Gobiidae), cardinalfishes (Apogonidae), groupers (Serranidae), butterflyfishes (Chaetodontidae), surgeonfishes (Acanthuridae), parrotfishes (Scaridae), and snappers (Lutjanidae). These 10 families collectively account for about 59 percent of the total reef fauna (Table 3.4).

The relative abundance of Bali fish families is very similar to that found at other Indo-Pacific locations. Labridae, Pomacentridae, and Gobiidae are typically the most speciose families, although the order of these groups is variable according to location. The gobiidae is frequently the most abundant, which is not surprising given that approximately 600 species inhabit Indo-Pacific coral reefs. This family no doubt contains more species than any other family at Bali as well, but it is difficult to comprehensively survey the group due to the very small size and cryptic nature of many species. Also their proclivity for open sand and rubble habitats runs counter to the RAP survey method, which focuses mainly on reef substrate.

3.3.4 Zoogeographic affinities

Bali belongs to the Western Pacific faunal community, which forms an integral part of the greater Indo-West and central Pacific biotic province. Its reef fishes are very similar to those

Table 3.3. Coral fish diversity index (CFDI) values for restricted localities, number of coral reef fish species as determined by surveys to date, and estimated numbers using the CFDI regression formula (refer to text for details).

Locality	CFDI	No. reef fishes	Estim. reef fishes
Raja Ampat Islands, West Papua, Indonesia	373	1437	1465
Bali and Nusa Penida	**337**	**977**	**1,312**
Maumere Bay, Flores, Indonesia	333	1111	1108
Milne Bay Province, Papua New Guinea	333	1109	1295
Halmahera, Indonesia	327	974	1271
Berau, East Kalimantan, Indonesia	316	875	1050
Togean and Banggai Islands, Indonesia	308	819	1190
Cendrawasih Bay, West Papua, Indonesia	302	965	1165
Solomon Islands	301	1019	1160
Northern Tip of Palawan, Philippines	292	1003	1122
Komodo Islands, Indonesia	280	750	928
Yap State, Micronesia	280	787	928
Verde Passage, Philippines	278	808	921
Madang, Papua New Guinea	257	787	850
Kimbe Bay, Papua New Guinea	254	687	840
Manado, Sulawesi, Indonesia	249	624	823
Capricorn Group, Great Barrier Reef	232	803	765
Chuuk State, Micronesia	230	615	759
Brunei, Darussalam	230	673	759
Ashmore/Cartier Reefs, Timor Sea	225	669	742
Kashiwa-Jima Island, Japan	224	768	738
Samoa Islands	211	852	694
Chesterfield Islands, Coral Sea	210	699	691
Pohnpei and nearby atolls, Micronesia	202	470	664
Layang Layang Atoll, Malaysia	202	458	664
Bodgaya Islands, Sabah, Malaysia	197	516	647
Pulau Weh, Sumatra, Indonesia	196	533	644
Izu Islands, Japan	190	464	623
Christmas Island, Indian Ocean	185	560	606
Sipadan Island, Sabah, Malaysia	184	492	603
Rowley Shoals, Western Australia	176	505	576
Cocos-Keeling Atoll, Indian Ocean	167	528	545
North-West Cape, Western Australia	164	527	535
Tunku Abdul Rahman Is., Sabah	139	357	450
Lord Howe Island, Australia	139	395	450
Monte Bello Islands, W. Australia	119	447	382
Bintan Island, Indonesia	97	304	308
Kimberley Coast, Western Australia	89	367	281
Johnston Island, Central Pacific	78	227	243
Midway Atoll	77	250	240
Norfolk Island	72	220	223

Table 3.4. Largest fish families at Bali.

Rank	Family	Species	% of total species
1	Labridae	114	11.7
2	Pomacentridae	96	9.8
3	Gobiidae	84	8.6
4	Apogonidae	59	6.0
5	Serranidae	54	5.5
6	Chaetodontidae	43	4.4
7	Acanthuridae	39	4.0
8	Blenniidae	27	2.8
9	Scaridae	24	2.5
10	Lutjanidae	22	2.3

Table 3.5. Zoogeographic analysis of Bali reef fishes. Each category is mutually exclusive.

Distribution category	No. Spp.	% of fauna
Indo-West Pacific	551	56.39
Western Pacific	247	25.28
Indo-Australian Archipelago	87	8.90
Indonesian endemic	32	3.27
Indian Ocean	29	2.97
Undetermined	19	1.94
Circumtropical	7	0.07
Japan and Nusa Penida	5	0.05

Table 3.6. Indian Ocean species occurring at Bali.

Family Caesionidae	**Labridae**
Caesio xanthonota	*Bodianus diana*
Family Mullidae	*Gomphosus caeruleus*
Parupeneus macronemus	*Halichoeres chrysotaenia*
Parupenus trifasciatus	*Leptojulis cyanotaenia*
Family Chaetodontidae	**Family Scaridae**
Chaetodon collare	*Chlorurus capistratoides*
Chaetodon decussates	**Family Blenniidae**
Chaetodon guttatissimus	*Entomacrodus vermiculatus*
Chaetodon trifasciatus	**Family Gobiidae**
Family Pomacanthidae	*Trimma fucatum*
Centropyge eibli	**Family Acanthuridae**
Genicanthus caudivittatus	*Acanthurus leucosternon*
Family Pomacentridae	*Acanthurus tennentii*
Amphiprion akallopisos	*Acanthurus tristis*
Amphiprion sebae	*Ctenochaetus truncatus*
Chromis dimidiate	*Naso elegans*
Chromis opercularis	**Family Balistidae**
Pomacentrus alleni	*Melichthys indicus*

inhabiting other areas within this vast region that stretches from East Africa and the Red Sea to the islands of Micronesia and Polynesia. Although most families and many genera and species are consistently present across the region, the species composition varies greatly according to locality.

Dispersal capabilities and the larval lifespan of a given species are usually reflected in its geographic distribution. Most reef fishes have a relatively long pelagic stage, hence a disproportionate number of wide-ranging species inhabit tropical seas. This is clearly demonstrated in the Bali community with approximately 56 % of the species exhibiting distribution patterns that encompass much of the Indo-west and central Pacific region. Many species range from East Africa to either the western edge of the Pacific or well eastward to Micronesia and Polynesia.

Table 3.5 presents the major zoogeographic categories of Bali reef fishes. In addition to wide ranging Indo-Pacific species other major categories include species (about 25 %) that are widely distributed in the western Pacific and species (about 9 %) that are largely restricted to the Indo-Australian Archipelago (Andaman Sea eastward to the Melanesian Archipelago and Australia northward to the Philippines).

A total of 29 species have distributions that are mainly confined to the Indian Ocean (Table 3.6). Many of these range widely in the Indian Ocean, occurring as far westward as the East African coast and Red Sea. However, a few such as *Centropyge eibli* and *Pomacentrus alleni* are confined to the eastern portion of the Indian Ocean. In most cases the Bali region represents the eastern limit of distribution. Several examples of the Indian Ocean species occurring at Bali are illustrated in Plate 3.1.

Seven species (*Rhincodon typus, Manta birostris, Echeneis naucrates, Thunnus albacares, Melichthys niger, Diodon hystrix,* and *Mola mola*) exhibit circumtropical distributions. These are primarily species that have lengthy pelagic larval stages and settle on reefs at a relatively large size (e.g. *Melichthys*) or are adapted for life in the pelagic realm, far from shore (e.g. *Rhincodon, Manta, Thunnus,* and *Mola*). The sharksucker, *Echeneis*, is readily dispersed throughout the world's tropical seas by a variety of host organisms including large pelagic fishes, marine mammals, and turtles.

Five species of Bali/Nusa Penida fishes, including the wobbegong shark *Orectolobus japonicus*, apogonid *Apogon schlegeli*, scorpaenid *Scorpaenodes evides*, pomacentrid *Chromis albicauda,* and gobiid *Trimma imaii* display an unusual disjunct distribution that involves Japan and the Bali region. Most likely these species were once widely distributed in cooler waters of the west Pacific north of Indonesia, but warming of surface waters have caused widespread extinction. These species apparently now persist as "relict" populations in subtropical waters of Japan and Bali, where cool upwelling results in lowered sea temperatures. Although these species are currently known in Indonesia only from Bali and Nusa Penida, they can be expected in other parts of the Lesser Sunda Islands that are exposed to cool upwelling.

Zoogeographically, the most interesting groups of Bali fishes are those that exhibit highly restricted distribution patterns including the 32 Indonesian endemics, but especially the 16 species currently known only from the Lesser Sunda Islands (Table 3.7 and Plate 3.2). Allen & Adrim (2003) and Allen and Erdmann (2012) documented the highly endemic nature of the Indonesian reef fish fauna, indicating that the Nusa Tenggara Islands (i.e. Lesser Sunda Islands) is the richest area for regional endemism in Indonesia and the East Indian Region in general. Intensive work in the Bird's Head Peninsula in West Papua reveals that area as the second richest location for endemic species in Indonesia. The evolution of Bird's Head endemics has been fuelled by a combination of rich habitat diversity, tectonic activity, and sea level fluctuations, whereas the Lesser Sunda endemics appear to have resulted from the unique habitat conditions along the southern exit of the "Indonesian Through flow", an area of strong currents and cold upwelling.

Table 3.7. Lesser Sunda endemic reef fishes occurring at Bali.

Family	Species	Geographic distribution
Pseudochromidae	*Haliophis aethiopus*	Bali and Nusa Penida
	Pseudochromis aurulentus	Nusa Penida and Komodo
	Pseudochromis oligochrysus	Bali to Alor
	Pseudochromis rutilus	Nusa Penida
	Pseudochromis steenei	Bali to Alor
	Manonichthys sp.	Bali to Komodo
Apogonidae	*Apogon lineomaculus*	Bali to Komodo
	Siphamia sp.	Bali
Pomacentridae	*Chromis pura*	Nusa Penida and Alor
	Chromis sp.	Nusa Penida
Tripterygiidae	*Helcogramma kranos*	Bali to Komodo
	Helcogramma randalli	Bali to Alor
Bleniidae	*Meiacanthus cyanopterus*	Bali to Alor
	Meiacanthus abruptus	Bali to Komodo
Gobiidae	*Grallenia baliensis*	Bali
Acanthuridae	*Prionurus chrysurus*	Nusa Penida to Komodo

3.3.5 Geminate species and hybridization

Randall (1998) gave examples of 52 species pairs that involve closely related Indian Ocean and Pacific Ocean species. He suggested that these "geminate" species had evolved as the result of a common event — the former widely distributed Indo-Pacific ancestral species stock having been divided by lowered sea levels in the past that resulted in an East Indian barrier. For example during the Pleistocene, this barrier would have consisted of dry land extending from the northern tip of Sumatra to Timor, with only one small opening between Bali and the Lesser Sunda Islands.

One of the unusual features of the Bali fish fauna is the presence of both Indian Ocean and Pacific Ocean members of several of these twin-species pairs (Table 3.8 and Plate 3.3). In nearly every case the Pacific Ocean member of the pair is the most common in comparison with its relatively rare Indian Ocean counterpart. This phenomenon possibly indicates predominately southward flowing currents.

Hybridization is a relatively rare phenomenon in marine fishes compared to their freshwater counterparts. However, tropical butterflyfishes (Chaetodontidae) and angelfishes (Pomacanthidae) are exceptions with many hybrids having been reported. Pyle and Randall (1994) provided references to 15 butterflyfish hybrids and noted that at least 12 others remain to be documented in the literature. These authors also documented 11 examples of probable hybridization in angelfishes. Moreover, a recent study by Hobbs et al (2008) reported 11 hybrids belonging to six families at Christmas Island, which lies approximately 1000 km southwest of Bali or 350 km directly south of Genteng Point, west Java.

No hybrids were observed during the current Bali RAP, but were seen on several occasions during the 2008 survey

Table 3.8. Examples of geminate species pairs recorded at Bali.

Family	Pacific Ocean Species	Indian Ocean Species
Caesionidae	*Caesio teres*	*Caesio xanthonota*
Chaetodontidae	*Chaetodon vagabundus*	*Chaetodon decussatus*
	Chaetodon punctatofasciatus	*Chaetodon guttatissimus*
	Chaetodon lunulatus	*Chaetodon trifasciatus*
Pomacanthidae	*Centropyge vroliki*	*Centropyge eibli*
Pomacentridae		
	Chromis margaritifer	*Chromis dimidiata*
	Chromis xanthurus	*Chromis opercularis*
	Pomacentrus coelestis	*Pomacentrus alleni*
Scaridae	*Chlorurus bleekeri*	*Chlorurus capistratoides*
Acanthuridae	*Acanthurus pyroferus*	*Acanthurus tristis*
	Ctenochaetus cyanocheilus	*Ctenochaetus truncatus*
	Naso lituratus	*Naso elegans*

Plate 3.1. Example of Indian Ocean species at Bali (from left to right starting on top): *Acanthurus tristis, Amphiprion sebae, Chaetodon trifasciatus, Chromis opercularis, Leptojulis chrysotaenia,* and *Melichthys indicus.*

Plate 3.2. *Apogon lineomaculus,* 6 cm total length. Known only from Bali and Komodo.

Plate 3.3. Examples of geminate species pairs (Indian Ocean species on left and Pacific species on right): upper–*Chaetodon decussatus* and *C. vagabundus*; middle–*Chromis dimidiata* and *C. margaritifer*; lower–*Ctenochaetus cyanocheilus* and *C. truncatus*.

Plate 3.4. An example of hybridization (center) at Nusa Penida between *Centropyge eibli* (left) and *C. vroliki* (right).

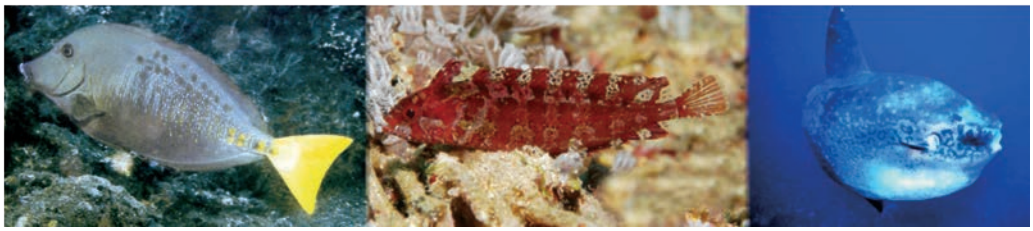

Plate 3.5. Examples of Bali species associated with areas of cool upwelling: from left to right – *Prionurus chrysurus, Springeratus xanthosoma,* and *Mola mola.*

Plate 3.6. *Parapercis bimacula*, 11 cm total length.

Plate 3.7. *Manonichthys* sp., 3.5 cm total length.

Plate 3.8. Two new *Pseudochromis* from Bali and Nusa Penida, 7 cm total length.

Plate 3.9. *Siphamia* sp., 3.5 cm total length.

Plate 3.10. Two new jawfishes (Opistognathidae) from Bali (left to right): *Opistognathus* species 1, 4 cm total length, *Opistognathus* species 2, 3.5 cm total length.

Plate 3.11. *Meiacanthus abruptus*, 7 cm total length.

Plate 3.12. *Meiacanthus cyanopterus*, 6 cm total length.

Plate 3.13. *Priolepis* sp., 2.5 cm total length.

Plate 3.14. *Grallenia baliensis*, 2.5 cm total length.

Plate 3.15. *Lepadichthys* sp., 3 cm total length.

Plate 3.16. *Ptereleotris rubristigma*, 10 cm total length.

Plate 3.17. New distributional records included (from left to right): *Chaetodon reticulatus, Abudefduf lorentzi,* and *Cirrhilabrus pylei.*

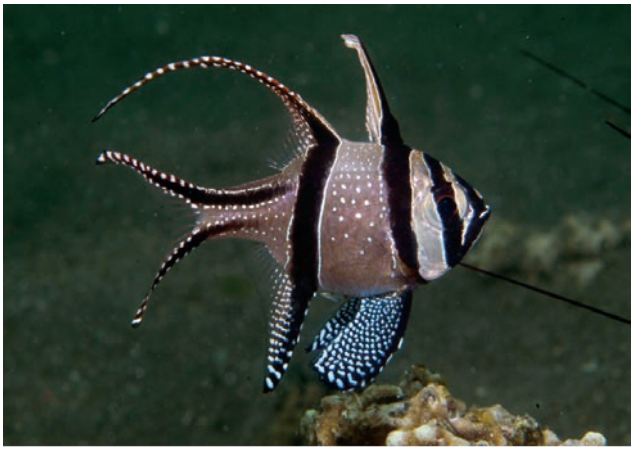

Plate 3.18. The introduced Banggai Cardinalfish (*Pterapogon kauderni*), 8 cm TL, Secret Bay, Bali.

