

The background of the entire page is an underwater photograph. It shows a dense school of small, dark-colored fish, possibly damselfishes, swimming in clear, light blue water. Below them, a complex coral reef structure is visible, with various types of coral and smaller fish interspersed among the branches. The overall scene is vibrant and teeming with marine life.

**Fish Density, Biomass,
and Species Overview
of the Dive Hub MPA
Antulang, Si-it, Siaton,
Negros Oriental**

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January 2011

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Fieldwork conducted in December 2010

SUMMARY

Fish density and fish biomass have continuously increased since the establishment of the Dive Hub Marine Protected Area in 2007. In December 2010, mean fish density was 2054 fish per 500 m² (a 37% increase) and mean fish biomass was 54.2 kg per 500 m² (which equals 108.4 tonne/km², a 10% increase). During the survey, 290 fish species were found with 78 first records for this MPA. This raised the total number of fish species and families, which have been observed within the Dive Hub Marine Protected Area, to 379 and 52 respectively. This includes one shark species.

The high density and biomass of reef fish within the Dive Hub Marine Protected Area provides the following main benefits:

- Fish will ‘spillover’ to nearby areas increasing the catches of local fishermen;
- Large fish can reproduce without being disturbed and will provide fish larvae and juveniles to coastal habitats in southern Negros;
- The MPA contributes to the conservation of marine biodiversity.



Figure 1 A school of rainbow runners (*Elagatis bipinnulatus*, Carangidae) along the drop-off in the Dive Hub MPA.

Introduction

Since 2007, the coral reef in front of the Dive Hub Resort in Antulang (Si-it, Siaton) along the Southern Negros coast has been protected and recently became a marine protected area (MPA). This relatively small MPA (about 0.3 ha) was surveyed in August 2008 and July 2009 by experts from the Silliman University in Dumaguete. These studies provided baseline data for the MPA; species lists were made available and density and biomass figures were provided (Nillos-Kleiven & Stockwell 2009). The numbers of fish species observed during these two surveys were 201 and 260 respectively adding up to a grand total of 282 species belonging to 39 families. In March 2010, the species list was extended with another 18 species (Bos 2010).

Since the last density and biomass estimations of the fish populations in the Dive Hub MPA were performed in 2009, it is of high interest to perform another survey as to observe the development of the fish populations. The present report provides data on fish density and biomass as observed in December 2010 and provides an overview of fish species that have been observed in the MPA.

Methodology

To determine density, fish were counted in six transects inside the Dive Hub Marine Protected Area, which is located in Si-it (Municipality Siaton) at the south-eastern coast of Negros Oriental (the Philippines) from 30 December 2010 to 1 January 2011. To determine biomass, fish size was simultaneously estimated. Fish Visual Census and SCUBA diving were used. Three transects (20 m in length and 10 m in width) were performed at 10 m, whereas the other three were performed at 5 m depth. Transects were laid parallel to the shore at constant depth separated by 10 m intervals. For density and biomass estimations, fish were identified at family level.

Further SCUBA diving and snorkeling was performed between 30 December 2010 and 2 January 2011 to study fish at species level and produce an overview of the species in the MPA. SCUBA diving was always limited to a maximum depth of 25 m and one dive was performed after sunset in the evening of 1 January. Fish were identified while diving, but cryptic and uncommon species were photographed and later identified from the photographs (Allen *et al.* 2003, Froese & Pauly 2010, Lieske & Myers 2002). The wind conditions (Amihan season – predominantly North-Eastern winds) were relatively rough with

4-8 Beaufort. Although wave activity caused reduced visibility in the shallow areas, the visibility was still ≥ 20 m at depths below 5 m.

Fish biomass was calculated using the growth formula $W = a \cdot L^b$, where W is the weight of an individual fish and L the estimated length. The values a and b were used as mean for each fish family as provided by Fish-Base (Froese & Pauly 2010). For the sake of comparison, fish density and biomass are presented per 500 m^2 as was done for the earlier surveys (Nillos-Kleiven & Stockwell 2009).

Results and discussion

Fish Density and Biomass

Mean density of the six transects within the Dive Hub MPA was 2054 fish per 500 m^2 (Figure 2), which is an increase of 37% compared to the survey performed in 2009 (Nillos-Kleiven & Stockwell 2009). Especially the small fish, in the survey mainly represented by the Pomacentridae (damselfishes),

