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Assessment of Reef Fish Abundance and Biomass in the Pujada Bay Corridor of Davao Oriental for Marine Protected Area Management

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ABSTRACT

The five marine protected areas (MPA) covered by this study are located in the barangays of Luban, Lanca and Lawigan in Mati City; Barangay San Ignacio in Manay; and Barangay Jovellar in Tarragona. Fish visual census was used to determine reef fish abundance and biomass inside the MPAs. The same assessment was also done in representative sites outside of the MPAs for comparison. Of the five sites, Barangay Luban MPA has the best reef fish assemblage, having moderate fish abundance and high fish biomass. On the other hand, Barangay Lanca has the lowest fish abundance and biomass among the sites. Target species have comprised most of the biomass inside the MPAs except in Barangay Lanca and San Ignacio, wherein non-target species contributed more to the biomass. It was also in these two areas that abundance and biomass outside the MPAs were higher than inside. It is hoped that effective management efforts of these MPAs will solve the present problem of low stocks and improve the assemblage, abundance, and biomass inside the MPAs including as well the outside marine reserves through spillover effect.

Keywords: reef fish, fish abundance, fish biomass, marine protected area, Integrated Coastal Resource Management Project

INTRODUCTION

The province of Davao Oriental straddles the southeastern coastline of Mindanao. Its municipalities sharing the waters of the Philippine Sea to the east, and Pujada Bay and Davao Gulf to the south. The resources along the extensive coastal and marine area of the province provide important goods and services to the community such as food, livelihood, recreation, and education. I Fisheries, in particular, play a vital role in the socioeconomic landscape of Davao Oriental as it provides readily available food and livelihood opportunities to what is predominantly a coastal community. But increasing consumer demand for marine products has led to their overexploitation and unscrupulous harvesting methods which inevitably resulted in the destruction of coastal habitats.2

Sustaining the coastal and marine resources of Davao Oriental, especially fisheries, is crucial in ensuring food security not just of the province but also of neighboring cities and towns. As such, it is important that they be managed properly. This has become even more imperative as most of the fishing grounds in the country are now overexploited.3 Over the years, fishery managers have developed numerous measures to regulate fishing efforts and outputs so that overfishing will be curbed.4 Among the suite of fisheries management interventions is the establishment of MPAs. It is more preferred by managers because of better return of natural fisheries stocks.

Through the establishment of MPAs, marine ecosystems are allowed to return to their natural state with concomitant increase in biodiversity.6 The degree of protection in different MPA types varies but, in most cases, MPA core zones are strictly no-take zones surrounded by buffer zones where specific forms of fishing and non-extractive activities may be allowed. The underlying concept is that one requisite for MPAs to become successful is to limit the fishing effort to a minimum.7

Municipalities in Davao Oriental have initiated the establishment of their respective MPAs to comply with stipulations set forth in Republic Act 7160 (Local Government Code of 1991) and RA8550 (The Philippine Fisheries Code). Like most community-based MPAs, however, the resources to accomplish this task have been largely insufficient. The Integrated Coastal Resource Management Project (ICRMP) aimed to address this issue by providing the needed technical and financial support to coastal communities in Davao Oriental to set up MPAs.8

The main objective of this study was to provide the technical basis for the sustainable use and conservation of reef fishes in the MPAs of the Pujada Bay corridor and its adjacent waters of Southeastern Mindanao. Specifically, this study aimed to determine the coral reef fish abundance and biomass in five

MPAs, compare the diversity of the coral reef fish in the five MPAs, and provide baseline information for the formulation of management strategies for the MPAs, Being a coastal province, fisheries play a vital role in the everyday lives of the people of Davao Oriental. It is thus imperative to ensure that the goods and services the coastal and marine environment provides are sustained. It is for this reason that MPAs were established in the coastal municipalities of the province.