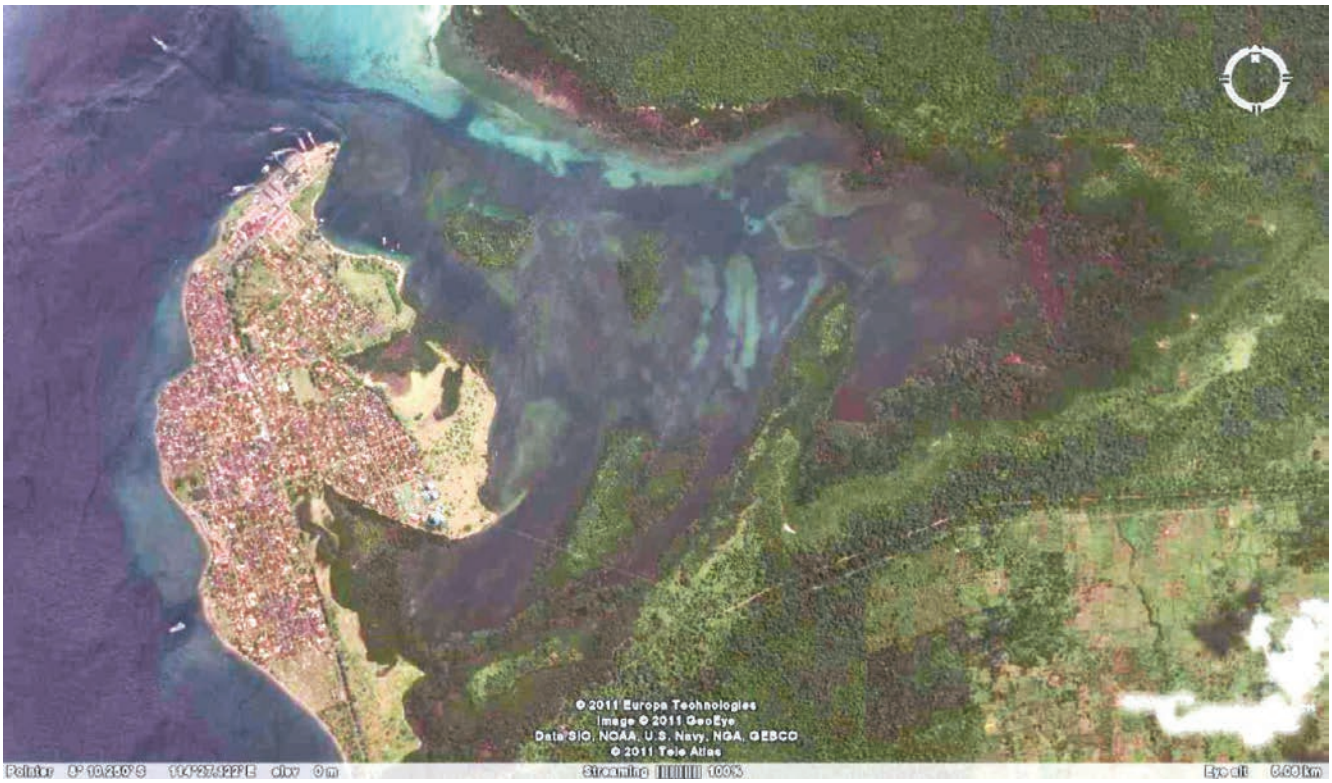

Figure 3.1. Satellite image of Secret Bay at Gilimanuk.

of Nusa Penida. These cases involved crosses between the butterflyfishes *Chaetodon guttatissimus* and *C. punctofasciatus* and the angelfishes *Centropyge eibli* and *C. vroliki* (Plate 3.4). Although no hybrids were detected between the closely related *Chaetodon lunulatus* and *C. trifasciatus*, several mixed pairs between these species were seen during both the 2008 and 2011 surveys.

3.3.6 Cool upwelling

The eastern coast of Bali, including the Lombok Strait and the island of Nusa Penida, is characterized by swift currents and cool temperatures due to upwelling of deep water. It is not unusual to encounter temperatures in the low 20s or even colder. Table 3.9 presents a list of species that are frequently associated with these areas of upwelling and three examples are also shown in Plate 3.5.

Table 3.9. Cool upwelling associated species occurring at Bali.

Family Chaetodontidae	**Family Clinidae**
Chaetodon guentheri	*Springeratus xanthosoma*
Heniochus diphreutes	**Family Acanthuridae**
Family Pomacanthidae	*Prionurus chrysurus*
Chaetodontoplus melanosoma	**Molidae**
Family Pomacentridae	*Mola mola*
Chromis albicauda	
Chromis pura	

3.3.7 New species

Several undescribed species were recorded during the current RAP survey. These are discussed in more detail in the following paragraphs, noting that many of these new species have since been described by the authors and specialist colleagues (e.g., Allen and Erdmann, 2012; Smith-Vaniz and Allen, 2011; Gill, Allen and Erdmann, 2012).

Parapercis bimacula Allen and Erdmann, 2012 (Pinguipedidae; Plate 3.6) — This beautiful grubfish has now been recorded from Bali, Komodo, Pulau Weh (Sumatra) and the Andaman Islands, where it is found typically on sand/rubble bottoms with scattered live coral rock outcrops in 2–8 depth. It was recently described by the authors in their book in reef fishes of the East Indies.

Manonichthys species (Pseudochromidae; Plate 3.7) — This species was observed and photographed in 29–30 m depth at two sites (25 and 28) on the northwestern coast, including Menjangan Island. It is also known from Komodo. It is closely related to *M. alleni* of northern Borneo and is currently being studied by pseudochromid expert Anthony Gill of Sydney University, Australia, who will determine its definitive status.

Pseudochromis oligochrysus Gill, Allen and Erdmann, 2012 (Pseudochromidae; Plate 3.8, left) — This species was not encountered during the present survey, but several specimens

were collected during the 2008 RAP at Nusa Penida. It is locally common on moderate slopes at depths between about 25–50 m. The species was recently described in early 2012 by Anthony Gill in conjunction with the authors.

Pseudochromis rutilus Gill, Allen and Erdmann, 2012 (Pseudochromidae; Plate 3.8, right)—This new species (Plate 3.7) was collected at Nusa Penida in 2008 and also during the current survey at Menjangan (site 27) at depths between about 60–70 m. It is generally seen around rocky outcrops, sponges and in crevices on outer reef slopes. It has also been collected in the Alor region of Nusa Tenggara. As with the previous species, this one was described in January 2012 by Anthony Gill and the authors.

Siphamia species (Apogonidae; Plate 3.9)—A single specimen of this unusual cardinalfish was collected at Menjangan Island (site 27) in 70 m depth. Like all members of the genus *Siphamia* it is characterized by a silvery bioluminescent organ along the lower side of the body. It appears to belong to an undescribed species closely related to the poorly-known species *S. argentea*, and is distinguished by its unique colouration in combination with a striated light organ, relatively deep body, and complete lateral line. The species is currently being examined closely by South African apogonid expert Ofer Gon.

Opistognathus species 1 (Opistognathidae; Plate 3.10, left)—Jawfishes have been a particularly rewarding group with many new discoveries by the authors in recent years. This species remains undescribed, but has been previously reported from the Andaman Islands, Kalimantan (Derawan), Philippines (Siquijor Island), and Indonesia (Morotai Island and Cenderawasih Bay, West Papua). It inhabits Sand/rubble bottoms near reefs in 20–70 m. Three specimens were collected during the present survey at site 25 (Sumber Kima). It will soon be described by American opistognathid expert, William Smith-Vaniz.

Opistognathus species 2 (Opistognathidae; Plate 3.10)—This new jawfish has previously been collected at Brunei and the Philippines. It inhabits turbid coastal reefs on sand/rubble bottoms near reefs in areas of periodic strong currents in about 15-70 m depth. A single specimen was collected during the Bali survey at site 25 (Sumber Kima). The species will also be described by William Smith-Vaniz.

Meiacanthus abruptus Smith-Vaniz and Allen, 2011 (Blenniidae; Plate 3.11)—This new species was first collected by G. Allen at Komodo in 1995. About 10 individuals were photographed at Secret Bay, Gilimanuk (site 30) during the current Bali survey. It was found on a small patch reef with nearly 100 percent coral cover in 2–4 m depth. The species is characterized by a yellow head and pair of black stripes on the body. The species has now been described as of October 2011 (Smith-Vaniz and Allen, 2011).

Meiacanthus cyanopterus Smith-Vaniz and Allen, 2011 (Blenniidae; Plate 3.12)—A single specimen of this deep-dwelling species was observed in 70 m depth at site 19. It is currently known only from the Nusa Tenggara Islands at Bali and the Alor region. Like the former species, this species has now been described as of October 2011 (Smith-Vaniz and Allen, 2011).

Priolepis species (Gobiidae; Plate 3.13)—This apparently undescribed species superficially resembles *P. pallidicincta* Winterbottom & Burridge, but markedly differs in having transverse rows of cheek papillae. It was collected at two sites (10 and 26) during the present survey at a depth of 70 m.

Grallenia baliensis Allen and Erdmann, 2012 (Gobiidae; Plate 3.14)—This diminutive (maximum size about 2.5 cm TL) goby was previously known on the basis of a few specimens collected in the Tulamben area on sand/pebble bottoms in 5–15 m depth. It was found at Amed (site 17) and Buleleng (site 21) during the current survey. Detailed examination reveals it is a new species distinguished by its unique colour pattern, lack of filamentous dorsal spines in males, relatively short anal and second dorsal fin rays, and a short pectoral fin. The species was recently described by the authors in their book on reef fishes of the East Indies in March 2012.

Lepadichthys species (Gobiesocidae; Plate 3.15)—This apparently undescribed species was previously known only on the basis of underwater photographs from Flores, Indonesia and Manus Island, Papua New Guinea. It is normally dark reddish brown with distinctive white stripes, one midlaterally on each side, and another mid-dorsally from the top of the snout to the upper edge of the caudal fin. The species sometimes seeks shelter among the spines of *Diadema* urchins and generally occurs in 5–15 m depth. A single specimen was collected during the 2011 survey at site 25 (Sumber Kima).

Ptereleotris rubristigma Allen, Erdmann and Cahyani, 2012 (Ptereleotridae; Plate 3.16)—This species was previously misidentified as *P. hanae*, but differs from that species in lacking elongate filaments on the caudal fin, in having a filamentous second dorsal spine in adult males, and a reddish mark (sometimes absent) on the pectoral-fin base. It is widely distributed in Indonesia and surrounding regions. During the current survey it was observed at Seraya (site 12), Amed (site 16), and Taka Pemuteran (site 24). The habitat consists of open sand and rubble bottoms at depths between about 5–50 m. The species was recently described by the authors (and geneticist colleague Dita Cahyani) in their book on reef fishes of the East Indies in March 2012.

3.3.8 Range extensions and noteworthy records

Chaetodon reticulatus Cuvier, 1831 (Chaetodontidae; Plate 3.17, left)—This species is widely distributed in the western Pacific, mainly at islands of Oceania eastward to the Line and Society islands. It has only been reported from Indonesia at Halmahera and off northern Sulawesi and our current Bali record (site) represents a range extension of approximately 1500 km.

Abudefduf lorentzi Hensley & Allen, 1977 (Pomacentride; Plate 3.17, middle)—This is a common shallow water inhabitant of eastern Sulawesi, Halmahera and the Papuan region of Indonesia, as well as Papua New Guinea, Solomon

Islands, and the Philippines. It is generally replaced by the closely related *A. bengalensis* east and south of Sulawesi. Therefore it was unexpected to see a single subadult along the shoreline at site 28 (Menjangan), representing a range extension of approximately 900 km.

Cirrhilabrus pylei. (Labridae; Plate 3.17, right)—Although previously reported from Bali on the basis of underwater photographs we were able to confirm its presence in the region with the collection of specimens at both Nusa Penida in 2008 and site 28 (Menjangan) during the present survey. Most previous records of this spectacular species are from the Melanesian Archipelago, including West Papua, Papua New Guinea, Solomon Islands, and Vanuatu.

3.3.9 Introduced fishes

Although introduced species constitute a relatively minor portion of global fish communities they have the potential to alter the dynamics of local fish populations. The scorpaenid fish *Pterois volitans* is a classic example of this phenomenon. Although it is commonly encountered throughout its western and central Pacific distributional range, it is usually seen in relatively low numbers. For example, it is not unusual to see one per several dives during typical RAP surveys. This species is collected for the aquarium trade and was released in Florida waters approximately 20 years ago. Apparently it is now in "plague proportions" in certain areas of the eastern USA coast and Caribbean Sea and has significantly impacted local fish communities due to its predatory habits, which target a wide range of small fishes and invertebrates. In addition to accidental and deliberate release of aquarium fishes other introductions are the result of intentional stock enhancement of commercially valuable species (e.g. *Lutjanus kasmira* in Hawaii), access to previously separated seas due to canal construction (e.g. Red Sea introductions in the Mediterranean Sea via the Suez Canal), and transport of larvae and small benthic fishes in the ballast tanks of freight ships.

The Banggai Cardinalfish (*Pterapogon kauderni*, Plate 3.18) has a very restricted natural distribution, limited to the Banggai Islands and nearby adjacent areas of central-eastern Sulawesi. This strikingly handsome fish was introduced to the aquarium trade in 1995 and was an instant sensation, selling for approximately $100 per fish during the initial months of its availability. Huge numbers were shipped overseas, primarily via fish sellers based at Bali and north Sulawesi.

Consequently the fish was intentionally released in the Lembeh Straits region of Sulawesi and at Gilimanuk, Bali, where populations continue to flourish. The Bali population appears to be confined to a very small area near the beach on the south side of the entrance to Secret Bay at Gilimanuk. It is associated with *Diadema* sea urchins, which are common in the shallows and around the sunken wreckage of a small boat. We estimate a current population of approximately 1000 individuals, and compared to casual observations made by us about two years ago, the numbers appear to be increasing. There is no indication that the species has penetrated outside of the bay, and due its peculiar reproductive mode (eggs and small young orally incubated by male) and lack of pelagic dispersal capability, the expansion of its range around Bali will likely be a slow process. The species feeds on planktonic organisms and small benthic invertebrates. Therefore, its impact on the general fish population appears to be minimal, possibly limited to a few other apogonid species that compete for living space among the spines of *Diadema.* One positive aspect of this introduction is that tourist divers are attracted to the site by the rare opportunity to photograph this spectacular species, sparing the expense and logistic difficulties of travelling to the Banggai Islands.

3.4 SITES OF SPECIAL SIGNIFICANCE FOR FISHES WITH POTENTIAL CONSERVATION VALUE

Comparison of major geographic areas of the Bali region

The current survey reveals that Bali has a remarkably diverse reef fish fauna, reflecting a relatively wide range of habitat variability. The CFDI method of predicting an overall faunal total, based on key index families indicates that Bali is one of Indonesia's richest areas for reef fishes and therefore globally important with regards to conservation significance. The fish community is particularly impressive considering that sheltered lagoon conditions are generally lacking. Therefore, the species associated with this habitat are either rare or absent. Bali is conveniently divisible into discrete zones or areas, based on components of the marine fauna in combination with broad-scale physical oceanographic features, particularly temperature and currents, including upwelling. A comparison of fish diversity for the major geographic areas is presented in Table 3.10.

The north coast is the richest area for fish diversity. It contains Bali's best examples of coral development as exemplified by reefs at Amed and Menjangan Island. Within this area there are also interesting silt bottom "muck dive" areas that harbor unusual fishes, not usually seen on typical coral reefs.