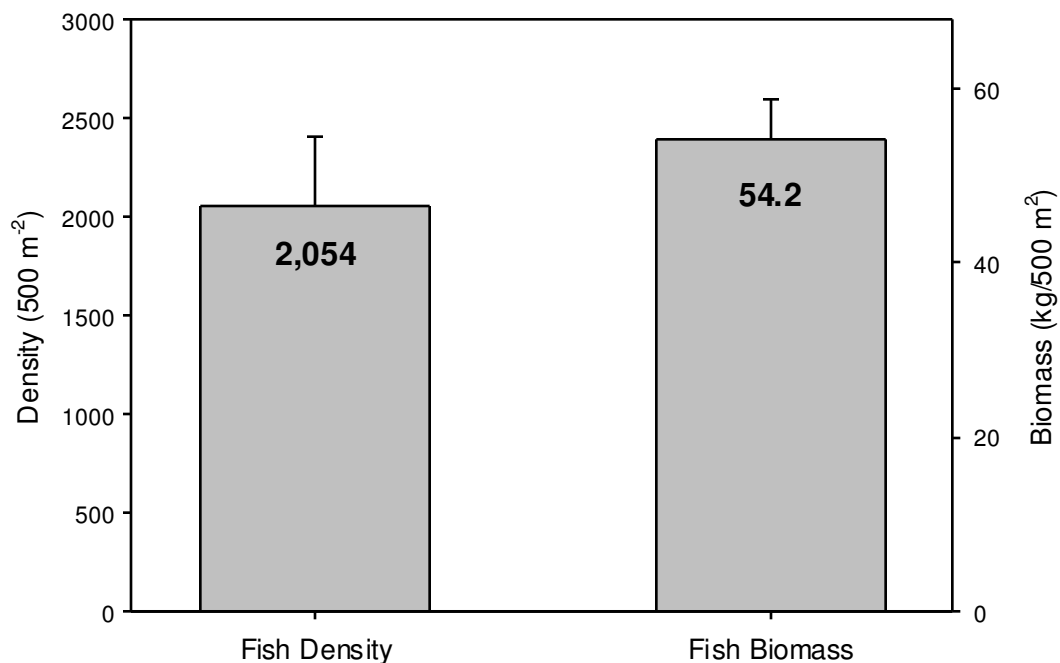


Figure 2 Mean fish density (500 m^{-2}) and biomass ($\text{kg}/500 \text{ m}^2$) with standard error in the Dive Hub Marine Protected Area as observed in 6 transects between 30 December 2010 and 1 January 2011.

increased significantly (see cover photo). These small fish however are the primary food source for larger fish and the increased number ecologically supports the presence of large predatory species. This may explain that the mean fish biomass increased by almost 10% since the last survey in 2009 (Nillos-Kleiven & Stockwell 2009). In 2010, the mean biomass within the six transects performed in the Dive Hub Marine Protected Area was 54.2 kg per 500 m² (= 108.4 tonne/km²; Figure 2). Fish biomass increased through the presence of large representatives of the piscivorous families Lutjanidae and Sphyraenidae (snappers and barracudas; Figure 3). However, also large individuals of the families Mugilidae and Scaridae (mulletts and parrotfishes), and large schools of the Mullidae (goatfishes) and juvenile snappers contributed to the increase of the biomass.

Compared to other marine reserves in the Philippines, fish biomass in the Dive Hub MPA has developed similarly as the fish biomass in the Sumilon Island reserve. After three years of full protection, mean fish biomass in the Sumilon reserve increased to 100 tonne/km², whereas in the Apo Island reserve this was about 50 tonne/km² (Alcala & Russ 2006). The mean fish biomass of 108.4 tonne/km² after three years of protection, as presently observed in the Dive Hub MPA, underlines that the area is fully protected. Moreover, considering that fish biomass values have rapidly increased, it seems possible that biomass may further increase in the future.



Figure 3 Schools of blackspot snappers (*Lutjanus ehrenbergii*, Lutjanidae) with yellowtail barracudas (*Sphyraena flavicauda*, Sphyraenidae) in the upper left corner.

The high density and biomass of reef fish within the Dive Hub Marine Protected Area provides the following main benefits:

- Fish will ‘spillover’ to nearby areas increasing the catches of local fishermen;
- Large fish can reproduce without being disturbed and will provide fish larvae and juveniles to coastal habitats in southern Negros;
- The MPA contributes to the conservation of marine biodiversity (see below).



Figure 4 Butterfly fishes (Chaetodontidae), often encountered in the Dive Hub MPA, are indicators of healthy reefs.

Species Overview

During the present survey, a total of 289 fish species belonging to 48 families were observed within the Dive Hub Marine Protected Area (Figure 5 & Appendix). Additionally, one shark species was observed (*Triaenodon obesus*). Adding the present results to those of earlier studies, the total number of fish species and families for the Dive Hub MPA has risen to 379 and 52 respectively (Figure 5). The two most diverse families are the Labridae and the Pomacentridae with both around 50 species. The ten most