MATERIALS AND METHODS

Study Sites

Reef fish assemblages in five selected MPAs in the province of Davao Oriental were identified and assessed through the ICRMP. The five MPAs selected based on accessibility are as follow: Luban MPA in Barangay Luban, Lanca MPA in Barangay Lanca, Lawigan MPA in Barangay Lawigan, Rising Sun MPA in Barangay San Ignacio, Manay, and Jovellar MPA in Barangay Jovellar, Tarragona, the first three MPAs are all in Mati City.

Reef fish assessment

Coral reef fish abundance and species dominance were assessed using the fish visual census (FVC) described by English and others.8 At each study site, two selected sample areas for both inside and outside MPA were established and assessed. In the sampled area, and at depths of about 7.5 to 9 m, a 50 m transect line was laid on the reef bottom roughly parallel to the shore. A scuba diver recorded the fish encountered within 2.5 m on both sides and 5m above the transect line so that each transect covers an area about 250 m. The diver recorded the number of reef fish encountered every 5-meter interval, identifying each fish down to the species level. The diver also estimated the length in centimeters of each fish recorded.

Fish species are classified according to the following category: target, non-target, and coral indicator species. Target species are commercially important fishes while nontarget species belong to major demurrals. Coral indicator species are those that are coral -associated. Fish densities were determined by adding all individual's species recorded to 50 m by 5 m area. Biomass estimation were calculated using Length-Weight Relationship using the equation, W=aLb, which W is weight in gram, L is total length of fish in centimeter, and a and b are growth coefficient values taken from published length-weight data.9 Individual species biomass will be multiplied by the species count: Microsoft Excel program was utilized for further analyses on density and biomass.

Reef fish status was determined by comparing the inside and outside of the MPAs based on fish abundance and fish biomass, respectively according to the categories described by Hilomen and others10 and by Nañola and others ll as shown in Tables 1 and 2.

Table 1. Categories of sites according to fish abundance

Category	No. of individuals 1000 m^{-2}
Very poor	0 – 201
Poor	202 – 676
Moderate	667 – 2267
High	2268 – 7582
Very High	>7592

Source: Hilomen et al., 2000

Table 2. Categories of sites according to fish biomass

Category	Biomass in mt km^{-2}
Very Low	<5
Low	6 – 10
Medium	11 – 20
High	21 – 40
Very High	>41

Source: Nanola et al., 2006

RESULTS AND DISCUSSION

Fish biomass and fish abundance in the five selected MPA sites

Luban MPA, Barangay Luban, Mati City

The core zone of Barangay Luban MPA as well as a representative area outside of the MPA were assessed to describe the community structure of reef fish within and compare both their biomass and abundance (density) with those found outside the MPA. Biomass within the MPA was considerably higher for both target and non-target species as compared to those outside. Coral indicator species inside the MPA was only slightly higher than outside as shown in figure 1. The same trend was observed when comparing the relative abundance of target, non-target, and coral indicator species inside and outside the MPA (Figure 2).

The high biomass inside the MPA was primarily due to the abundance of target species, namely, the surgeonfish (*Acanthurus nigrofuscus*) and squirrelfish (*Myriptris mud* jan). The dominant non-target species were damselfishes (*A.*

polyacanthus and *C. margaritifer*) and wrasses (e.g., *Cirrilabrus cyanofleura*). Outside the MPA, surgeonfish (*A. nigrofuscus*) and squirrelfish (*M. murdjan*) were also the abundant target species while the dominant non-target species were damselfishes (*A. polyacanthus*, *C. margaritifer* and *P. lacrymatus*) and surgeonfish (*Zebrasoma scopas*).

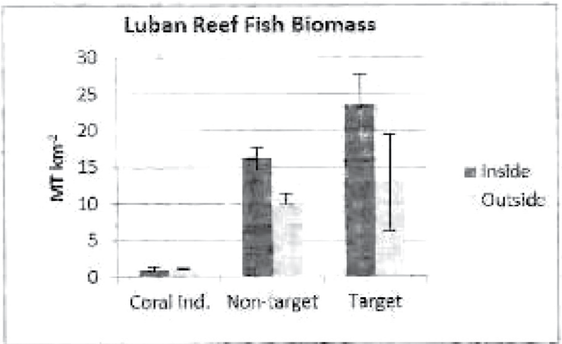

Figure 1. Comparison of reef fish biomass inside and outside of Barangay Luban MPA. Error bars = ± S.E.