Nusa Penida is worthy of a separate zone, due to its relative isolation, full exposure to the Indian Ocean, and general habitat conditions typified by swift currents and cold upwelling.

Table 3.10. Comparison of species totals for major geographic areas of the Bali region.

Geographic area	No. spp.	Spp./site
Northern Bali	622	214*
Nusa Penida	573	161
Eastern Bali	510	147
Gilimanuk	153	97
Grand Total	**964**	

* excludes silt bottom sites (20–23) in Lovina area.

The east coast of Bali, consisting of the Lombok Strait forms a third major zone. Like Nusa Penida it is subjected to periodic strong currents and cool upwelling. Several of the "signature"species that are also typical of Nusa Penida, for example the Yellowtail Surgeonfish (*Prionurus chrysurus*) and Ocean Sunfish (*Mola mola*), are also found here.

"Secret Bay" at Gilimanuk forms a fourth major zone. Although occupying an extremely small area (approximately 5.5 km^2), the bay is highly unique in the context of Bali marine habitats and the fish community it supports. The bay is bounded by mangrove and contains a number of patch reefs with good live coral growth as well as extensive silt-bottom habitat that is home to a wealth of unusual fishes not usually seen in other parts of the island.

The south coast was inadequately surveyed to determine if it is deserving of separate major area status. Only two sites (31–32) were sampled. These preliminary observations indicate there may be justification for including it in the same faunal region as eastern Bali.

3.5 CONSERVATION RECOMMENDATIONS

Though Bali hosts an astounding diversity of fishes for its size, we also found strong signs of overfishing at nearly every site. Large reef fishes of commercial value were nearly absent during this most recent survey. Indeed, in over 350 man-hours of diving, the survey team only recorded a grand total of 3 reef sharks (only at Gili Selang and Menjangan), 3 Napoleon wrasse (*Cheilinus undulatus*; observed only at Gili Selang and Tulamben), and 4 coral trout of the genus *Plectropomus*. Equally concerning, the team only recorded a grand total of 5 marine turtles observed during the survey. These disturbingly low numbers should serve as a sharp warning to the government of Bali; one would normally expect to see these numbers on a single dive on a healthy reef rather than as the cumulative total for 33 survey sites!

In order to counter this strong trend towards overfishing on Bali's reefs, it is highly recommended to establish a network of "no take" marine protected areas (MPAs) around the island that contain representative faunal communities in each of the major areas outlined above. The benefits for establishing effective marine protected areas include the sustainability of high biodiversity and increased economic value due to their attractiveness to divers and snorkellers, and also from the well-documented "spillover effect" that results from the biomass buildup in no-take areas and leads directly to increased catches of food fishes in areas adjacent to these MPAs.

The previous (2008) report recommended several sites that are most worthy of full protection at Nusa Penida including Crystal Bay, Toyapakeh, Batu Abah and Teluk Batu Abah based on their respective fish communities and remarkable reef habitat. Using similar criteria we also recommend the following sites for consideration for designation in no-take zones as a result of the 2011 survey.

Batu Tiga near Candidasa— these rocky islets support relatively rich coral communities and associated fish fauna, although large predatory species such as sharks and groupers were absent. A total of 187 species was recorded at West Batu Tiga (site 7), the third highest number for the eastern coast.

Gili Selang, near northeast corner of Bali (sites 13–14)— an area of good microhabitat diversity with a rich coral reef fish assemblage as well as soft-bottom and surge-zone associated species. The two highest totals for the east coast, 197 and 190 species, were recorded at North and South Selang respectively.

Taka Pemuteran and Sumber Kima reef complexes, northwest Bali (sites 24–25)— Both these areas exhibit good microhabitat diversity and support relatively rich fish communities (191 and 171 species respectively). The site at Taka Pemuteran was particularly rich for live corals and associated reef fishes. Both of these reef complexes have excellent potential for "no-take" zonation, with the intent of enriching fisheries in adjacent areas and providing high quality recreational diving.

Secret Bay, Gilimanuk (sites 29–30)— The nearly enclosed lagoon system at Secret Bay is highly unique and supports a wealth of fishes that are either absent or rare at other parts of the island. There is a need for further survey work to establish a comprehensive list of the bay's fish fauna. The bay provides a good blend of silty open bottom habitat, shoreline fringing reefs, and mid-lagoon patch reefs, as well as a mangrove shore and several mangrove-lined islands. Special conservation protection of this unique area is recommended, including protection of adjacent mangrove habitat.

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Appendix 3.1. List of the reef fishes of Bali (including Nusa Penida). **New records for Bali are indicated in the left column with a gray box.**

This list includes all species of shallow (to 70 m depth) coral reef fishes known to date from Bali and Nusa Penida. The first twocolumns include species that were previously recorded from Bali (by GRA) and Nusa Pendia (2008 RAP and other surveys). The subsequent site columns refer to the 2011 Bali survey. The phylogenetic sequence of the families appearing in this list follows Eschmeyer (Catalog of Fishes, California Academy of Sciences, 1998) with slight modification (e.g.. placement of Cirrhitidae). Genera and species are arranged alphabetically within each family. The Author name(s) and year of publication have been omitted from each species entry, but this information can be easily accessed on the California Academy of Sciences Catalog of Fishes website: http://www.calacademy.org/research/ichthyology/catalog/fishcatsearch.html.

	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Rhincodontidae (1 spp.)																																	0	0	0	0	0	0	0
Rhincodon typus		1																															0	1	1	1	0	0	0
Alopiidae (1 spp.)																																	0	0	0	0	0	0	0
Alopias pelagicus		1																															0	1	1	1	0	0	0
Orectobobidae (1 spp.)																																	0	0	0	0	0	0	0
Orectolobus japonicus		1																															0	1	1	1	0	0	0
Carcharhinidae (2 spp.)																																	0	0	0	0	0	0	0
Carcharhinus amblyrhynchos	1	1																															0	1	1	1	0	0	0
Triaenodon obesus													1													1							1	0	1	0	1	1	0
Dasyatidae (3 spp.)																																	0	0	0	0	0	0	0
Dasyatis kuhlii	1	1	1		1	1						1			1				1	1													1	1	1	1	1	1	0
Taeniura lymma			1	1	1	1		1					1	1	1	1	1	1	1					1		1							1	0	1	0	1	1	0
Taeniura meyeni		1																															0	1	1	1	0	0	0
Myliobatidae (1 spp.)																																	0	0	0	0	0	0	0
Aetobatus narinari		1																															0	1	1	1	0	0	0
Mobulidae (1 spp.)																																	0	0	0	0	0	0	0
Manta birostris		1																															0	1	1	1	0	0	0
Moringuidae (1 spp.)																																	0	0	0	0	0	0	0
Moringa microchir		1																															0	1	1	1	0	0	0
Chlopsidae (1 spp.)																																	0	0	0	0	0	0	0
Kaupichthys diodontus		1																															0	1	1	1	0	0	0
Muraenidae (15 spp.)																																	0	0	0	0	0	0	0
Anarchias seychellensis	1																																0	1	1	0	0	0	0
Echidna nebulosa		1									1										1		1										1	1	1	1	1	1	0

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Appendix 3.1. *continued*

	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Gymnothorax angusticauda																						1											1	0	1	0	0	1	0
Gymnothorax chilospilus		1																															0	1	1	1	0	0	0
Gymnothorax fimbriatus		1																	1				1									1	1	1	1	1	0	1	0
Gymnothorax flavimarginatus	1													1																			1	1	1	0	1	0	0
Gymnothorax javanicus	1													1					1								1						1	1	1	0	1	1	0
Gymnothorax melatremus		1																															0	1	1	1	0	0	0
Gymnothorax monochrous																			1														1	0	1	0	0	1	0
Gymnothorax richardsonii?		1																															0	1	1	1	0	0	0
Gymnothorax thrysoideus																							1										1	0	1	0	0	1	0
Gymnothorax zonipectis		1																	1														1	1	1	1	0	1	0
Rhinomuraena quaesita	1			1																1													1	1	1	0	1	1	0
Scuticara tigrina																											1						1	0	1	0	0	1	0
Uropterygius fuscoguttatus		1																															0	1	1	1	0	0	0
Ophichthidae (5 spp.)																																	0	0	0	0	0	0	0
Brachysomophis cirrocheilos																							1										1	0	1	0	0	1	0
Myrichthys maculosus		1																															0	1	1	1	0	0	0
Ophichthus bonaparti																						1	1										1	0	1	0	0	1	0
Pisodonophis cancrivorus																						1											1	0	1	0	0	1	0
Scolecenchelys macroptera																			1														1	0	1	0	0	1	0
Congridae (8 spp.)																																	0	0	0	0	0	0	0
Ariosoma fasciatum												1																					1	0	1	0	1	0	0
Gorgasia barnesi																								1									1	0	1	0	0	1	0
Gorgasia maculata																		1															1	0	1	0	0	1	0
Heteroconger enigmaticus																							1										1	0	1	0	0	1	0
Heteroconger hassi	1	1						1																1									1	1	1	1	1	1	0
Heteroconger mercyae																												1					1	0	1	0	0	1	0
Heteroconger perissodon	1																				1		1										1	1	1	0	0	1	0
Heteroconger polyzona																	1																1	0	1	0	0	1	0

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Appendix 3.1. *continued*

	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Clupeidae (1 spp.)																																	0	0	0	0	0	0	0
Spratelloides delicatulus		1																															0	1	1	1	0	0	0
Plotosidae (1 spp.)																																	0	0	0	0	0	0	0
Plotosus lineatus	1	1														1				1				1						1			1	1	1	1	0	1	1
Synodontidae (6 spp.)																																	0	0	0	0	0	0	0
Saurida elongata																							1										1	0	1	0	0	1	0
Saurida gracilis	1	1																															0	1	1	1	0	0	0
Saurida nebulosa																	1						1			1							1	0	1	0	0	1	0
Synodus dermatogenys				1				1							1						1				1	1					1	1	1	0	1	0	1	1	0
Synodus jaculum	1	1												1	1		1					1											1	1	1	1	1	1	0
Synodus variegatus				1																													1	0	1	0	1	0	0
Ophidiidae (1 spp.)																																	0	0	0	0	0	0	0
Ophidiid sp. (deep 70m Menjangan)																										1							1	0	1	0	0	1	0
Bythitidae (2 spp.)																																	0	0	0	0	0	0	0
Diancistrus sp 1 (brown) - live young		1																															0	1	1	1	0	0	0
Nielsenichthys pullus		1																															0	1	1	1	0	0	0
Antennariidae (5 spp.)																																	0	0	0	0	0	0	0
Antennarius coccineus	1	1																															0	1	1	1	0	0	0
Antennarius commersoni	1	1																															0	1	1	1	0	0	0
Antennarius rosaceus																		1															1	0	1	0	0	1	0
Antennarius sp.		1																															0	1	1	1	0	0	0
Antennatus tuberosus													1																				1	0	1	0	1	0	0
Gobiesocidae (3 spp.)																																	0	0	0	0	0	0	0
Diademichthys lineatus																							1										1	0	1	0	0	1	0
Lepadichthys lineatus																										1							1	0	1	0	0	1	0
Lepadichthys species																									1	1							1	0	1	0	0	1	0
Mugilidae (2 spp.)																																	0	0	0	0	0	0	0
Crenimugil crenilabis		1																															0	1	1	1	0	0	0

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	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Valamugil seheli	1												1			1			1														1	1	1	0	1	1	0
Belonidae (2spp.)																																	0	0	0	0	0	0	0
Tylosurus acus		1																															0	1	1	1	0	0	0
Tylosurus crocodilus	1	1						1						1			1									1							1	1	1	1	1	1	0
Hemiramphidae (1 spp.)																																	0	0	0	0	0	0	0
Hyporhamphus dussumieri		1																															0	1	1	1	0	0	0
Anomalopidae (2 spp.)																																	0	0	0	0	0	0	0
Anomalops katoptron	1																																0	1	1	0	0	0	0
Photoblepharon palpebratum	1																																0	1	1	0	0	0	0
Holocentridae (19 spp.)																																	0	0	0	0	0	0	0
Myripristis berndti	1	1			1	1	1	1		1	1	1	1	1				1	1														1	1	1	1	1	1	0
Myripristis botche	1	1													1																		1	1	1	1	0	1	0
Myripristes chryseres		1												1																			1	1	1	1	1	0	0
Myripristis hexagona																1				1	1			1									1	0	1	0	0	1	0
Myripristis kuntee	1	1	1	1		1		1		1			1		1	1			1														1	1	1	1	1	1	0
Myripristis murdjan	1	1	1	1				1		1	1							1	1		1												1	1	1	1	1	1	0
Myripristis pralinia																1		1															1	0	1	0	0	1	0
Myripristis violacea	1	1																															0	1	1	1	0	0	0
Myripristis vittata	1	1														1		1															1	1	1	1	0	1	0
Neoniphon aurolineatus		1																															0	1	1	1	0	0	0
Neoniphon sammara		1			1	1	1				1		1	1	1			1															1	1	1	1	1	1	0
Plectrypops lima		1																															0	1	1	1	0	0	0
Sargocentron caudimaculatum	1	1				1	1	1		1	1	1	1	1	1	1	1	1	1		1			1	1	1	1						1	1	1	1	1	1	0
Sargocentron diadema	1	1									1																						1	1	1	1	1	0	0
Sargocentron ittodai	1	1																															0	1	1	1	0	0	0
Sargocentron melanospilos											1																						1	0	1	0	1	0	0
Sargocentron microstoma								1																									1	0	1	0	1	0	0
Sargocentron praslin	1																																0	1	1	0	0	0	0

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Sargocentron rubrum				1								1																				1	1	0	1	0	1	0	0
Pegasidae (2 spp.)																																	0	0	0	0	0	0	0
Eurypegasus draconis																													1				1	0	1	0	0	0	1
Pegasus volitans																													1				1	0	1	0	0	0	1
Aulostomidae (1 spp.)																																	0	0	0	0	0	0	0
Aulostomus chinensis	1	1			1	1	1	1	1	1	1	1	1	1				1	1					1		1	1						1	1	1	1	1	1	0
Fistulariidae (1 spp.)																		1	1														1	0	1	0	0	1	0
Fistularia commersonii	1	1					1		1		1		1											1		1	1						1	1	1	1	1	1	0
Centriscidae (3 spp.)																																	0	0	0	0	0	0	0
Aeoliscus strigatus																										1			1	1			1	0	1	0	0	1	1
Centriscus cristatus																														1			1	0	1	0	0	0	1
Centriscus scutatus				1	1														1														1	0	1	0	1	1	0
Syngnathidae (6 spp.)																																	0	0	0	0	0	0	0
Corythoichthys haematopterus																									1								1	0	1	0	0	1	0
Doryrhamphus melanopleura																															1		1	0	1	0	0	0	0
Dunckerocampus dactyliophorus	1				1																								1				1	1	1	0	1	0	1
Hippocampus histrix																			1														1	0	1	0	0	1	0
Hippocampus kuda																													1				1	0	1	0	0	0	1
Trachyrhamphus bicoarctatus																													1				1	0	1	0	0	0	1
Scorpaenidae (21 spp.)																																	0	0	0	0	0	0	0
Dendrochirus brachypterus																							1						1				1	0	1	0	0	1	1
Dendrochirus zebra		1					1			1						1							1						1			1	1	1	1	1	1	1
Parascorpaena picta																	1						1										1	0	1	0	0	1	0
Pterois antennata	1	1											1			1		1	1		1				1	1							1	1	1	1	1	1	0
Pterois mombasae		1																	1														1	1	1	1	0	1	0
Pterois radiata		1								1																							1	1	1	1	1	0	0
Pterois russellii	1										1											1	1						1				1	1	1	0	1	1	1
Pterois volitans	1								1													1				1	1		1				1	1	1	0	1	1	1