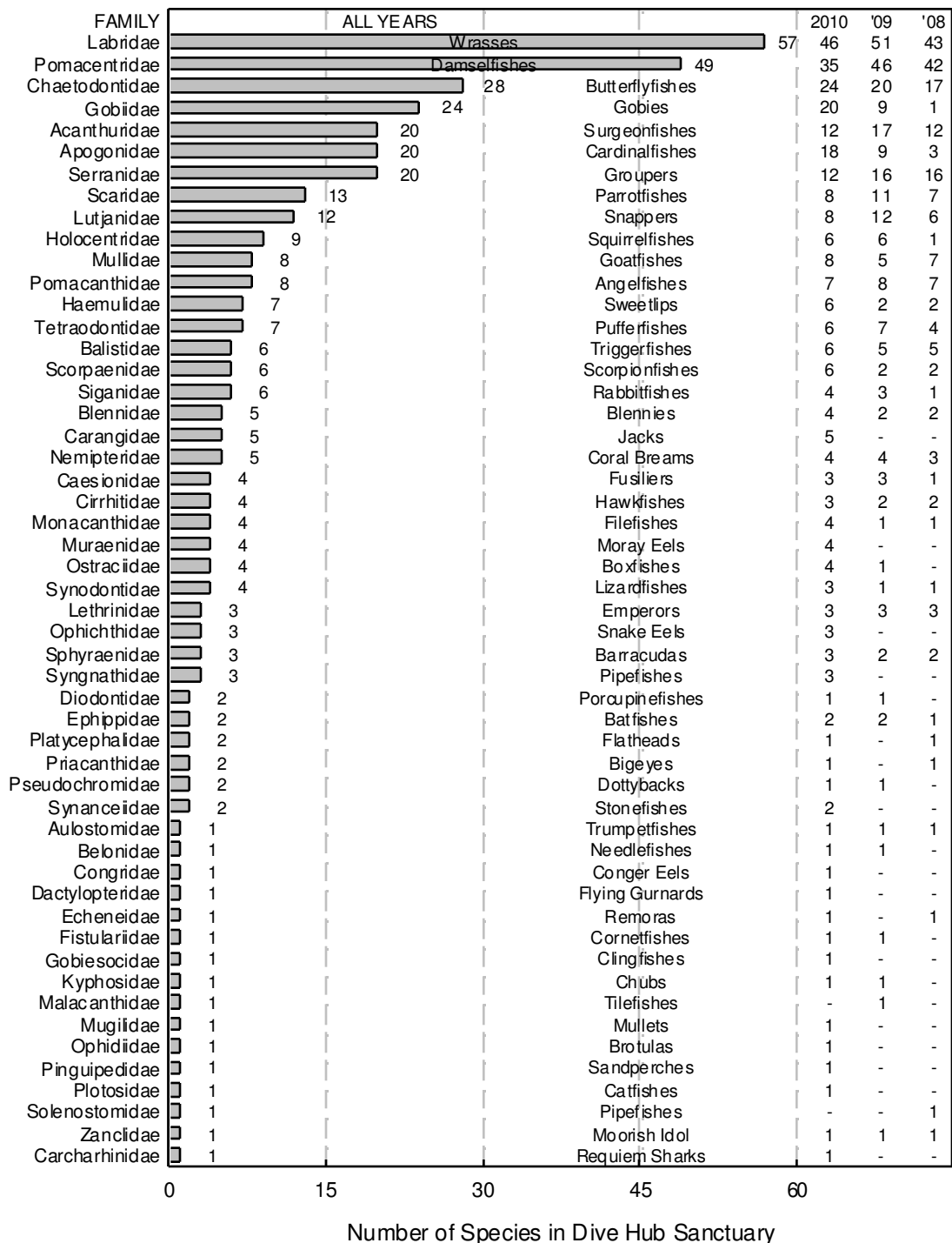


Figure 5 Total number of species per fish family in Dive Hub Marine Protected Area as observed in 2010 (present study including Bos, 2010), 2009 and 2008 (Nillos-Kleiven & Stockwell, 2009) and all years combined.

diverse families make up for 66% of all species. Several families, such as the Gobiidae and Apogonidae, had sharply increased numbers of species, whereas other families, such as the Carangidae (Figure 1) and Muraenidae, were observed for the first time. The Chaetodontidae, an indicator family for healthy coral reefs, is represented by 28 species (Figure 4). It seems that the three years of protection of this relatively small MPA allowed the biodiversity of fish to increase. Obviously, new species will be found during future surveys, but not at a rate as high as during the present survey. In 2008, the total number was 201 species, followed by 260 species in 2009. Presently, the highest number of 289 species was observed. Compared to the limited observations done by myself in March 2010, which resulted in 18 new records (Bos, 2010), the present survey resulted in 78 new species.

Acknowledgements

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APPENDIX

Overview of fish species per family which have been observed in the Dive Hub Marine Protected Area since 2008.

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008	
Acanthuriidae	<i>Acanthurus</i>	<i>lineatus</i>			√	√	
	<i>Acanthurus</i>	<i>mata</i>	√		√	√	
	<i>Acanthurus</i>	<i>nigricans</i>	√		√		
	<i>Acanthurus</i>	<i>nigrofuscus</i>			√	√	
	<i>Acanthurus</i>	<i>pyroferus</i>	√		√	√	
	<i>Acanthurus</i>	<i>trioptegus</i>	√				
	<i>Ctenochaetus</i>	<i>xanthopterus</i>			√		
	<i>Ctenochaetus</i>	<i>binotatus</i>	√		√	√	
	<i>Ctenochaetus</i>	<i>cyanocheilus</i>			√	√	
	<i>Ctenochaetus</i>	<i>striatus</i>	√		√	√	
	<i>Ctenochaetus</i>	<i>tominiensis</i>	√	√			
	<i>Naso</i>	<i>annulatus</i>			√		
	<i>Naso</i>	<i>brachycentron</i>			√	√	
	<i>Naso</i>	<i>caeruleacauda</i>	√		√	√	
	<i>Naso</i>	<i>hexacanthus</i>				√	
	<i>Naso</i>	<i>lopezi</i>			√		
	<i>Naso</i>	<i>minor</i>	√		√	√	
	<i>Naso</i>	<i>unicornis</i>	√		√		
	<i>Naso</i>	<i>vlamingii</i>	√		√		
	<i>Zebrasoma</i>	<i>scopas</i>	√		√	√	
	Apogonidae	<i>Apogon</i>	<i>aureus</i>			√	√
		<i>Apogon</i>	<i>bandanensis</i>	√		√	
		<i>Apogon</i>	<i>compressus</i>	√		√	√
<i>Apogon</i>		<i>crassiceps</i>		√			
<i>Apogon</i>		<i>cyanosoma</i>	√		√		
<i>Apogon</i>		<i>exostigma</i>	√				
<i>Apogon</i>		<i>fraenatus</i>	√				
<i>Apogon</i>		<i>multilineatus</i>	√				
<i>Apogon</i>		<i>neotes</i>	√				
<i>Apogon</i>		<i>parvulus</i>	√				
<i>Apogon</i>		<i>sealei</i>	√		√		
<i>Apogon</i>		<i>taeniophorus</i>	√				
<i>Apogon</i>		<i>trimaculatus</i>	√				
<i>Archamia</i>		<i>biguttata</i>	√				
<i>Archamia</i>		<i>macroptera</i>	√				
<i>Archamia</i>		<i>melasma</i>			√		
<i>Cheilodipterus</i>		<i>artus</i>	√		√		
<i>Cheilodipterus</i>	<i>macrodon</i>	√		√			
<i>Cheilodipterus</i>	<i>quinquelineatus</i>	√		√	√		
<i>Fowleria</i>	<i>vaiulae</i>	√	√				
Aulostomidae	<i>Aulostomus</i>	<i>chinensis</i>	√		√	√	

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Balistidae	<i>Balistapus</i>	<i>undulatus</i>	√		√	√
	<i>Balistoides</i>	<i>conspicillum</i>	√			√
	<i>Balistoides</i>	<i>viridescens</i>	√		√	√
	<i>Melichthys</i>	<i>vidua</i>	√		√	
	<i>Odonus</i>	<i>niger</i>	√		√	√
	<i>Rhinecanthus</i>	<i>verrucosus</i>	√		√	√
	Belonidae	<i>Tylosurus</i>	<i>crocodilus</i>	√		√
Blennidae	<i>Ecsenius</i>	<i>pictus</i>	√			
	<i>Meiacanthus</i>	<i>grammistes</i>	√			
Caesionidae	<i>Petrosarptes</i>	<i>breviceps</i>	√			
	<i>Plagiotremus</i>	<i>rhinorhynchus</i>	√		√	√
	<i>Plagiotremus</i>	<i>tapeinosoma</i>			√	√
	<i>Caesio</i>	<i>caerulaurea</i>	√		√	√
	<i>Pterocaesio</i>	<i>pisang</i>	√		√	
Carangidae	<i>Pterocaesio</i>	<i>tesselata</i>			√	
	<i>Pterocaesio</i>	<i>tile</i>	√			
	<i>Carangoides</i>	<i>bajad</i>	√			
	<i>Carangoides</i>	<i>plagiotaenia</i>	√			
	<i>Caranx</i>	<i>melampygus</i>	√			
Chaetodontidae	<i>Caranx</i>	<i>sexfasciatus</i>	√			
	<i>Elagatis</i>	<i>bipinnulatus</i>	√			
	<i>Chaetodon</i>	<i>adiergastos</i>	√			
	<i>Chaetodon</i>	<i>auriga</i>	√		√	√
	<i>Chaetodon</i>	<i>baronessa</i>	√		√	√
	<i>Chaetodon</i>	<i>citrinellus</i>	√		√	
	<i>Chaetodon</i>	<i>epphipium</i>	√			
	<i>Chaetodon</i>	<i>kleini</i>	√		√	√
	<i>Chaetodon</i>	<i>lunula</i>	√			
	<i>Chaetodon</i>	<i>lunulatus</i>	√		√	√
	<i>Chaetodon</i>	<i>melannotus</i>	√		√	√
	<i>Chaetodon</i>	<i>ornatissimus</i>	√		√	√
	<i>Chaetodon</i>	<i>pundatofasciatus</i>	√		√	√
	<i>Chaetodon</i>	<i>rafflesi</i>	√		√	√
	<i>Chaetodon</i>	<i>selene</i>				√
	<i>Chaetodon</i>	<i>speculum</i>	√			
	<i>Chaetodon</i>	<i>trifascialis</i>	√		√	√
	<i>Chaetodon</i>	<i>ulietensis</i>	√			√
	<i>Chaetodon</i>	<i>unimaculatus</i>	√		√	√
	<i>Chaetodon</i>	<i>vagabundus</i>	√		√	√
	<i>Coradion</i>	<i>melanopus</i>			√	
	<i>Coradion</i>	<i>chrysozonus</i>				√
	<i>Forcipiger</i>	<i>flavissimus</i>	√		√	√
	<i>Forcipiger</i>	<i>longirostris</i>	√		√	√
	<i>Heniochus</i>	<i>chrysostomus</i>	√		√	
	<i>Heniochus</i>	<i>diphreutes</i>	√		√	
	<i>Heniochus</i>	<i>flavissimus</i>			√	
	<i>Heniochus</i>	<i>monoceros</i>	√			