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Scorpaenodes evides		1																															0	1	1	1	0	0	0
Scorpaenodes guamensis		1																															0	1	1	1	0	0	0
Scorpaenodes hirsutus		1																															0	1	1	1	0	0	0
Scorpaenodes kelloggi								1																									1	0	1	0	1	0	0
Scorpaenodes parvipinnis		1						1																									1	1	1	1	1	0	0
Scorpaenodes varipinnis	1						1																										1	1	1	0	1	0	0
Scorpaenopsis diabolus								1																									1	0	1	0	1	0	0
Scorpaenopsis macrochir	1																																0	1	1	0	0	0	0
Scorpaenopsis neglecta		1																															0	1	1	1	0	0	0
Scorpaenopsis oxycephala	1	1			1		1			1			1																				1	1	1	1	1	0	0
Scorpaenopsis papuensis					1					1															1								1	0	1	0	1	1	0
Scorpaenopsis possi								1																									1	0	1	0	1	0	0
Taenianotus triacanthus		1		1																													1	1	1	1	1	0	0
Synanceiidae (1 spp.)																																	0	0	0	0	0	0	0
Inimicus didactylus																						1									1		1	0	1	0	0	1	0
Tetrarogidae (2 spp.)																																	0	0	0	0	0	0	0
Ablabys macracanthus																						1											1	0	1	0	0	1	0
Ablabys taenianotus				1																													1	0	1	0	1	0	0
Platycephalidae (6 spp.)																																	0	0	0	0	0	0	0
Cociella punctata		1																															0	1	1	1	0	0	0
Cymbacephalus beauforti																								1									1	0	1	0	0	1	0
Eurycephalus arenicola		1																															0	1	1	1	0	0	0
Onigocia pedimacula																									1								1	0	1	0	0	1	0
Onigocia sp. collected		1																															0	1	1	1	0	0	0
Thysanophrys chiltonae		1																															0	1	1	1	0	0	0
Caracanthidae (1 spp.)																																	0	0	0	0	0	0	0
Caracanthus unipinna	1																																0	1	1	0	0	0	0
Dactylopteridae (1 spp.)																																	0	0	0	0	0	0	0

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Dactyloptena orientalis																	1																1	0	1	0	0	1	0
Centrogeniidae (1 spp.)																																	0	0	0	0	0	0	0
Centrogenys vaigiensis	1																																0	1	1	0	0	0	0
Serranidae (54 spp.)																																	0	0	0	0	0	0	0
Aethaloperca rogaa	1	1					1								1	1	1	1		1	1			1		1	1						1	1	1	1	1	1	0
Anyperodon leucogrammicus												1	1	1	1	1	1	1							1	1	1				1		1	0	1	0	1	1	0
Belonoperca chabanaudi																		1															1	0	1	0	0	1	0
Cephalopholis argus	1	1									1		1											1		1	1						1	1	1	1	1	1	0
Cephalopholis boenak		1																															0	1	1	1	0	0	0
Cephalopholis cyanostigma									1				1		1					1	1			1	1	1	1				1	1	1	0	1	0	1	1	0
Cephalopholis leopardus		1													1		1	1							1								1	1	1	1	0	1	0
Cephalopholis microprion	1																								1	1			1				1	1	1	0	0	1	1
Cephalopholis miniata		1								1		1	1	1	1	1	1	1	1	1	1					1							1	1	1	1	1	1	0
Cephalopholis sexmaculata		1														1		1		1				1			1						1	1	1	1	0	1	0
Cephalopholis sonnerati																	1		1														1	0	1	0	0	1	0
Cephalopholis spiloparaea														1																			1	0	1	0	1	0	0
Cephalopholis urodeta	1	1				1	1							1	1	1	1	1	1					1	1								1	1	1	1	1	1	0
Epinephelus areolatus	1	1							1							1						1	1	1									1	1	1	1	1	1	0
Epinephelus bontoides																1			1														1	0	1	0	0	1	0
Epinephelus caeruleopunctatus									1																								1	0	1	0	1	0	0
Epinephelus coioides				1																			1						1				1	0	1	0	1	1	1
Epinephelus fasciatus		1						1							1		1		1		1			1	1	1					1	1	1	1	1	1	1	0
Epinephelus fuscoguttatus		1																															0	1	1	1	0	0	0
Epinephelus lanceolatus		1																															0	1	1	1	0	0	0
Epinephelus maculatus				1					1										1													1	1	0	1	0	1	1	0
Epinephelus melanostigma		1																															0	1	1	1	0	0	0
Epinephelus merra	1	1	1	1	1				1									1									1						1	1	1	1	1	1	0
Epinephelus ongus																					1												1	0	1	0	0	1	0

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Epinephelus quoyanus																																1	1	0	1	0	0	0	0
Epinephelus undulosus																						1											1	0	1	0	0	1	0
Grammistes sexlineatus	1	1									1			1			1						1										1	1	1	1	1	1	0
Luzonichthys waitei																				1													1	0	1	0	0	1	0
Plectranthias inermis																									1								1	0	1	0	0	1	0
Plectranthias longimanus	1	1									1		1					1	1														1	1	1	1	1	1	0
Plectropomus laevis																										1							1	0	1	0	0	1	0
Plectropomus leopardus																										1							1	0	1	0	0	1	0
Plectropomus maculatus					1																											1	1	0	1	0	1	0	0
Pogonoperca punctata		1																															0	1	1	1	0	0	0
Pseudanthias bicolor		1															1									1							1	1	1	1	0	1	0
Pseudanthias bimaculatus	1																																0	1	1	0	0	0	0
Pseudanthias charleneae	1	1													1												1						1	1	1	1	0	1	0
Pseudanthias dispar		1						1			1		1	1				1			1												1	1	1	1	1	1	0
Pseudanthias fasciatus		1												1	1	1	1										1						1	1	1	1	1	1	0
Pseudanthias huchtii	1	1								1	1		1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Pseudanthias hutomoi																				1						1	1						1	0	1	0	0	1	0
Pseudanthias hypselosoma		1						1	1				1	1	1	1	1			1				1		1					1		1	1	1	1	1	1	0
Pseudanthias lori		1																									1						1	1	1	1	0	1	0
Pseudanthias luzonensis	1	1						1		1					1																		1	1	1	1	1	1	0
Pseudanthias parvirostris		1																															0	1	1	1	0	0	0
Pseudanthias pleurotaenia	1	1			1					1		1	1	1	1	1	1	1	1	1				1		1	1						1	1	1	1	1	1	0
Pseudanthias randalli		1																															0	1	1	1	0	0	0
Pseudanthias squamipinnis	1	1					1	1	1	1	1	1	1	1				1	1					1	1	1	1				1	1	1	1	1	1	1	0
Pseudanthias tuka		1						1					1			1		1			1									1			1	1	1	1	1	1	1
Pseudogramma polyacanthus		1									1								1														1	1	1	1	1	1	0
Pseudogramma sp. 70 m (photo)		1																															0	1	1	1	0	0	0
Serranocirrhitus latus		1																															0	1	1	1	0	0	0

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Variola albimarginata	1	1						1		1	1	1	1	1	1	1		1	1					1		1							1	1	1	1	1	1	0
Variola louti		1						1				1	1		1	1	1	1	1														1	1	1	1	1	1	0
Cirrhitidae (7 spp.)																																	0	0	0	0	0	0	0
Cirrhitichthys aprinus	1	1																				1							1		1	1	1	1	1	0	1	1
Cirrhitichthys falco		1		1													1																1	1	1	1	1	1	0
Cirrhitichthys oxycephalus		1					1			1	1	1	1	1					1	1													1	1	1	1	1	1	0
Cirrhitus pinnulatus	1	1								1				1		1																	1	1	1	1	1	1	0
Cyprinocirrhites polyactis	1	1								1				1	1	1	1							1			1						1	1	1	1	1	1	0
Paracirrhites arcatus		1									1				1	1	1	1	1														1	1	1	1	1	1	0
Paracirrhites forsteri	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1					1		1	1						1	1	1	1	1	1	0
Pseudochromidae (19 spp.)																																	0	0	0	0	0	0	0
Congrogadus subducens		1																															0	1	1	1	0	0	0
Haliophis aethiopus	1	1																															0	1	1	1	0	0	0
Labracinus cyclophthalmus	1	1			1		1																							1			1	1	1	1	1	0	1
Lubbockichthys multisquamatus																											1						1	0	1	0	0	1	0
Manonichthys sp. 1 (cf. alleni)																									1		1						1	0	1	0	0	1	0
Pictichromis paccagnellae												1				1		1			1			1	1	1	1						1	0	1	0	1	1	0
Pseudochromis andamanensis			1				1				1																						1	0	1	0	1	0	0
Pseudochromis arulenteus	1	1								1	1																						1	1	1	1	1	0	0
Pseudochromis fuscus		1																												1			1	1	1	1	0	0	1
Pseudochromis litus		1																							1								1	1	1	1	0	1	0
Pseudochromis marshallensis																								1	1		1						1	0	1	0	0	1	0
Pseudochromis oligochrysus		1																								1							1	1	1	1	0	1	0
Pseudochromis perspicillatus																																1	1	0	1	0	0	0	0
Pseudochromis ransonetti																															1		1	0	1	0	0	0	0
Pseudochromis rutilus	1	1																															0	1	1	1	0	0	0
Pseudochromis steenei																			1														1	0	1	0	0	1	0
Pseudoplesiops annae																									1								1	0	1	0	0	1	0

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Pseudoplesiops collare																								1									1	0	1	0	0	1	0
Pseudoplesiops immaculatus		1																															0	1	1	1	0	0	0
Plesiopidae (4 spp.)																																	0	0	0	0	0	0	0
Belonopterygium fasciolatum		1																															0	1	1	1	0	0	0
Calloplesiops altivelis																											1						1	0	1	0	0	1	0
Plesiops coeruleolineatus		1					1																										1	1	1	1	1	0	0
Steeneichthys nativitatis						1																											1	0	1	0	1	0	0
Opistognathidae (5 spp.)																																	0	0	0	0	0	0	0
Opistognathus sp. 1 “hyalinus”																									1								1	0	1	0	0	1	0
Opistognathus randalli																	1							1		1							1	0	1	0	0	1	0
Opistognathus solorensis							1																										1	0	1	0	1	0	0
Opistognathus variabilis			1																														1	0	1	0	1	0	0
Opistognathus sp. 2 “vicinus”																									1								1	0	1	0	0	1	0
Priacanthidae (3 spp.)																																	0	0	0	0	0	0	0
Priacanthus blochii			1	1			1																										1	0	1	0	1	0	0
Priacanthus hamrur				1						1																							1	0	1	0	1	0	0
Priacanthus sagittarius																					1												1	0	1	0	0	1	0
Apogonidae (59 spp.)																																	0	0	0	0	0	0	0
Apogon angustatus											1		1		1				1														1	0	1	0	1	1	0
Apogon apogonides	1	1														1																	1	1	1	1	0	1	0
Apogon aureus	1	1		1	1											1				1	1	1										1	1	1	1	1	1	0
Apogon bryx									1													1	1										1	0	1	0	1	1	0
Apogon ceramensis																													1				1	0	1	0	0	0	1
Apogon chrysopomus				1	1																												1	0	1	0	1	0	0
Apogon chrysotaenia	1	1																	1												1	1	1	1	1	0	1	0
Apogon compressus				1																	1									1			1	0	1	0	1	1	1
Apogon crassiceps	1	1																															0	1	1	1	0	0	0
Apogon cyanosoma																								1					1				1	0	1	0	0	1	1

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Apogon dispar	1																										1						1	1	1	0	0	1	0
Apogon evermanni	1	1																															0	1	1	1	0	0	0
Apogon exostigma	1																																0	1	1	0	0	0	0
Apogon fleurieu																				1				1									1	0	1	0	0	1	0
Apogon fraenatus	1			1													1			1	1												1	1	1	0	1	1	0
Apogon guamensis																			1		1								1	1			1	0	1	0	0	1	1
Apogon hartzfeldii																													1	1			1	0	1	0	0	0	1
Apogon hoevenii																													1	1			1	0	1	0	0	0	1
Apogon kallopterus	1	1		1											1		1		1	1	1												1	1	1	1	1	1	0
Apogon leptacanthus																													1	1			1	0	1	0	0	0	1
Apogon lineomaculus																				1													1	0	1	0	0	1	0
Apogon monospilus				1																		1	1										1	0	1	0	1	1	0
Apogon moluccensis	1																					1	1										1	1	1	0	0	1	0
Apogon multilineatus		1																															0	1	1	1	0	0	0
Apogon nigrofasciatus	1	1													1			1	1	1	1				1	1	1				1	1	1	1	1	0	1	0
Apogon novemfasciatus		1																															0	1	1	1	0	0	0
Apogon parvulus																1								1						1			1	0	1	0	0	1	1
Apogon schlegeli		1																															0	1	1	1	0	0	0
Apgon seminigracaudus		1						1		1									1						1								1	1	1	1	1	1	0
Apogon semiornatus		1																	1														1	1	1	1	0	1	0
Apogon taeniophorus						1											1		1	1	1												1	0	1	0	1	1	0
Apogon thermalis																													1	1			1	0	1	0	0	0	1
Apogon timorensis		1																															0	1	1	1	0	0	0
Apogon trimaculatus					1																												1	0	1	0	1	0	0
Apogon viria																													1	1			1	0	1	0	0	0	1
Apogon wassinki	1	1															1			1				1							1		1	1	1	1	0	1	0
Apogonichthys perdix		1																															0	1	1	1	0	0	0
Archamia biguttata				1																	1			1									1	0	1	0	1	1	0

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Archamia fucata				1																1	1												1	0	1	0	1	1	0
Archamia macroptera				1																									1	1			1	0	1	0	1	0	1
Archamia melasma																					1												1	0	1	0	0	1	0
Cheilodipterus artus									1											1									1	1			1	0	1	0	1	1	1
Cheilodipterus macrodon		1					1		1											1				1	1		1		1	1			1	1	1	1	1	1	1
Cheilodipterus quinquelineatus	1	1		1	1				1						1													1	1			1	1	1	1	1	1	1
Coranthus polyacanthus		1																															0	1	1	1	0	0	0
Foa fo									1											1													1	0	1	0	1	1	0
Fowleria marmorata		1																							1								1	1	1	1	0	1	0
Fowleria vaiulae														1																			1	0	1	0	1	0	0
Fowleria variegata		1																															0	1	1	1	0	0	0
Neamia notula																									1								1	0	1	0	0	1	0
Neamia octospina		1																															0	1	1	1	0	0	0
Pseudamia gelatinosa		1																															0	1	1	1	0	0	0
Pseudamiops gracilicauda																			1														1	0	1	0	0	1	0
Pterapogon kauderni	1																												1				1	1	1	0	0	0	1
Rhabdamia cypselurus	1																																0	1	1	0	0	0	0
Rhabdamia gracilis	1	1												1										1									1	1	1	1	1	1	0
Siphamia sp. 1 (cf argentea 70 m Menjangan)																										1							1	0	1	0	0	1	0
Siphamia tubifer																							1										1	0	1	0	0	1	0
Sphaeramia nematoptera																														1			1	0	1	0	0	0	1
Malacanthidae (6 spp.)																																	0	0	0	0	0	0	0
Hoplolatilus chlupatyi								1																									1	0	1	0	1	0	0
Hoplolatilus cuniculus		1								1	1															1	1						1	1	1	1	1	1	0
Hoplolatilus randalli		1								1																							1	1	1	1	1	0	0
Hoplolatilus starcki	1	1												1				1															1	1	1	1	1	1	0
Malacanthus brevirostris		1						1		1		1	1	1	1	1	1	1						1		1							1	1	1	1	1	1	0