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Chaetodontidae	<i>Heniochus</i>	<i>singularis</i>	√		√	
	<i>Heniochus</i>	<i>varius</i>	√		√	√
Cirrhitidae	<i>Cirrhitichthys</i>	<i>aprinus</i>		√		
	<i>Cirrhitichthys</i>	<i>falco</i>	√		√	√
	<i>Cirrhitichthys</i>	<i>oxycephalus</i>	√			
	<i>Paracirrhites</i>	<i>forsteri</i>			√	√
Congridae	<i>Heteroconger</i>	<i>hassi</i>	√			
Dactylopteridae	<i>Dactyloptera</i>	<i>orientalis</i>		√		
Diodontidae	<i>Cyclichthys</i>	<i>orbicularis</i>			√	
	<i>Diodon</i>	<i>liturosus</i>	√	√		
Echeneidae	<i>Echeneis</i>	<i>naucrates</i>	√			√
Ephippidae	<i>Platax</i>	<i>pinnatus</i>	√		√	
	<i>Platax</i>	<i>teira</i>	√		√	√
Fistulariidae	<i>Fistularia</i>	<i>commersoni</i>	√		√	
Gobiesocidae	<i>Discotrema</i>	<i>echinophila</i>	√			
Gobiidae	<i>Amblyeleotris</i>	<i>guttata</i>	√		√	
	<i>Amblyeleotris</i>	<i>randalli</i>			√	
	<i>Amblyeleotris</i>	<i>steinitzii</i>	√		√	
	<i>Amblyeleotris</i>	<i>wheeleri</i>		√		
	<i>Amblygobius</i>	<i>decussatus</i>	√		√	
	<i>Amblygobius</i>	<i>hectori</i>	√		√	√
	<i>Amblygobius</i>	<i>phalaena</i>			√	
	<i>Bryaninops</i>	<i>erythropterus</i>	√			
	<i>Coryphopterus</i>	<i>neophytus</i>	√			
	<i>Coryphopterus</i>	<i>signipinnis</i>	√			
	<i>Ctenogobiops</i>	<i>croceus</i>	√			
	<i>Ctenogobiops</i>	<i>tangaroai</i>			√	
	<i>Eviota</i>	<i>albolineata</i>	√			
	<i>Eviota</i>	<i>pellucida</i>	√	√		
	<i>Eviota</i>	<i>sebreei</i>	√			
	<i>Eviota</i>	<i>sp.</i>	√			
	<i>Gnatholepis</i>	<i>cauerensis</i>	√			
	<i>Istigobius</i>	<i>decoratus</i>	√			
	<i>Pleurosicya</i>	<i>labiata</i>	√			
	<i>Trimma</i>	<i>benjamini</i>	√			
<i>Trimma</i>	<i>sp.</i>	√				
<i>Trimma</i>	<i>stobbsi</i>	√				
<i>Valenciennesa</i>	<i>puellaris</i>			√		
<i>Valenciennesa</i>	<i>strigata</i>	√		√		
Haemulidae	<i>Diagramma</i>	<i>melanacrum</i>	√			
	<i>Diagramma</i>	<i>pictum</i>	√		√	
	<i>Plectorhinchus</i>	<i>chaetodonoides</i>	√			√
	<i>Plectorhinchus</i>	<i>gibbosus</i>	√			
	<i>Plectorhinchus</i>	<i>lessoni</i>	√		√	
	<i>Plectorhinchus</i>	<i>lineatus</i>	√			
	<i>Plectorhinchus</i>	<i>vittatus</i>				√

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Holocentridae	<i>Myripristis</i>	<i>berndti</i>			√	
	<i>Myripristis</i>	<i>kuntee</i>	√			√
	<i>Myripristis</i>	<i>murdjan</i>	√		√	
	<i>Sargocentron</i>	<i>caudimaculatum</i>	√			
	<i>Sargocentron</i>	<i>cornutum</i>			√	
	<i>Sargocentron</i>	<i>diadema</i>	√		√	
	<i>Sargocentron</i>	<i>melanospilos</i>			√	
	<i>Sargocentron</i>	<i>rubrum</i>	√			
	<i>Sargocentron</i>	<i>spiniferum</i>	√		√	
Kyphosidae	<i>Kyphosus</i>	<i>vaigiensis</i>	√		√	
Labridae	<i>Anampses</i>	<i>geographicus</i>			√	√
	<i>Anampses</i>	<i>melanurus</i>	√		√	
	<i>Anampses</i>	<i>meleagrides</i>	√		√	√
	<i>Anampses</i>	<i>twistii</i>	√		√	√
	<i>Bodianus</i>	<i>axillaris</i>			√	
	<i>Bodianus</i>	<i>diana</i>	√		√	√
	<i>Bodianus</i>	<i>mesothorax</i>	√		√	√
	<i>Cheililnus</i>	<i>fasciatus</i>	√		√	
	<i>Cheililnus</i>	<i>oxycephalus</i>			√	√
	<i>Cheililnus</i>	<i>trilobatus</i>	√		√	√
	<i>Cheililnus</i>	<i>undulatus</i>			√	
	<i>Cheilio</i>	<i>inermis</i>	√		√	√
	<i>Cirrhilabrus</i>	<i>cyanopleura</i>	√		√	√
	<i>Cirrhilabrus</i>	<i>exquisitus</i>	√			
	<i>Cirrhilabrus</i>	<i>lubbocki</i>			√	√
	<i>Coris</i>	<i>aygula</i>			√	
	<i>Coris</i>	<i>batuensis</i>	√		√	√
	<i>Coris</i>	<i>gaimard</i>	√		√	√
	<i>Diproctacanthus</i>	<i>xanthurus</i>	√		√	√
	<i>Epibulus</i>	<i>insidiator</i>	√		√	√
	<i>Gomphosus</i>	<i>varius</i>	√		√	√
	<i>Halichoeres</i>	<i>argus</i>	√		√	
	<i>Halichoeres</i>	<i>chrysus</i>	√		√	√
	<i>Halichoeres</i>	<i>hortulanus</i>	√		√	√
	<i>Halichoeres</i>	<i>marginatus</i>			√	√
	<i>Halichoeres</i>	<i>melanurus</i>	√		√	√
	<i>Halichoeres</i>	<i>nebulosus</i>	√			
	<i>Halichoeres</i>	<i>podostigma</i>	√		√	√
	<i>Halichoeres</i>	<i>prosopeion</i>	√		√	√
	<i>Halichoeres</i>	<i>richmondi</i>	√		√	√
	<i>Halichoeres</i>	<i>scapularis</i>	√		√	√
	<i>Halichoeres</i>	<i>solorensis</i>			√	√
	<i>Hemigymmus</i>	<i>fasciatus</i>	√		√	√
<i>Hemigymmus</i>	<i>melapterus</i>	√		√	√	
<i>Hologymmosus</i>	<i>annulatus</i>			√		
<i>Labrichthys</i>	<i>unilineatus</i>	√		√	√	
<i>Labroides</i>	<i>bicolor</i>	√		√	√	
<i>Labroides</i>	<i>dimidiatus</i>	√		√	√	

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Labridae	<i>Labropsis</i>	<i>manabei</i>				√
	<i>Macropharyngodon</i>	<i>meleagris</i>	√		√	√
	<i>Macropharyngodon</i>	<i>negrosensis</i>	√		√	√
	<i>Novaculichthys</i>	<i>taeniourus</i>	√			
	<i>Oxycheilinus</i>	<i>celebicus</i>	√		√	√
	<i>Oxycheilinus</i>	<i>diagrammus</i>	√		√	√
	<i>Oxycheilinus</i>	<i>rhodochrous</i>	√			
	<i>Pseudocheilinus</i>	<i>evanidus</i>	√		√	√
	<i>Pseudocheilinus</i>	<i>hexataenia</i>	√		√	√
	<i>Pseudocoris</i>	<i>yamashiroi</i>			√	√
	<i>Pseudodax</i>	<i>mollucanus</i>	√		√	√
	<i>Pterogogus</i>	<i>enneacanthus</i>	√		√	
	<i>Pterogogus</i>	<i>cryptus</i>	√		√	√
	<i>Stethojulis</i>	<i>bandanensis</i>	√		√	√
	<i>Stethojulis</i>	<i>interrupta</i>	√		√	√
	<i>Stethojulis</i>	<i>trilineatus</i>	√		√	
	<i>Thalassoma</i>	<i>hardwicke</i>	√		√	√
	<i>Thalassoma</i>	<i>lunare</i>	√		√	√
	<i>Thalassoma</i>	<i>quinquivittatum</i>	√			
	Lethrinidae	<i>Lethrinus</i>	<i>erythracanthus</i>	√		√
<i>Lethrinus</i>		<i>ornatus</i>	√		√	√
<i>Monotaxis</i>		<i>grandoculis</i>	√		√	√
Lutjanidae	<i>Lutjanus</i>	<i>argenti maculatus</i>	√		√	
	<i>Lutjanus</i>	<i>biguttatus</i>			√	√
	<i>Lutjanus</i>	<i>bohar</i>	√		√	
	<i>Lutjanus</i>	<i>decussatus</i>	√		√	√
	<i>Lutjanus</i>	<i>ehrenbergii</i>	√		√	√
	<i>Lutjanus</i>	<i>fulviflamma</i>			√	√
	<i>Lutjanus</i>	<i>fulvus</i>	√		√	√
	<i>Lutjanus</i>	<i>gibbus</i>			√	
	<i>Lutjanus</i>	<i>monostigma</i>	√		√	
	<i>Lutjanus</i>	<i>rivulatus</i>	√		√	
	<i>Lutjanus</i>	<i>russeli</i>			√	
	<i>Macolor</i>	<i>macularis</i>	√		√	√
	Malacanthidae	<i>Malacanthus</i>	<i>latovittatus</i>			√
Monacanthidae	<i>Aluterus</i>	<i>scriptus</i>	√		√	√
	<i>Amanses</i>	<i>scopas</i>	√		√	√
	<i>Oxymonacanthus</i>	<i>longirostris</i>	√		√	√
	<i>Paraluterus</i>	<i>prionurus</i>		√		
Mugilidae	<i>Crenimugil</i>	<i>crenilabis</i>	√			
Mullidae	<i>Mulloidichthys</i>	<i>flavolineatus</i>	√		√	√
	<i>Mulloidichthys</i>	<i>vanicolensis</i>	√			√
	<i>Parupeneus</i>	<i>barberinus</i>	√		√	√
	<i>Parupeneus</i>	<i>bifasciatus</i>	√		√	√
	<i>Parupeneus</i>	<i>cyclostomus</i>	√			√
	<i>Parupeneus</i>	<i>multifasciatus</i>	√		√	√
	<i>Parupeneus</i>	<i>pleurostigma</i>	√		√	√
	<i>Upeneus</i>	<i>tragula</i>	√			