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Malacanthus latovittatus	1	1						1							1	1	1	1															1	1	1	1	1	1	0
Echeneidae (1 spp.)																																	0	0	0	0	0	0	0
Echeneis naucrates	1	1																				1											1	1	1	1	0	1	0
Carangidae (10 spp.)																																	0	0	0	0	0	0	0
Carangoides bajad															1	1	1									1	1						1	0	1	0	0	1	0
Carangoides ferdau				1															1														1	0	1	0	1	1	0
Carangoides fulvoguttatus	1																																0	1	1	0	0	0	0
Carangoides oblongus				1																													1	0	1	0	1	0	0
Carangoides plagiotaenia		1						1					1					1								1	1						1	1	1	1	1	1	0
Caranx ignobilis	1	1																	1														1	1	1	1	0	1	0
Caranx melampygus	1	1		1				1		1		1	1	1	1	1	1	1	1						1	1	1						1	1	1	1	1	1	0
Caranx sexfasciatus																		1															1	0	1	0	0	1	0
Elagatis bipinnulata										1																							1	0	1	0	1	0	0
Scomberoides lysan															1				1							1							1	0	1	0	0	1	0
Lutjanidae (22 spp.)																																	0	0	0	0	0	0	0
Aprion virescens		1																															0	1	1	1	0	0	0
Lutjanus argentimaculatus				1																	1												1	0	1	0	1	1	0
Lutjanus biguttatus								1																									1	0	1	0	1	0	0
Lutjanus bohar	1	1										1	1	1	1	1	1	1		1				1	1	1	1						1	1	1	1	1	1	0
Lutjanus decussatus	1	1						1		1			1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Lutjanus ehrenbergii														1																			1	0	1	0	1	0	0
Lutjanus fulviflamma	1	1	1	1	1										1	1	1	1	1							1	1						1	1	1	1	1	1	0
Lutjanus fulvus	1	1		1	1									1	1	1	1	1	1		1			1		1							1	1	1	1	1	1	0
Lutjanus gibbus	1	1				1									1	1		1						1		1			1				1	1	1	1	1	1	1
Lutjanus kasmira	1	1						1		1				1	1	1										1							1	1	1	1	1	1	0
Lutjanus lutjanus														1			1					1										1	1	0	1	0	1	1	0
Lutjanus madras																1	1	1															1	0	1	0	0	1	0
Lutjanus malabaricus																							1										1	0	1	0	0	1	0

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Lutjanus monostigma		1								1																1							1	1	1	1	1	1	0
Lutjanus quinquelineatus					1														1			1	1			1			1				1	0	1	0	1	1	1
Lutjanus rivulatus	1	1		1									1		1	1	1	1															1	1	1	1	1	1	0
Lutjanus rufolineatus																			1										1				1	0	1	0	0	1	1
Lutjanus sebae																						1	1										1	0	1	0	0	1	0
Macolor macularis	1	1								1	1		1	1	1	1	1	1	1	1				1		1	1						1	1	1	1	1	1	0
Macolor niger	1	1																						1		1							1	1	1	1	0	1	0
Paracaesio sordida																									1								1	0	1	0	0	1	0
Paracaesio xanthura		1			1					1																							1	1	1	1	1	0	0
Caesionidae (14 spp.)																																	0	0	0	0	0	0	0
Caesio caerulaurea	1	1	1			1		1		1	1		1	1	1	1	1	1						1		1	1		1			1	1	1	1	1	1	1	1
Caesio cuning				1						1		1		1	1	1	1		1					1		1	1				1	1	1	0	1	0	1	1	0
Caesio lunaris	1	1						1		1	1		1	1	1	1	1	1								1	1						1	1	1	1	1	1	0
Caesio teres	1	1								1	1			1	1	1	1	1								1							1	1	1	1	1	1	0
Caesio varilineata								1																									1	0	1	0	1	0	0
Caesio xanthonota	1	1						1			1							1															1	1	1	1	1	1	0
Pterocaesio chrysozona																														1	1		1	0	1	0	0	0	0
Pterocaesio diagramma	1	1		1	1					1															1								1	1	1	1	1	1	0
Pterocaesio marri																										1							1	0	1	0	0	1	0
Pterocaesio pisang																				1							1			1	1		1	0	1	0	0	1	1
Pterocaesio randalli										1								1							1	1							1	0	1	0	1	1	0
Pterocaesio tessellata			1							1																1	1						1	0	1	0	1	1	0
Pterocaesio tile		1				1		1					1				1	1									1						1	1	1	1	1	1	0
Pterocaesio trilineata																								1						1			1	0	1	0	0	1	1
Symphysanodontidae (1 spp.)																																	0	0	0	0	0	0	0
Symphysanodon cf katayamai		1																															0	1	1	1	0	0	0
Gerreidae (1 spp.)																																	0	0	0	0	0	0	0
Gerres oyena																											1		1				1	0	1	0	0	1	1

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Haemulidae (8 spp.)																																	0	0	0	0	0	0	0
Diagramma pictum																	1												1	1			1	0	1	0	0	1	1
Plectorhinchus chaetodontoides		1		1							1							1								1			1				1	1	1	1	1	1	1
Plectorhinchus chrysotaenia		1																															0	1	1	1	0	0	0
Plectorhinchus flavomaculatus						1																				1							1	0	1	0	1	1	0
Plectorhinchus lessonii	1	1	1	1	1	1	1			1	1		1	1				1							1				1				1	1	1	1	1	1	1
Plectorhinchus lineatus		1		1	1	1				1					1	1	1							1							1	1	1	1	1	1	1	1	0
Plectorhinchus polytaenia	1	1						1	1		1		1			1			1		1					1						1	1	1	1	1	1	1	0
Plectorhinchus vittatus	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1													1	1	1	1	1	1	1	0
Lethrinidae (10 spp.)																																	0	0	0	0	0	0	0
Gnathodentex aurolineatus		1		1	1					1																							1	1	1	1	1	0	0
Gymnocranius griseus																			1				1										1	0	1	0	0	1	0
Gymnocranius sp.						1				1																							1	0	1	0	1	0	0
Lethrinus amboinensis	1	1																															0	1	1	1	0	0	0
Lethrinus harak	1	1			1											1	1			1			1										1	1	1	1	1	1	0
Lethrinus microdon	1														1																		1	1	1	0	0	1	0
Lethrinus olivaceus		1		1	1			1		1					1			1	1					1								1	1	1	1	1	1	0
Lethrinus ornatus		1				1							1		1	1	1	1						1		1							1	1	1	1	1	1	0
Monotaxis grandoculis	1	1		1	1			1			1		1	1	1	1	1	1	1	1				1	1	1	1						1	1	1	1	1	1	0
Monotaxis heterodon													1		1		1	1						1									1	0	1	0	1	1	0
Nemipteridae (13 spp.)																																	0	0	0	0	0	0	0
Pentapodus aureofasciatus	1																							1									1	1	1	0	0	1	0
Pentapodus nagasakiensis ?								1			1																						1	0	1	0	1	0	0
Pentapodus trivittatus		1		1																					1		1		1				1	1	1	1	1	1	1
Scolopsis affinis	1	1	1	1	1			1	1						1	1	1	1	1	1	1	1	1	1		1						1	1	1	1	1	1	1	0
Scolopsis auratus							1					1	1	1	1	1	1	1	1														1	0	1	0	1	1	0
Scolopsis bilineatus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Scolopsis ciliatus				1	1				1									1	1						1				1			1	1	0	1	0	1	1	1

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Scolopsis lineatus	1	1		1															1						1	1	1						1	1	1	1	1	1	0
Scolopsis margaritifer																									1					1			1	0	1	0	0	1	1
Scolopsis monogramma	1				1		1								1				1														1	1	1	0	1	1	0
Scolopsis torquata																															1	1	1	0	1	0	0	0	0
Scolopsis trilineatus	1		1																														1	1	1	0	1	0	0
Scolopsis xenochrous	1						1	1		1		1	1	1											1								1	1	1	0	1	1	0
Mullidae (15 spp.)																																	0	0	0	0	0	0	0
Mulloidichthys flavolineatus	1	1	1	1	1								1	1	1	1	1	1						1		1							1	1	1	1	1	1	0
Mulloidichthys vanicolensis	1	1		1		1	1			1		1	1	1	1	1	1	1															1	1	1	1	1	1	0
Parupeneus barberinoides																																1	1	0	1	0	0	0	0
Parupeneus barberinus	1	1	1	1	1	1	1	1	1	1		1	1		1	1	1			1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Parupeneus crassilabris		1												1			1							1	1	1	1						1	1	1	1	1	1	0
Parupeneus cyclostomus				1	1		1	1	1	1	1	1	1	1																			1	0	1	0	1	0	0
Parupeneus heptacanthus	1	1	1	1	1		1										1		1	1		1	1										1	1	1	1	1	1	0
Parupeneus indicus	1	1		1	1	1																											1	1	1	1	1	0	0
Parupeneus macronemus	1	1	1	1	1	1	1		1			1	1		1	1	1	1	1					1	1		1						1	1	1	1	1	1	0
Parupeneus multifasciatus	1	1		1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1					1	1				1	1	1	1	1	1	1	1	0
Parupeneus pleurostigma																								1								1	1	0	1	0	0	1	0
Parupeneus spilurus		1						1			1		1																				1	1	1	1	1	0	0
Parupeneus trifasciatus	1	1	1		1		1				1	1																					1	1	1	1	1	0	0
Upeneus sundaicus																						1	1										1	0	1	0	0	1	0
Upeneus tragula					1																								1			1	1	0	1	0	1	0	1
Pempheridae (4 spp.)																																	0	0	0	0	0	0	0
Parapriacanthus ransonneti	1	1		1																													1	1	1	1	1	0	0
Pempheris oualensis	1			1	1																												1	1	1	0	1	0	0
Pempheris schwenkii					1																												1	0	1	0	1	0	0
Pempheris vanicolensis	1	1	1	1	1	1	1								1			1			1										1	1	1	1	1	1	0
Kyphosidae (2 spp.)																																	0	0	0	0	0	0	0

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Kyphosus cinerascens		1								1						1		1						1									1	1	1	1	1	1	0
Kyphosus vaigensis	1	1		1	1			1				1		1	1	1	1	1								1	1						1	1	1	1	1	1	0
Monodactylidae (1 spp.)																																	0	0	0	0	0	0	0
Monodactylus argenteus																													1				1	0	1	0	0	0	1
Chaetodontidae (43 spp.)																																	0	0	0	0	0	0	0
Chaetodon adiergastos	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1			1	1	1	1			1	1	1	1	1	1	1	1	0
Chaetodon auriga	1	1	1	1	1	1	1	1		1								1							1	1	1		1				1	1	1	1	1	1	1
Chaetodon baronessa	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1			1	1	1	1	1	1	1	1	0
Chaetodon bennetti																													1				1	0	1	0	0	0	1
Chaetodon citrinellus	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1						1		1					1	1	1	1	1	1	0
Chaetodon collare		1																															0	1	1	1	0	0	0
Chaetodon decussatus	1	1	1	1	1	1	1		1			1	1	1	1	1	1	1													1		1	1	1	1	1	0
Chaetodon ephippium	1	1	1		1													1															1	1	1	1	1	1	0
Chaetodon guentheri	1	1								1			1						1														1	1	1	1	1	1	0
Chaetodon guttatissimus	1	1		1			1																										1	1	1	1	1	0	0
Chaetodon kleinii	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1			1	1		1	1	1	1	1	0
Chaetodon lineolatus	1	1											1																				1	1	1	1	1	0	0
Chaetodon lunula	1	1			1				1		1			1					1														1	1	1	1	1	1	0
Chaetodon lunulatus	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1			1			1	1	1	1	1	1	1
Chaetodon melannotus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1		1			1				1	1	1	1	1	1	1
Chaetodon mertensii		1																															0	1	1	1	0	0	0
Chaetodon meyeri	1	1			1		1	1										1															1	1	1	1	1	1	0
Chaetodon ocellicaudus	1	1																						1								1	1	1	1	1	0	1	0
Chaetodon octofasciatus																														1			1	0	1	0	0	0	1
Chaetodon ornatissimus	1	1			1		1																										1	1	1	1	1	0	0
Chaetodon oxycephalus	1	1											1	1			1	1								1							1	1	1	1	1	1	0
Chaetodon punctatofasciatus	1	1								1	1																						1	1	1	1	1	0	0
Chaetodon rafflesi	1	1										1	1	1	1	1	1	1	1					1	1	1	1			1			1	1	1	1	1	1	1

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Chaetodon reticulatus										1																							1	0	1	0	1	0	0
Chaetodon selene	1	1					1			1				1																	1		1	1	1	1	1	0	0
Chaetodon speculum	1	1	1	1				1		1	1				1	1	1	1	1						1		1		1				1	1	1	1	1	1	1
Chaetodon trifascialis	1	1		1		1	1	1	1	1	1	1	1	1				1	1							1	1						1	1	1	1	1	1	0
Chaetodon trifasciatus		1																1															1	1	1	1	0	1	0
Chaetodon unimaculatus	1	1				1	1	1			1	1		1																		1	1	1	1	1	1	0	0
Chaetodon vagabundus	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1		1		1	1	1	1	1	1	1	1	1
Chaetodon xanthurus		1								1																							1	1	1	1	1	0	0
Coradion altivelis	1	1																															0	1	1	1	0	0	0
Coradion chrysozonus							1								1									1		1					1	1	1	0	1	0	1	1	0
Coradion melanopus																		1								1							1	0	1	0	0	1	0
Forcipiger flavissimus	1	1						1		1	1		1		1	1	1	1			1					1	1						1	1	1	1	1	1	0
Forcipiger longirostris	1	1						1		1								1								1							1	1	1	1	1	1	0
Hemitaurichthys polylepis	1	1						1		1	1			1	1		1	1						1		1	1						1	1	1	1	1	1	0
Heniochus acuminatus										1										1													1	0	1	0	1	1	0
Heniochus chrysostomus	1	1								1	1				1	1	1	1								1	1					1	1	1	1	1	1	1	0
Heniochus diphreutes	1	1						1	1				1	1					1			1	1			1			1				1	1	1	1	1	1	1
Heniochus monoceros					1		1																										1	0	1	0	1	0	0
Heniochus singularius	1	1			1					1		1		1	1						1			1		1		1	1		1		1	1	1	1	1	1	1
Heniochus varius	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1						1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Pomacanthidae (21 spp.)																																	0	0	0	0	0	0	0
Apolemichthys trimaculatus	1	1						1		1		1	1	1	1			1	1							1							1	1	1	1	1	1	0
Centropyge bicolor	1	1		1			1			1	1				1	1	1	1		1	1			1		1	1		1		1	1	1	1	1	1	1	1	1
Centropyge bispinosa	1	1						1																									1	1	1	1	1	0	0
Centropyge eibli	1	1	1	1	1	1	1								1			1	1						1	1	1						1	1	1	1	1	1	0
Centropyge flavicauda	1	1						1		1			1																				1	1	1	1	1	0	0
Centropyge nox																		1								1							1	0	1	0	0	1	0
Centropyge tibicen	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1		1		1	1	1	1	1	1	1	1	1

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Centropyge vroliki	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Chaetodontoplus melanosoma								1		1	1	1	1																				1	0	1	0	1	0	0
Chaetodontoplus mesoleucus																														1			1	0	1	0	0	0	1
Genicanthus caudivittatus		1																															0	1	1	1	0	0	0
Genicanthus lamarck	1	1						1		1								1	1						1	1	1						1	1	1	1	1	1	0
Genicanthus melanospilos	1	1								1																	1						1	1	1	1	1	1	0
Paracentropyge multifasciata													1																				1	0	1	0	1	0	0
Pomacanthus annularis			1																														1	0	1	0	1	0	0
Pomacanthus imperator	1	1						1		1		1	1	1	1	1	1	1	1	1						1	1					1	1	1	1	1	1	1	0
Pomacanthus navarchus																										1	1						1	0	1	0	0	1	0
Pomacanthus semicirculatus		1		1	1		1	1	1	1	1	1	1	1	1	1	1										1					1	1	1	1	1	1	0
Pomacanthus sexstriatus													1	1	1	1	1												1			1	0	1	0	1	1	1
Pomacanthus xanthometopon					1									1				1														1	0	1	0	1	1	0
Pygoplites diacanthus	1	1											1	1	1	1	1	1	1						1	1	1						1	1	1	1	1	1	0
Pomacentridae (96 spp.)																																	0	0	0	0	0	0	0
Abudefduf lorentzi																											1						1	0	1	0	0	1	0
Abudefduf notatus	1	1																															0	1	1	1	0	0	0
Abudefduf septemfasciatus		1										1						1						1			1						1	1	1	1	1	1	0
Abudefduf sexfasciatus	1	1	1	1	1	1	1	1	1	1	1															1	1		1				1	1	1	1	1	1	1
Abudefduf sordidus		1																1															1	1	1	1	0	1	0
Abudefduf vaigiensis	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Amblyglyphidodon aureus	1	1								1			1	1	1	1	1	1		1	1			1	1	1	1						1	1	1	1	1	1	0
Amblyglyphidodon batunai		1																															0	1	1	1	0	0	0
Amblyglyphidodon curacao	1	1		1	1		1		1			1	1		1			1						1	1	1	1			1	1		1	1	1	1	1	1	1
Amblyglyphidodon leucogaster		1						1		1	1		1		1	1	1	1		1	1			1	1	1	1		1	1	1		1	1	1	1	1	1	1
Amblyglyphidodon ternatensis	1	1										1																	1	1			1	1	1	1	1	0	1
Amblypomacentrus breviceps	1								1													1							1	1			1	1	1	0	1	1	1
Amblypomacentrus clarus																								1									1	0	1	0	0	1	0