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	Stockwell 2008	
Muraenidae	<i>Gymnothorax</i>	<i>fimbriatus</i>	√	√			
	<i>Gymnothorax</i>	<i>javanicus</i>	√				
	<i>Rhinomuraena</i>	<i>quaesita</i>	√				
	<i>Siderea</i>	<i>thyrsoides</i>	√				
Nemipteridae	<i>Scolopsis</i>	<i>affinis</i>	√		√	√	
	<i>Scolopsis</i>	<i>bilineatus</i>	√		√	√	
	<i>Scolopsis</i>	<i>ciliata</i>	√		√	√	
	<i>Scolopsis</i>	<i>lineatus</i>			√		
Ophichthidae	<i>Scolopsis</i>	<i>monogramma</i>	√	√			
	<i>Brachysomophis</i>	<i>henshawi</i>	√				
	<i>Ophichthus</i>	<i>bonaparti</i>	√				
Ophichthidae	<i>Ophichthus</i>	<i>cephalozona</i>	√				
	<i>Brotula</i>	<i>multibarbata</i>	√				
Ophidiidae	<i>Lactoria</i>	<i>cornuta</i>	√				
Ostraciidae	<i>Ostracion</i>	<i>cubicus</i>	√		√		
	<i>Ostracion</i>	<i>meleagris</i>	√				
	<i>Ostracion</i>	<i>solorensis</i>	√				
Pinguipedidae	<i>Parapercis</i>	<i>clathrata</i>	√				
Platycephalidae	<i>Thysanophrys</i>	<i>otaitensis</i>				√	
	<i>Thysanophrys</i>	<i>arenicola</i>	√				
Plotosidae	<i>Plosotus</i>	<i>lineatus</i>	√				
Pomacanthidae	<i>Centropyge</i>	<i>bicolor</i>	√		√	√	
	<i>Centropyge</i>	<i>nox</i>			√	√	
	<i>Centropyge</i>	<i>tibicen</i>	√		√	√	
	<i>Centropyge</i>	<i>vroliki</i>	√		√	√	
	<i>Genicanthus</i>	<i>lamarck</i>	√		√	√	
	<i>Pomacanthus</i>	<i>imperator</i>	√		√		
	<i>Pomacanthus</i>	<i>navarchus</i>	√		√	√	
	<i>Pygoplites</i>	<i>diacanthus</i>	√		√	√	
	Pomacentridae	<i>Abudefduf</i>	<i>lorenzi</i>	√			√
		<i>Abudefduf</i>	<i>sexfasciatus</i>	√		√	√
		<i>Abudefduf</i>	<i>vaigiensis</i>	√		√	√
		<i>Amblyglyphidodon</i>	<i>aureus</i>	√		√	√
		<i>Amblyglyphidodon</i>	<i>curacao</i>	√		√	√
		<i>Amblyglyphidodon</i>	<i>leucogaster</i>	√		√	√
<i>Amphiprion</i>		<i>clarkii</i>	√		√	√	
<i>Amphiprion</i>		<i>frenatus</i>	√		√	√	
<i>Amphiprion</i>		<i>ocellaris</i>	√		√	√	
<i>Amphiprion</i>		<i>perideraion</i>	√		√	√	
<i>Amphiprion</i>		<i>sandaracinos</i>	√		√	√	
<i>Chromis</i>		<i>amboinensis</i>	√		√	√	
<i>Chromis</i>		<i>analis</i>	√		√	√	
<i>Chromis</i>		<i>atripectoralis</i>	√		√	√	
<i>Chromis</i>	<i>caudalis</i>			√			
<i>Chromis</i>	<i>delta</i>			√			
<i>Chromis</i>	<i>margaritifer</i>	√		√	√		
<i>Chromis</i>	<i>retrofasciata</i>	√		√	√		
<i>Chromis</i>	<i>ternatensis</i>	√		√	√		

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Pomacentridae	<i>Chromis</i>	<i>viridis</i>	√		√	√
	<i>Chromis</i>	<i>weberi</i>	√		√	√
	<i>Chromis</i>	<i>xanthura</i>			√	√
	<i>Chrysiptera</i>	<i>cyanea</i>	√		√	
	<i>Chrysiptera</i>	<i>rollandi</i>	√		√	√
	<i>Chrysiptera</i>	<i>springeri</i>			√	√
	<i>Chrysiptera</i>	<i>talboti</i>	√		√	√
	<i>Chrysiptera</i>	<i>unimaculatus</i>			√	√
	<i>Dascyllus</i>	<i>aruanus</i>	√		√	√
	<i>Dascyllus</i>	<i>reticulatus</i>	√		√	√
	<i>Dascyllus</i>	<i>trimaculatus</i>	√		√	√
	<i>Neoglyphidodon</i>	<i>melas</i>	√		√	√
	<i>Neoglyphidodon</i>	<i>nigroris</i>	√		√	√
	<i>Neopomacentrus</i>	<i>anabatooides</i>			√	
	<i>Plectroglyphidodon</i>	<i>dickii</i>	√		√	√
	<i>Plectroglyphidodon</i>	<i>lacrymatus</i>	√		√	√
	<i>Pomacentrus</i>	<i>adelus</i>			√	√
	<i>Pomacentrus</i>	<i>amboinensis</i>			√	√
	<i>Pomacentrus</i>	<i>bankanensis</i>	√		√	√
	<i>Pomacentrus</i>	<i>brachialis</i>	√		√	√
	<i>Pomacentrus</i>	<i>chrysus</i>	√			
	<i>Pomacentrus</i>	<i>coelestis</i>			√	√
	<i>Pomacentrus</i>	<i>lepidogenys</i>			√	√
	<i>Pomacentrus</i>	<i>moluccensis</i>	√		√	√
	<i>Pomacentrus</i>	<i>nigromarginatus</i>			√	√
	<i>Pomacentrus</i>	<i>opisthostigma</i>			√	√
	<i>Pomacentrus</i>	<i>stigma</i>			√	√
	<i>Pomacentrus</i>	<i>tripunctatus</i>			√	
	<i>Pomacentrus</i>	<i>vaiuli</i>	√		√	√
	<i>Stegastes</i>	<i>nigricans</i>	√			
Priacanthidae	<i>Heteropriacanthus</i>	<i>cruentatus</i>				√
	<i>Priacanthus</i>	<i>hamrur</i>	√	√		
Pseudochromidae	<i>Pseudochromis</i>	<i>bitaeniatus</i>	√			
	<i>Pseudochromis</i>	<i>fuscus</i>			√	
Scaridae	<i>Chlorurus</i>	<i>bleekeri</i>	√		√	√
	<i>Chlorurus</i>	<i>japonicus</i>			√	
	<i>Scarus</i>	<i>chameleon</i>			√	√
	<i>Scarus</i>	<i>dimidiatus</i>	√		√	√
	<i>Scarus</i>	<i>niger</i>	√		√	√
	<i>Scarus</i>	<i>oviceps</i>	√			
	<i>Scarus</i>	<i>prasiognathus</i>			√	
	<i>Scarus</i>	<i>psittacus</i>			√	√
	<i>Scarus</i>	<i>quoyi</i>	√		√	√
	<i>Scarus</i>	<i>rivulatus</i>	√		√	
	<i>Scarus</i>	<i>sordidus</i>	√			
	<i>Scarus</i>	<i>spinus</i>	√		√	√
	<i>Scarus</i>	<i>tricolor</i>			√	