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Amphiprion akallopisos	1	1		1											1			1															1	1	1	1	1	1	0
Amphiprion clarkii	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						1	1				1	1	1	1	1	1	1	1	0
Amphiprion frenatus																													1				1	0	1	0	0	0	1
Amphiprion melanopus		1																															0	1	1	1	0	0	0
Amphiprion ocellaris	1	1		1	1			1		1				1					1												1	1	1	1	1	1	1	1	0
Amphiprion perideraion	1	1		1				1					1	1				1							1						1		1	1	1	1	1	1	0
Amphiprion polymnus	1							1				1										1	1									1	1	1	1	0	1	1	0
Amphiprion sebae																																1	1	0	1	0	0	0	0
Chromis albicauda	1	1						1					1																				1	1	1	1	1	0	0
Chromis alpha																									1	1	1						1	0	1	0	0	1	0
Chromis amboinensis	1	1						1										1						1	1	1	1						1	1	1	1	1	1	0
Chromis analis	1	1								1			1	1	1	1	1	1								1	1						1	1	1	1	1	1	0
Chromis atripectoralis	1	1																														1	1	1	1	1	0	0	0
Chromis atripes	1	1								1	1		1		1	1	1	1		1	1			1	1	1	1						1	1	1	1	1	1	0
Chromis caudalis	1	1								1			1		1	1	1	1		1	1					1	1						1	1	1	1	1	1	0
Chromis delta	1	1											1	1	1	1	1	1		1	1			1	1	1	1						1	1	1	1	1	1	0
Chromis dimidiata		1																															0	1	1	1	0	0	0
Chromis earina																											1						1	0	1	0	0	1	0
Chromis elerae		1																1	1	1				1			1						1	1	1	1	0	1	0
Chromis lepidolepis	1	1					1	1	1	1					1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Chromis margaritifer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Chromis opercularis	1	1									1	1																					1	1	1	1	1	0	0
Chromis pura		1																															0	1	1	1	0	0	0
Chromis retrofasciata	1	1						1	1	1	1				1	1	1	1		1	1			1	1	1	1			1			1	1	1	1	1	1	1
Chromis scotochilopterus	1	1								1	1	1	1	1	1	1	1							1		1	1				1	1	1	1	1	1	1	0
Chromis sp. (70m Buyuk)		1																															0	1	1	1	0	0	0
Chromis ternatensis	1	1						1	1	1	1				1	1	1	1	1	1	1			1	1	1	1			1			1	1	1	1	1	1	1
Chromis viridis	1	1						1	1				1	1	1	1	1				1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1

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Chromis weberi	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Chromis xanthochira	1	1																								1							1	1	1	1	0	1	0
Chromis xanthura				1							1		1		1	1	1	1			1					1	1						1	0	1	0	1	1	0
Chrysiptera bleekeri	1	1																															0	1	1	1	0	0	0
Chrysiptera brownriggii	1	1		1						1	1			1	1	1	1	1	1								1						1	1	1	1	1	1	0
Chrysiptera glauca		1																															0	1	1	1	0	0	0
Chrysiptera rollandi	1	1														1		1		1	1			1	1	1	1			1	1	1	1	1	1	1	0	1	1
Chrysiptera springeri																															1	1	1	0	1	0	0	0	0
Chrysiptera talboti	1	1								1	1	1	1	1	1	1	1	1	1					1	1	1	1						1	1	1	1	1	1	0
Chrysiptera unimaculata	1	1													1	1	1	1	1								1						1	1	1	1	0	1	0
Dascyllus aruanus	1	1			1																			1					1	1			1	1	1	1	1	1	1
Dascyllus melanurus	1	1																											1	1			1	1	1	1	0	0	1
Dascyllus reticulatus	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1
Dascyllus trimaculatus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	1	1
Dischistodus chrysopoecilus		1																												1			1	1	1	1	0	0	1
Dischistodus melanotus																		1							1	1	1			1			1	0	1	0	0	1	1
Dischistodus perspicillatus		1																											1	1			1	1	1	1	0	0	1
Dischistodus prosopotaenia					1																								1	1			1	0	1	0	1	0	1
Hemiglyphidodon plagiometopon																														1			1	0	1	0	0	0	1
Neoglyphidodon bonang		1																															0	1	1	1	0	0	0
Neoglyphidodon crossi	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	1			1												1	1	1	1	1	1	0
Neoglyphidodon melas	1	1	1	1	1	1	1		1				1	1												1							1	1	1	1	1	1	0
Neoglyphidodon nigroris		1																			1												1	1	1	1	0	1	0
Neoglyphidodon oxyodon		1																															0	1	1	1	0	0	0
Neopomacentrus azysron																	1															1	1	0	1	0	0	1	0
Neopomacentrus cyanomos	1																			1									1				1	1	1	0	0	1	1
Neopomacentrus violascens	1																					1	1						1				1	1	1	0	0	1	1
Plectroglyphidodon dickii	1	1	1	1	1		1							1				1						1		1							1	1	1	1	1	1	0

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Plectroglyphidodon johnstonianus	1	1									1																					1	1	1	1	1	0	0
Plectroglyphidodon lacrymatus	1	1	1	1	1		1	1	1			1		1	1	1	1	1	1					1	1	1				1	1	1	1	1	1	1	1	0
Plectroglyphidodon leucozona	1	1	1							1	1				1	1	1	1	1														1	1	1	1	1	1	0
Pomacentrus adelus		1		1	1				1			1	1		1	1	1	1						1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus alexanderae	1	1			1				1				1		1			1						1	1	1	1			1			1	1	1	1	1	1
Pomacentrus alleni		1																															0	1	1	1	0	0	0
Pomacentrus amboinensis	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1
Pomacentrus auriventris	1	1					1	1		1	1	1	1	1	1	1	1	1	1		1			1	1	1	1		1		1	1	1	1	1	1	1	1
Pomacentrus bankanensis	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus brachialis	1	1		1	1		1	1		1	1		1		1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus chrysurus		1	1	1		1									1	1	1	1	1					1		1	1						1	1	1	1	1	1	0
Pomacentrus coelestis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus grammorhynchus																														1			1	0	1	0	0	0	1
Pomacentrus lepidogenys	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus melanochir	1																						1										1	1	1	0	0	1	0
Pomacentrus moluccensis	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1			1	1	1	1	1	1	1	1	1
Pomacentrus nagasakiensis	1	1			1		1		1					1						1	1										1	1	1	1	1	1	1	0
Pomacentrus nigromarginatus	1	1								1						1	1	1		1	1			1	1	1	1						1	1	1	1	1	1	0
Pomacentrus pavo																													1				1	0	1	0	0	0	1
Pomacentrus philippinus		1	1	1	1	1	1				1			1			1									1						1	1	1	1	1	1	0
Pomacentrus reidi	1	1						1		1			1		1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Pomacentrus simsiang																													1	1			1	0	1	0	0	0	1
Pomacentrus tripunctatus																											1						1	0	1	0	0	1	0
Pomacentrus vaiuli	1	1			1	1	1	1		1			1		1	1	1	1			1			1		1	1						1	1	1	1	1	1	0
Pristotis obtrusirostris																						1											1	0	1	0	0	1	0
Stegastes fasciolatus	1	1	1															1															1	1	1	1	1	1	0
Stegastes punctatus																													1	1			1	0	1	0	0	0	1
Labridae (114 spp.)																																	0	0	0	0	0	0	0

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Anampses caeruleopunctatus		1																															0	1	1	1	0	0	0
Anampses geographicus	1																																0	1	1	0	0	0	0
Anampses melanurus	1									1			1				1				1			1		1	1						1	1	1	0	1	1	0
Anampses meleagrides		1				1	1										1	1	1							1							1	1	1	1	1	1	0
Anampses twistii	1	1											1													1	1						1	1	1	1	1	1	0
Bodianus axillaris	1	1		1						1														1						1			1	1	1	1	1	1	0
Bodianus bilunulatus		1								1	1	1	1	1																			1	1	1	1	1	0	0
Bodianus bimaculatus		1												1																			1	1	1	1	1	0	0
Bodianus diana	1	1						1		1		1	1	1	1	1	1	1		1	1			1		1	1						1	1	1	1	1	1	0
Bodians izuensis		1																	1							1							1	1	1	1	0	1	0
Bodianus leucostictus		1																															0	1	1	1	0	0	0
Bodianus mesothorax	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1			1			1	1	1	1				1	1	1	1	1	1	1	0
Cheilinus chlorourus	1	1	1	1	1	1	1	1	1	1	1																						1	1	1	1	1	0	0
Cheilinus fasciatus	1	1					1									1		1						1	1	1	1			1			1	1	1	1	1	1	1
Cheilinus oxycephalus	1	1						1					1				1							1		1	1						1	1	1	1	1	1	0
Cheilinus trilobatus	1	1	1				1	1	1			1			1	1	1	1	1					1	1	1	1					1	1	1	1	1	1	1	0
Cheilinus undulatus	1	1											1					1															1	1	1	1	1	1	0
Cheilio inermis	1	1			1				1				1													1							1	1	1	1	1	1	0
Choerodon anchorago	1	1					1		1																1					1			1	1	1	1	1	1	1
Choerodon zamboangae																										1							1	0	1	0	0	1	0
Cirrhilabrus brunneus								1																									1	0	1	0	1	0	0
Cirrhilabrus cf cyanopleura	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1		1	1			1	1	1	1			1	1	1	1	1	1	1	1	1
Cirrhilabrus exquisitus	1	1								1																1							1	1	1	1	1	1	0
Cirrhilabrus filamentosus	1	1						1		1																							1	1	1	1	1	0	0
Cirrhilabrus flavidorsalis	1	1																								1							1	1	1	1	0	1	0
Cirrhilabrus lubbocki	1	1																1								1				1			1	1	1	1	0	1	1
Cirrhilabrus pylei		1																									1						1	1	1	1	0	1	0
Cirrhilabrus rubrimarginatus	1	1						1																		1							1	1	1	1	1	1	0

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Cirrhilabrus solorensis		1																															0	1	1	1	0	0	0
Cirrhilabrus temminckii	1	1																															0	1	1	1	0	0	0
Coris aygula		1																															0	1	1	1	0	0	0
Coris batuensis	1	1						1					1											1	1				1				1	1	1	1	1	1	1
Coris dorsomacula	1	1						1	1		1	1		1																1		1	1	1	1	1	1	0	0
Coris gaimardi	1	1								1		1	1		1	1	1								1	1	1				1	1	1	1	1	1	1	0
Coris pictoides	1																												1		1	1	1	1	1	0	0	0	1
Diproctacanthus xanthurus	1	1							1				1																	1			1	1	1	1	1	0	1
Epibulus brevis		1																															0	1	1	1	0	0	0
Epibulus insidiator	1	1		1	1		1		1	1	1		1		1	1	1							1	1	1	1		1	1			1	1	1	1	1	1	1
Gomphosus caeruleus						1	1																										1	0	1	0	1	0	0
Gomphosus varius	1	1		1	1	1	1	1	1				1	1	1	1	1							1		1	1						1	1	1	1	1	1	0
Halichoeres argus																													1				1	0	1	0	0	0	1
Halichoeres biocellatus	1	1																															0	1	1	1	0	0	0
Halichoeres chloropterus																													1	1			1	0	1	0	0	0	1
Halichoeres chrysotaenia				1	1																												1	0	1	0	1	0	0
Halichoeres chrysus	1	1					1	1				1		1	1	1	1	1	1		1			1	1	1	1						1	1	1	1	1	1	0
Halichoeres hartzfeldii	1	1												1																		1	1	1	1	1	1	0	0
Halichoeres hortulanus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1				1	1	1	1	1	1	1	0
Halichoeres margaritaceus	1	1		1								1	1	1	1	1	1																1	1	1	1	1	1	0
Halichoeres marginatus	1	1	1	1	1		1				1	1			1	1	1	1	1	1	1						1						1	1	1	1	1	1	0
Halichoeres melanochir		1																															0	1	1	1	0	0	0
Halichoeres melanurus															1										1					1	1	1	1	0	1	0	0	1	1
Halichoeres nebulosus	1	1																															0	1	1	1	0	0	0
Halichoeres nigrescens																							1										1	0	1	0	0	1	0
Halichoeres podostigma	1	1							1									1									1						1	1	1	1	1	1	0
Halichoeres prosopeion	1	1								1			1	1	1	1	1	1						1	1	1	1				1	1	1	1	1	1	1	0
Halichoeres richmondi	1	1																															0	1	1	1	0	0	0

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Halichoeres scapularis	1	1			1			1	1							1		1	1					1			1		1	1			1	1	1	1	1	1	1
Halichoeres solorensis	1	1	1			1		1					1																		1	1	1	1	1	1	0	0
Halichoeres timorensis				1	1		1																										1	0	1	0	1	0	0
Halichoeres trimaculatus	1	1																															0	1	1	1	0	0	0
Hemigymnus fasciatus	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1					1	1	1	1					1	1	1	1	1	1	0
Hemigymnus melapterus	1	1		1	1				1						1			1							1		1		1	1			1	1	1	1	1	1	1
Hologymnosus annulatus	1	1											1												1		1						1	1	1	1	1	1	0
Hologymnosus doliatus	1	1	1					1					1					1							1								1	1	1	1	1	1	0
Iniistius aneitensis	1	1																				1											1	1	1	1	0	1	0
Iniistius javanicus	1	1																															0	1	1	1	0	0	0
Iniistius melanopus												1								1		1											1	0	1	0	1	1	0
Iniistius pavo	1	1																															0	1	1	1	0	0	0
Iniistius pentadactylus	1	1														1						1											1	1	1	1	0	1	0
Iniistius tetrazona	1	1																															0	1	1	1	0	0	0
Labrichthys unilineatus	1	1		1	1		1	1	1	1	1		1	1	1	1	1	1						1	1	1	1						1	1	1	1	1	1	0
Labroides bicolor	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1			1										1		1	1	1	1	1	1	0
Labroides dimidatus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1			1	1	1	1			1	1	1	1	1	1	1	1	1	1
Labroides pectoralis	1	1																															0	1	1	1	0	0	0
Labropsis alleni				1											1		1																1	0	1	0	1	1	0
Labropsis manabei		1																															0	1	1	1	0	0	0
Leptojulis chrysotaenia												1	1		1											1						1	1	0	1	0	1	1	0
Leptojulis cyanopleura		1		1															1	1													1	1	1	1	1	1	0
Leptojulis polylepis ?																				1													1	0	1	0	0	1	0
Macropharyngodon negrosensis														1	1		1																1	0	1	0	1	1	0
Macropharyngodon ornatus	1	1				1	1			1	1		1													1	1					1	1	1	1	1	1	0
Novaculichthys taeniourus	1	1			1					1						1																	1	1	1	1	1	1	0
Oxycheilinus bimaculatus	1	1			1		1	1	1											1					1				1	1	1	1	1	1	1	1	1	1
Oxycheilinus digramma	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1					1	1	1	1			1	1	1	1	1	1	1	1	1	1

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Oxycheilinus unifasciatus													1																				1	0	1	0	1	0	0
Paracheilinus sp.		1																															0	1	1	1	0	0	0
Paracheilinus filamentosus		1																		1													1	1	1	1	0	1	0
Paracheilinus flavianalis	1	1						1					1		1			1							1	1			1		1	1	1	1	1	1	1	1	1
Pseudocheilinus evanidus	1	1						1					1																				1	1	1	1	1	0	0
Pseudocheilinus hexataenia	1	1	1	1	1		1	1	1	1	1		1					1	1	1	1			1	1	1	1						1	1	1	1	1	1	0
Pseudocheilinus octotaenia	1	1																															0	1	1	1	0	0	0
Pseudocoris bleekeri														1																			1	0	1	0	1	0	0
Pseudocoris heteroptera	1	1																								1							1	1	1	1	0	1	0
Pseudocoris yamashiroi	1	1																															0	1	1	1	0	0	0
Pseudodax moluccanus	1	1								1	1		1	1												1	1				1	1	1	1	1	1	1	0
Pseudojuloides cerasinus								1																									1	0	1	0	1	0	0
Pseudojuloides kaleidos	1	1																															0	1	1	1	0	0	0
Pseudojuloides mesostigma																											1						1	0	1	0	0	1	0
Pseudojuloides severnsi								1																									1	0	1	0	1	0	0
Pteragogus cryptus													1																				1	0	1	0	1	0	0
Pteragogus enneacanthus	1	1																															0	1	1	1	0	0	0
Stethojulis bandanensis	1	1			1										1	1	1								1								1	1	1	1	1	1	0
Stethojulis interrupta	1	1					1	1	1																1								1	1	1	1	1	1	0
Stethojulis strigiventer		1																											1	1			1	1	1	1	0	0	1
Stethojulis trilineata	1	1					1		1						1	1	1																1	1	1	1	1	1	0
Terelabrus rubrovittatus		1																															0	1	1	1	0	0	0
Thalassoma amblycephalus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1				1	1	1	1	1	1	1	0
Thalassoma hardwicke	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1			1	1	1	1	1	1	1	1	1
Thalassoma jansenii	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1								1				1	1	1	1	1	1	1	0
Thalassoma lunare	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Thalassoma purpureum	1	1												1																			1	1	1	1	1	0	0
Thalassoma quinquevittatum	1	1																															0	1	1	1	0	0	0

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Thalassoma trilobatum	1	1												1																			1	1	1	1	1	0	0
Wetmorella nigropinnata		1																															0	1	1	1	0	0	0
Scaridae (24 spp.)																																	0	0	0	0	0	0	0
Bolbometopon muricatum										1				1				1						1									1	0	1	0	1	1	0
Calotomus carolinus	1	1			1	1		1																									1	1	1	1	1	0	0
Cetoscarus ocellatus	1	1																1						1			1						1	1	1	1	0	1	0
Chlorurus bleekeri	1	1																							1	1	1						1	1	1	1	0	1	0
Chlorurus capistratoides		1						1			1				1	1		1	1					1									1	1	1	1	1	1	0
Chlorurus microrhinos																											1						1	0	1	0	0	1	0
Chlorurus sordidus	1	1		1	1			1	1	1	1			1											1	1	1				1	1	1	1	1	1	1	0
Leptoscarus vaigiensis		1																															0	1	1	1	0	0	0
Scarus dimidatus		1																							1		1		1	1			1	1	1	1	0	1	1
Scarus festivus	1	1																															0	1	1	1	0	0	0
Scarus flavipectoralis	1	1								1	1																						1	1	1	1	1	0	0
Scarus forsteni	1	1															1	1															1	1	1	1	0	1	0
Scarus frenatus	1	1															1																1	1	1	1	0	1	0
Scarus ghobban	1	1		1	1	1	1	1	1					1												1			1		1	1	1	1	1	1	1	1
Scarus niger	1	1		1	1					1				1	1	1	1	1	1					1	1	1	1						1	1	1	1	1	1	0
Scarus oviceps		1						1	1	1	1							1						1		1	1						1	1	1	1	1	1	0
Scarus prasiognathos								1						1													1						1	0	1	0	1	1	0
Scarus psittacus	1	1	1	1	1	1																											1	1	1	1	1	0	0
Scarus quoyi		1							1							1	1	1							1	1	1					1	1	1	1	1	1	0
Scarus rivulatus		1														1	1										1					1	1	1	1	0	1	0
Scarus rubroviolaceus	1	1					1					1		1	1	1	1		1					1			1						1	1	1	1	1	1	0
Scarus schlegeli	1	1														1	1																1	1	1	1	0	1	0
Scarus spinus	1	1							1								1	1						1			1						1	1	1	1	1	1	0
Scarus tricolor		1										1		1	1	1	1							1		1	1						1	1	1	1	1	1	0
Trichonotidae 3 spp.)																																	0	0	0	0	0	0	0

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Pteropsaron springeri																		1			1			1		1							1	0	1	0	0	1	0
Trichonotus elegans		1																															0	1	1	1	0	0	0
Trichonotus setiger	1											1				1	1																1	1	1	0	1	1	0
Creediidae (1 spp.)																																	0	0	0	0	0	0	0
Limnichthys nitidus		1										1					1																1	1	1	1	1	1	0
Pinguipedidae (10 spp.)																																	0	0	0	0	0	0	0
Parapercis bimacula	1																																0	1	1	0	0	0	0
Parapercis clathrata	1	1												1	1	1	1	1							1						1	1	1	1	1	1	1	0
Parapercis cylindrica	1	1	1	1	1				1							1	1								1				1	1	1	1	1	1	1	1	1	1
Parapercis flavolineata																									1	1							1	0	1	0	0	1	0
Parapercis hexophtalma	1	1		1	1																			1	1	1	1						1	1	1	1	1	1	0
Parapercis maculata	1																																0	1	1	0	0	0	0
Parapercis millepunctata	1	1				1									1	1	1		1	1	1					1							1	1	1	1	1	1	0
Parapercis schauinslandii	1	1						1	1										1														1	1	1	1	1	1	0
Parapercis sp. (photos)							1	1	1							1															1		1	0	1	0	1	1	0
Parapercis tetracantha	1	1											1	1	1	1	1	1	1					1									1	1	1	1	1	1	0
Trypterygiidae 14 spp,)																																	0	0	0	0	0	0	0
Ceratobregma helenae		1																															0	1	1	1	0	0	0
Enneapterygius flavoccipitis																					1												1	0	1	0	0	1	0
Enneapterygius hemimelas	1	1																															0	1	1	1	0	0	0
Enneapterygius similis										1																							1	0	1	0	1	0	0
Enneapterygius tutuilae															1				1								1						1	0	1	0	0	1	0
Enneapterygius sp 1 (photo)														1																			1	0	1	0	1	0	0
Helcogramma kranos?		1																															0	1	1	1	0	0	0
Helcogramma randalli														1																			1	0	1	0	1	0	0
Helcogramma rhinoceros												1																					1	0	1	0	1	0	0
Helcogramma sp. 1 (dark saddles)		1																															0	1	1	1	0	0	0
Helcogramma sp. 2 (photo)															1				1														1	0	1	0	0	1	0

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Helcogramma striatum	1	1		1		1		1		1	1	1	1	1	1	1	1	1	1														1	1	1	1	1	1	0
Norfolkia brachylepis		1																															0	1	1	1	0	0	0
Ucla xenogrammus	1	1																															0	1	1	1	0	0	0
Clinidae (1 spp.)																																	0	0	0	0	0	0	0
Springeratus xanthosoma		1																															0	1	1	1	0	0	0
Blenniidae (27 spp.)																																	0	0	0	0	0	0	0
Aspidontus taeniatus																							1										1	0	1	0	0	1	0
Atrosalarias fuscus		1																								1				1			1	1	1	1	0	1	1
Blenniella chrysospilos																											1						1	0	1	0	0	1	0
Cirripectes auritus		1																															0	1	1	1	0	0	0
Cirripectes filamentosus			1																														1	0	1	0	1	0	0
Cirripectes polyzona											1			1																			1	0	1	0	1	0	0
Ecsenius bathi		1																															0	1	1	1	0	0	0
Ecsenius bicolor		1						1			1			1			1	1	1						1		1						1	1	1	1	1	1	0
Ecsenius namiyei																								1									1	0	1	0	0	1	0
Ecsenius ops																								1									1	0	1	0	0	1	0
Ecsenius shirleyae																									1		1						1	0	1	0	0	1	0
Ecsenius yaeyamaenis																1																	1	0	1	0	0	1	0
Entomacrodus decussatus																											1						1	0	1	0	0	1	0
Entomacrodus vermiculatus														1																			1	0	1	0	1	0	0
Istiblennius edentulus																											1						1	0	1	0	0	1	0
Meiacanthus cf abditus																										1							1	0	1	0	0	1	0
Meiacanthus abruptus																														1			1	0	1	0	0	0	1
Meiacanthus atrodorsalis															1			1			1			1	1	1					1		1	0	1	0	0	1	0
Meiacanthus cyanopterus																			1														1	0	1	0	0	1	0
Meiacanthus grammistes																								1	1								1	0	1	0	0	1	0
Nannosalarias nativitatus										1	1			1																			1	0	1	0	1	0	0
Petroscirtes breviceps		1							1														1	1					1				1	1	1	1	1	1	1

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Petroscirtes variabilis		1																															0	1	1	1	0	0	0
Plagiotremus rhinorhynchus	1	1	1	1	1			1		1			1	1	1	1	1	1							1	1	1		1				1	1	1	1	1	1	1
Plagiotremus tapeinosoma														1					1														1	0	1	0	1	1	0
Salarias fasciatus		1																															0	1	1	1	0	0	0
Salarias guttatus		1																									1						1	1	1	1	0	1	0
Callionymidae (7 **spp.**)																																	0	0	0	0	0	0	0
Callionymus filamentosus																						1											1	0	1	0	0	1	0
Callionymus superbus (photo - Tul)	1																																0	1	1	0	0	0	0
Callionymus sp. 1 (photo)																			1														1	0	1	0	0	1	0
Callionymus sp. 2 (photo)																					1												1	0	1	0	0	1	0
Dactylopus dactylopus																													1				1	0	1	0	0	0	1
Synchiropus ocellatus		1																															0	1	1	1	0	0	0
Synchiropus tudorjonesi																		1															1	0	1	0	0	1	0
Gobiidae (84 **spp.**)																																	0	0	0	0	0	0	0
Amblyeleotris fasciata	1	1													1	1	1		1													1	1	1	1	1	0	1	0
Amblyeleotris fontanesii																							1										1	0	1	0	0	1	0
Amblyeleotris guttata																										1						1	1	0	1	0	0	1	0
Amblyeleotris periophthalma																																1	1	0	1	0	0	0	0
Amblyeleotris steinitzi	1																																0	1	1	0	0	0	0
Amblyeleotris yanoi	1																1																1	1	1	0	0	1	0
Amblygobius nocturnus																					1									1			1	0	1	0	0	1	1
Amblygobius phalaena																											1		1				1	0	1	0	0	1	1
Asterropteryx ensifera	1								1						1	1	1													1			1	1	1	0	1	1	1
Asterropteryx striata																		1	1		1			1						1			1	0	1	0	0	1	1
Bryaninops amplus										1														1									1	0	1	0	1	1	0
Bryaninops tigris?		1																															0	1	1	1	0	0	0
Cryptocentrus caeruleomaculatus					1																												1	0	1	0	1	0	0
Cryptocentrus inexplicatus																													1				1	0	1	0	0	0	1

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Cryptocentrus leptocephalus																													1				1	0	1	0	0	0	1
Cryptocentrus leucostictus				1																													1	0	1	0	1	0	0
Cryptocentrus strigilliceps			1		1																								1	1			1	0	1	0	1	0	1
Ctenogobiops pomastictus			1	1	1																				1								1	0	1	0	1	1	0
Drombus species 1			1																														1	0	1	0	1	0	0
Drombus species 2																							1										1	0	1	0	0	1	0
Eviota guttata	1	1					1				1	1		1					1						1	1	1						1	1	1	1	1	1	0
Eviota prasites	1																																0	1	1	0	0	0	0
Eviota punctulata														1																			1	0	1	0	1	0	0
Eviota queenslandica?		1																															0	1	1	1	0	0	0
Eviota rubrisparsa																	1							1			1						1	0	1	0	0	1	0
Eviota sebreei		1									1				1	1	1	1	1						1								1	1	1	1	1	1	0
Eviota sigillata																1								1									1	0	1	0	0	1	0
Eviota sp. 1 (red head)																									1								1	0	1	0	0	1	0
Exyrias akihito																									1								1	0	1	0	0	1	0
Exyrias ferrarisi																													1	1			1	0	1	0	0	0	1
Fusigobius duospilus		1																															0	1	1	1	0	0	0
Fusigobius inframaculatus	1	1												1			1			1									1		1		1	1	1	1	1	1	1
Fusigobius melacron	1																														1		1	1	1	0	0	0	0
Fusigobius neophytus		1																	1														1	1	1	1	0	1	0
Fusigobius signipinnis																								1	1						1		1	0	1	0	0	1	0
Gladiogobius ensifer																														1			1	0	1	0	0	0	1
Gnatholepis cauerensis	1	1																	1	1				1	1					1			1	1	1	1	0	1	1
Gobiid sp. 1 (photo - Tulamben)	1																																0	1	1	0	0	0	0
Gobiid sp. 2 (photo - Tulamben)	1																																0	1	1				
Gobiodon citrinus		1																															0	1	1	1	0	0	0
Gobiodon prolixus																										1							1	0	1	0	0	1	0
Gobiodon quinquestrigatus	1																																0	1	1	0	0	0	0

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Gobiodon sp.1 (dark with 2 blue bars)	1																																0	1	1	0	0	0	0
Gobiodon sp.2 (br with many blue bars)	1																																0	1	1	0	0	0	0
Grallenia baliensis																	1				1												1	0	1	0	0	1	0
Hazeus otakii																						1	1										1	0	1	0	0	1	0
Istigobius decoratus	1	1		1	1								1	1	1	1	1	1	1	1	1				1				1	1	1	1	1	1	1	1	1	1	1
Istigobius sp. 1 (70 m photo)																									1								1	0	1	0	0	1	0
Istigobius spence							1																								1		1	0	1	0	1	0	0
Mahidolia mystacinus																			1				1										1	0	1	0	0	1	0
Oplopomus caninoides																						1	1										1	0	1	0	0	1	0
Oplopomus oplopomus			1																										1	1			1	0	1	0	1	0	1
Paragobiodon xanthosoma					1																												1	0	1	0	1	0	0
Pleurosicya annadalei																										1							1	0	1	0	0	1	0
Pleurosicya labiata																															1		1	0	1	0	0	0	0
Pleurosicya mossambica																			1	1													1	0	1	0	0	1	0
Priolepis cinctus	1	1			1									1									1										1	1	1	1	1	1	0
Priolepis compita		1																															0	1	1	1	0	0	0
Priolepis nuchifasciatus		1																															0	1	1	1	0	0	0
Priolepis semidoliatus		1																															0	1	1	1	0	0	0
Priolepis sp. 1 (broad yellow bars - 70 m)		1																															0	1	1	1	0	0	0
Priolepis sp. 2 (photo)										1																1							1	0	1	0	1	1	0
Tomiyamichthys oni	1																																0	1	1	0	0	0	0
Trimma annosum							1																										1	0	1	0	1	0	0
Trimma benjamini		1																															0	1	1	1	0	0	0
Trimma fucatum							1												1														1	0	1	0	1	1	0
Trimma halonevum	1																1		1	1			1		1	1							1	1	1	0	0	1	0
Trimma kudoi																								1									1	0	1	0	0	1	0
Trimma imaii		1																															0	1	1	1	0	0	0