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008	
Scorpaenidae	<i>Pterois</i>	<i>antennata</i>	√		√	√	
	<i>Pterois</i>	<i>mombasae</i>	√				
	<i>Pterois</i>	<i>volitans</i>	√		√	√	
	<i>Scorpaenopsis</i>	<i>papuensis</i>		√			
	<i>Scorpaenopsis</i>	<i>venosa</i>	√	√			
	<i>Taenianotus</i>	<i>triacanthus</i>	√			√	
Serranidae	<i>Anyperodon</i>	<i>leucogrammicus</i>	√		√		
	<i>Cephalopholis</i>	<i>argus</i>	√		√	√	
	<i>Cephalopholis</i>	<i>boenak</i>				√	
	<i>Cephalopholis</i>	<i>cyanostigma</i>	√		√	√	
	<i>Cephalopholis</i>	<i>leopardus</i>			√	√	
	<i>Cephalopholis</i>	<i>microprion</i>	√		√	√	
	<i>Cephalopholis</i>	<i>miniata</i>				√	
	<i>Cephalopholis</i>	<i>spiloparaea</i>			√		
	<i>Cephalopholis</i>	<i>urodeta</i>	√		√	√	
	<i>Diplorion</i>	<i>bifasciatum</i>	√		√	√	
	<i>Epinephelus</i>	<i>fasciatus</i>	√		√	√	
	<i>Epinephelus</i>	<i>merra</i>	√		√	√	
	<i>Epinephelus</i>	<i>ongus</i>		√			
	<i>Plectropomus</i>	<i>leopardus</i>			√		
	<i>Plectropomus</i>	<i>oligacanthus</i>				√	
	<i>Pseudanthias</i>	<i>dispar</i>	√		√	√	
	<i>Pseudanthias</i>	<i>huchtii</i>	√		√	√	
	<i>Pseudanthias</i>	<i>squamipinnis</i>			√	√	
	<i>Pseudanthias</i>	<i>tuka</i>	√		√	√	
	<i>Variola</i>	<i>louti</i>			√	√	
	Siganidae	<i>Siganus</i>	<i>canaliculatus</i>	√			
		<i>Siganus</i>	<i>corallinus</i>			√	√
<i>Siganus</i>		<i>guttatus</i>	√		√		
<i>Siganus</i>		<i>puellus</i>	√				
<i>Siganus</i>		<i>spinus</i>	√				
<i>Siganus</i>		<i>unifasciatus</i>			√		
Solenostomidae	<i>Solenostomus</i>	<i>cyanopterus</i>				√	
Sphyraenidae	<i>Sphyraena</i>	<i>forsteri</i>	√		√		
	<i>Sphyraena</i>	<i>barracuda</i>	√		√	√	
	<i>Sphyraena</i>	<i>flavicauda</i>	√			√	
Synanceiidae	<i>Inimicus</i>	<i>didactylus</i>		√			
	<i>Synanceia</i>	<i>verrucosa</i>	√				
Syngnathidae	<i>Doryrhamphus</i>	<i>dactyliophorus</i>	√				
	<i>Doryrhamphus</i>	<i>pessuliferus</i>	√				
Synodontidae	<i>Halicampus</i>	<i>mataafae</i>		√			
	<i>Saurida</i>	<i>gracilis</i>		√			
	<i>Synodus</i>	<i>binotatus</i>	√				
	<i>Synodus</i>	<i>variegatus</i>	√		√		
	<i>Synodus</i>	<i>rubromarmoratus</i>				√	

Family	Genus	species	Present Survey	Bos 2010	Nillos & Stockwell 2009	2008
Tetraodontidae	<i>Arothron</i>	<i>mappa</i>	√		√	√
	<i>Arothron</i>	<i>nigropunctatus</i>	√		√	√
	<i>Arothron</i>	<i>stellatus</i>	√		√	
	<i>Canthigaster</i>	<i>coronata</i>			√	
	<i>Canthigaster</i>	<i>papua</i>	√		√	√
	<i>Canthigaster</i>	<i>valentini</i>	√		√	√
	<i>Sufflamen</i>	<i>bursa</i>	√		√	
Zandidae	<i>Zandus</i>	<i>comutus</i>	√		√	√
Carcharhinidae	<i>Triaenodon</i>	<i>obesus</i>	√			
Total	379		290	18	260	201