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Trimma macrophthalma	1	1																								1							1	1	1	1	0	1	0
Trimma maiandros	1																																0	1	1	0	0	0	0
Trimma nomurai																			1					1									1	0	1	0	0	1	0
Trimma okinawae		1					1							1	1						1					1						1	1	1	1	1	1	0
Trimma stobbsi		1																															0	1	1	1	0	0	0
Trimma taylori	1															1								1			1						1	1	1	0	0	1	0
Trimma tevegae																		1						1	1	1	1						1	0	1	0	0	1	0
Trimma yanoi																					1			1									1	0	1	0	0	1	0
Tryssogobius sarah																		1															1	0	1	0	0	1	0
Valenciennea helsdingenii	1	1													1	1	1			1				1		1							1	1	1	1	0	1	0
Valenciennea puellaris	1	1													1	1	1	1			1			1									1	1	1	1	0	1	0
Valenciennea sexguttata		1	1													1		1	1							1			1				1	1	1	1	1	1	1
Valenciennea strigata												1	1	1	1	1	1	1			1			1	1	1							1	0	1	0	1	1	0
Vanderhorstia lanceolata																			1														1	0	1	0	0	1	0
Vanderhorstia species 1																							1										1	0	1	0	0	1	0
Xenisthmidae (1 spp.)																																	0	0	0	0	0	0	0
Xenisthmus polyzonatus?		1																															0	1	1	1	0	0	0
Microdesmidae (2 spp.)																																	0	0	0	0	0	0	0
Gunnellichthys curiosus								1									1																1	0	1	0	1	1	0
Gunnellichthys viridescens																					1			1									1	0	1	0	0	1	0
Ptereleotridae (8 spp.)																																	0	0	0	0	0	0	0
Nemateleotris decora		1								1															1	1	1						1	1	1	1	1	1	0
Nemateleotris magnifica		1									1		1					1								1							1	1	1	1	1	1	0
Ptereleotris brachyptera																				1				1									1	0	1	0	0	1	0
Ptereleotris evides	1	1			1	1	1	1		1	1		1	1	1	1	1	1							1	1	1						1	1	1	1	1	1	0
Ptereleotris grammica		1																															0	1	1	1	0	0	0
Ptereleotris hanae	1																					1											1	1	1	0	0	1	0

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Ptereleotris heteroptera	1	1						1		1			1		1	1	1																1	1	1	1	1	1	0
Ptereleotris rubristigma												1				1								1									1	0	1	0	1	1	0
Ephippidae (4 spp.)																																	0	0	0	0	0	0	0
Platax boersi				1	1	1		1					1												1	1	1		1				1	0	1	0	1	1	1
Platax orbicularis					1								1										1		1								1	0	1	0	1	1	0
Platax pinnatus						1																			1								1	0	1	0	1	1	0
Platax teira	1																																0	1	1	0	0	0	0
Siganidae (13 spp.)																																	0	0	0	0	0	0	0
Siganus argenteus	1	1						1									1	1	1					1		1						1	1	1	1	1	1	1	0
Siganus canaliculatus																										1	1						1	0	1	0	0	1	0
Siganus corallinus	1	1										1	1		1	1	1	1	1					1									1	1	1	1	1	1	0
Siganus guttatus				1	1	1		1									1								1	1			1			1	1	0	1	0	1	1	1
Siganus labyrinthodes																		1														1	1	0	1	0	0	1	0
Siganus margaritifer																		1	1							1							1	0	1	0	0	1	0
Siganus puellus	1							1		1			1			1		1	1					1		1				1		1	1	1	1	0	1	1	1
Siganus punctatissimus																		1															1	0	1	0	0	1	0
Siganus punctatus																	1							1		1			1				1	0	1	0	0	1	1
Siganus spinus	1	1				1			1						1	1	1																1	1	1	1	1	1	0
Siganus vermiculatus																	1																1	0	1	0	0	1	0
Siganus virgatus	1				1										1	1	1		1					1	1	1	1			1			1	1	1	0	1	1	1
Siganus vulpinus	1												1					1			1			1		1	1						1	1	1	0	1	1	0
Zanclidae (1 spp.)																																	0	0	0	0	0	0	0
Zanclus cornutus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	0
Acanthuridae (39 spp.)																																	0	0	0	0	0	0	0
Acanthurus barine	1	1	1									1									1												1	1	1	1	1	1	0
Acanthurus blochii															1	1	1	1													1	1	1	0	1	0	0	1	0
Acanthurus dussumieri	1	1				1							1				1																1	1	1	1	1	1	0
Acanthurus leucocheilus	1	1						1		1		1																			1		1	1	1	1	1	0	0

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Acanthurus leucosternon	1	1						1							1																		1	1	1	1	1	1	0
Acanthurus lineatus	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1							1	1				1	1	1	1	1	1	1	1	0
Acanthurus maculiceps		1													1										1		1						1	1	1	1	0	1	0
Acanthurus mata	1	1					1	1	1	1	1	1						1	1	1	1			1		1	1				1	1	1	1	1	1	1	1	0
Acanthurus nigricans	1	1				1	1	1		1	1	1	1	1	1	1	1	1	1														1	1	1	1	1	1	0
Acanthurus nigricauda	1	1		1	1	1	1	1	1			1	1	1	1	1	1	1	1					1		1	1		1		1	1	1	1	1	1	1	1	1
Acanthurus nigrofuscus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													1	1	1	1	1	1	1	1	0
Acanthurus olivaceus	1	1		1				1	1		1	1			1	1	1	1	1													1	1	1	1	1	1	1	0
Acanthurus pyroferus	1	1		1				1		1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Acanthurus tennentii	1																																0	1	1	0	0	0	0
Acanthurus thompsoni	1	1								1						1		1								1	1						1	1	1	1	1	1	0
Acanthurus triostegus	1	1													1	1	1										1						1	1	1	1	0	1	0
Acanthurus tristis	1	1				1	1	1				1																				1	1	1	1	1	0	0
Acanthurus xanthopterus	1	1		1											1				1				1						1		1	1	1	1	1	1	1	1
Ctenochaetus binotatus	1	1																		1	1			1	1	1	1		1				1	1	1	1	0	1	1
Ctenochaetus cyanocheilus	1	1																															0	1	1	1	0	0	0
Ctenochaetus striatus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1				1	1	1	1	1	1	1	1	0
Ctenochaetus truncatus		1									1																				1	1	1	1	1	1	0	0
Naso annulatus	1	1																															0	1	1	1	0	0	0
Naso brachycentron	1	1		1				1			1		1	1	1	1	1	1	1						1	1							1	1	1	1	1	1	0
Naso brevirostris	1	1			1	1		1						1	1			1	1								1		1		1		1	1	1	1	1	1	1
Naso caeruleacauda																			1														1	0	1	0	0	1	0
Naso elegans	1	1																															0	1	1	1	0	0	0
Naso hexacanthus	1	1				1		1		1					1	1	1	1	1							1	1				1		1	1	1	1	1	1	0
Naso lituratus	1	1		1						1			1	1	1	1	1	1	1							1							1	1	1	1	1	1	0
Naso lopezi	1	1																						1									1	1	1	1	0	1	0
Naso minor	1	1								1	1		1		1	1	1	1			1					1							1	1	1	1	1	1	0
Naso reticulatus	1																																0	1	1	0	0	0	0

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Naso thynnoides	1	1							1								1	1	1							1							1	1	1	1	1	1	0
Naso unicornis	1	1								1				1			1	1	1														1	1	1	1	1	1	0
Naso vlamingii	1	1	1		1			1		1		1	1	1	1	1	1	1	1	1	1				1	1	1		1				1	1	1	1	1	1	1
Paracanthurus hepatus		1						1										1															1	1	1	1	1	1	0
Prionurus chrysurus		1			1			1				1	1	1																			1	1	1	1	1	0	0
Zebrasoma scopas	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1		1							1	1	1	1	1	1	0
Zebrasoma veliferum																	1	1					1										1	0	1	0	0	1	0
Sphyraenidae (4 spp.)																																	0	0	0	0	0	0	0
Sphyraena barracuda		1						1								1			1														1	1	1	1	1	1	0
Sphyraena jello													1				1																1	0	1	0	1	1	0
Sphyraena obtusata																				1		1											1	0	1	0	0	1	0
Sphyraena qenie					1																												1	0	1	0	1	0	0
Scombridae (6 spp.)																																	0	0	0	0	0	0	0
Euthynnus affinis																										1							1	0	1	0	0	1	0
Grammatorcynus bilineatus		1											1																				1	1	1	1	1	0	0
Gymnosarda unicolor		1											1					1						1									1	1	1	1	1	1	0
Rastrelliger kanagurta																1										1	1						1	0	1	0	0	1	0
Scomberomorus commrsonnianus		1													1																		1	1	1	1	0	1	0
Thunnus albacares		1																															0	1	1	1	0	0	0
Bothidae (3 spp.)																																	0	0	0	0	0	0	0
Asterorhombus intermedius																							1										1	0	1	0	0	1	0
Bothus mancus	1	1	1		1											1																	1	1	1	1	1	1	0
Bothus pantherinus		1												1		1						1	1										1	1	1	1	1	1	0
Soleidae (6 spp.)																																	0	0	0	0	0	0	0
Aseraggodes chapleaui		1																															0	1	1	1	0	0	0
Aseraggodes suzimotoi		1																															0	1	1	1	0	0	0
Brachirus marmoratus		1																															0	1	1	1	0	0	0
Liachirus melanospilos																							1										1	0	1	0	0	1	0

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Appendix 3.1. *continued*

	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Pardachirus pavoninus																1																	1	0	1	0	0	1	0
Soleichthys heterorhinos			1																														1	0	1	0	1	0	0
Samaridae (1 spp.)																																	0	0	0	0	0	0	0
Samariscus triocellatus		1																															0	1	1	1	0	0	0
Balistidae (17 spp.)																																	0	0	0	0	0	0	0
Abalistes stellatus																1						1	1										1	0	1	0	0	1	0
Balistapus undulatus	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1			1	1	1	1				1	1	1	1	1	1	1	1	0
Balistoides conspicillum	1	1						1					1		1	1																	1	1	1	1	1	1	0
Balistoides viridescens	1	1	1	1				1	1				1	1	1	1	1	1	1							1	1						1	1	1	1	1	1	0
Canthidermis maculatus																1														1	1	1	0	1	0	0	1	0
Melichthys indicus		1											1																			1	1	1	1	1	0	0
Melichthys niger	1	1					1			1			1				1															1	1	1	1	1	1	0
Melichthys vidua	1	1				1	1	1		1		1	1	1	1	1	1	1						1	1	1	1						1	1	1	1	1	1	0
Odonus niger	1	1						1		1	1		1	1	1	1	1	1			1			1	1	1							1	1	1	1	1	1	0
Pseudobalistes flavimarginatus	1	1		1	1			1											1										1				1	1	1	1	1	1	1
Pseudobalistes fuscus		1																															0	1	1	1	0	0	0
Rhinecanthus rectangulus	1	1																															0	1	1	1	0	0	0
Rhinecanthus verrucosus		1													1	1	1	1								1	1						1	1	1	1	0	1	0
Sufflamen bursa	1	1						1		1	1		1	1	1	1	1	1			1			1	1	1					1	1	1	1	1	1	1	0
Sufflamen chrysopterus	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1						1	1						1	1	1	1	1	1	1	0
Sufflamen frenatus		1																															0	1	1	1	0	0	0
Xanthichthys auromarginatus		1								1			1																				1	1	1	1	1	0	0
Monacanthidae (14 spp.)																																	0	0	0	0	0	0	0
Acreichthys tomentosus																						1	1						1				1	0	1	0	0	1	1
Aluterus scriptus	1	1						1	1	1	1		1	1							1						1					1	1	1	1	1	1	0
Amanses scopas	1	1											1	1	1	1	1	1			1			1		1	1						1	1	1	1	1	1	0
Cantherhines dumerilii	1	1		1				1		1	1			1	1	1	1	1															1	1	1	1	1	1	0
Cantherhines fronticinctua	1	1		1						1								1															1	1	1	1	1	1	0

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Appendix 3.1. *continued*

	Previous Bali	NP Surveys	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 28	Site 33	Site 29	Site 30	Site 31	Site 32	Present Survey	Previous Surveys	Grand Total	Nusa Penida	East Bali	North Bali	Gilimanuk
Cantherhines pardalis	1	1					1	1		1	1		1	1	1	1	1	1						1	1	1	1				1	1	1	1	1	1	1	1	0
Chaetodermis pencilligerus																													1				1	0	1	0	0	0	1
Oxymonacanthus longirostris	1	1		1																													1	1	1	1	1	0	0
Paraluteres prionurus	1	1					1							1												1						1	1	1	1	1	1	1	0
Paramonacanthus curtorhynchos																						1											1	0	1	0	0	1	0
Pervagor janthinosoma		1						1					1																				1	1	1	1	1	0	0
Pervagor melanocephalus	1	1																								1							1	1	1	1	0	1	0
Pseudalutarius nasicornis									1														1										1	0	1	0	1	1	0
Pseudomonacanthus macrurus	1																					1											1	1	1	0	0	1	0
Ostraciidae (5 spp.)																																	0	0	0	0	0	0	0
Lactoria diaphanus											1																						1	0	1	0	1	0	0
Lactoria fornasini																																1	1	0	1	0	0	0	0
Ostracion cubicus	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1							1							1	1	1	1	1	1	0
Ostracion meleagris	1	1				1		1	1	1	1				1	1	1				1					1							1	1	1	1	1	1	0
Ostracion solorensis																		1							1							1	1	0	1	0	0	1	0
Tetraodontidae (15 spp.)																																	0	0	0	0	0	0	0
Arothron caeruleopunctatus		1																															0	1	1	1	0	0	0
Arothron hispidus	1	1						1	1																								1	1	1	1	1	0	0
Arothron immaculatus	1																																0	1	1	0	0	0	0
Arothron manilensis																									1								1	0	1	0	0	1	0
Arothron mappa	1												1						1					1			1						1	1	1	0	1	1	0
Arothron nigropunctatus	1	1						1	1				1	1	1	1	1	1	1	1	1			1	1	1	1						1	1	1	1	1	1	0
Arothron stellatus	1	1			1								1						1														1	1	1	1	1	1	0
Canthigaster amboinensis		1		1		1	1							1																			1	1	1	1	1	0	0
Canthigaster axilogus		1									1																						1	1	1	1	1	0	0
Canthigaster bennetti	1	1		1	1		1																									1	1	1	1	1	0	0
Canthigaster compressa	1								1													1	1						1	1			1	1	1	0	1	1	1
Canthigaster epilamprus	1	1								1				1																			1	1	1	1	1	0	0

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Appendix 3.1. *continued*

	Canthigaster janthinoptera	Canthigaster papua	Canthigaster valentini	**Diodontidae (2 spp.)**	Diodon hystrix	Diodon liturosus	**Molidae (1 spp.)**	Mola mola		
Gilimanuk	0	0	1	0	1	0	0	0	153	Gilimanuk
North Bali	1	1	1	0	1	1	0	0	622	North Bali
East Bali	1	1	1	0	1	1	0	0	510	East Bali
Nusa Penida	1	1	1	0	1	1	0	1	573	Nusa Penida
Grand Total	1	1	1	0	1	1	0	1	977	Grand Total
Previous Surveys	1	1	1	0	1	1	0	1	641	Previous Surveys
Present Survey	1	1	1	0	1	1	0	0	805	Present Survey
Site 32	1	1	1						139	Site 32
Site 31			1						113	Site 31
Site 30									85	Site 30
Site 29			1		1				109	Site 29
Site 33									2	Site 33
Site 28			1						212	Site 28
Site 26			1		1				248	Site 26
Site 25		1	1						171	Site 25
Site 24			1			1			191	Site 24
Site 23									56	Site 23
Site 22									42	Site 22
Site 21			1						114	Site 21
Site 20			1						99	Site 20
Site 19	1		1			1			189	Site 19
Site 18			1						246	Site 18
Site 17			1		1				230	Site 17
Site 16			1						220	Site 16
Site 15			1						217	Site 15
Site 14			1		1				190	Site 14
Site 13			1						197	Site 13
Site 12			1						117	Site 12
Site 11			1						143	Site 11
Site 10			1		1				183	Site 10
Site 9			1						115	Site 9
Site 7		1	1						187	Site 7
Site 5	1		1						131	Site 5
Site 4									91	Site 4
Site 3		1	1		1	1			157	Site 3
Site 2			1						162	Site 2
Site 1			1						96	Site 1
NP Surveys	1	1	1		1	1		1	573	NP Surveys
Previous Bali	1		1			1			428	Previous Bali
74 new records for Bali										