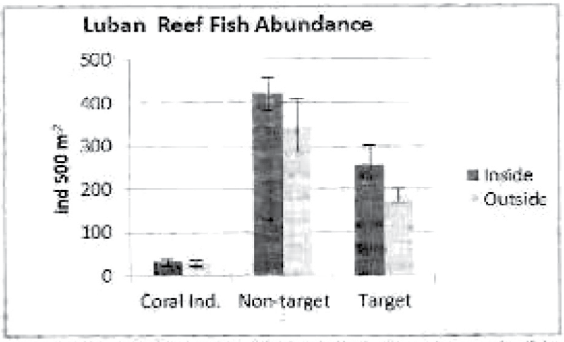

Figure 2. Comparison of reef fish abundance inside and outside of Barangay Luban MPA. Error bars = ± S.E.

Lanca MPA, Barangay Lanca, Mati City

Reef fish biomass and abundance outside the MPA was higher than biomass and abundance inside the MPA (Figures 3 and 4). Inside the MPA, fish biomass and abundance for non-target species were higher than those of target species. The most dominant target species were surgeonfishes (*A. nigrofuscus* and *C. binotatus*) while the dominant non-target species were damselfishes (*A. polyacanthus*, *C. margaritifer* and *P. lacrymatus*). Outside the MPA, the biomass for target species (*A. nigrqfuscus* and *C. binotatus*) was higher than non-targets but abundance of targets was lower than that for non-target species (Figures 3 and 4). This indicates the presence of some large target species outside the MP A. Damselfishes (A. *polyacanthus* and *C marga* ritifer) were the most abundant species outside the protected area. The high fish biomass and abundance observed outside the MPA maybe due to less human settlers at the coast line where established site was made and several settlers were observed near the coastal area near the MPA site.

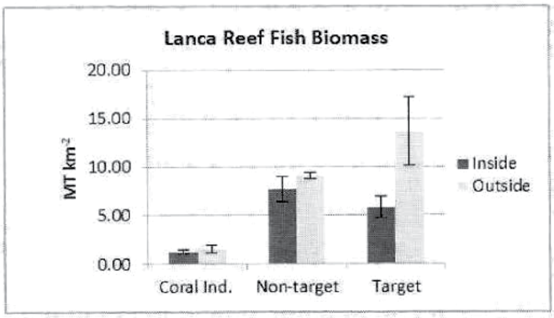

Figure 3. Comparison of reef fish biomass inside and outside of Barangay Lanca MPA. Error bars = ± S.E.

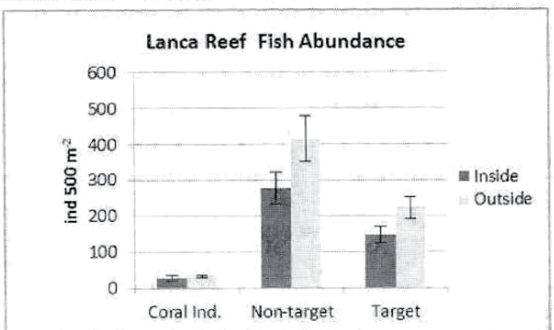

Figure 4. Comparison of reef fish abundance inside and outside of Barangay Lanca MPA. Error bars = ± S.E.

Lawigan MPA, Barangay Lawigan, City of Mati

Reef fish biomass inside of the MPA in Barangay Lawigan was higher for target, nontarget, and coral indicator species compared to the reef fish biomass outside (Figure 5). Abundance inside the MPA, however, was only slightly higher as shown in figure 6. This indicated bigger sizes of fish inside the MPA compared to those outside while smaller-sized fishes abound outside, particularly of the non—target kind. Surgeonfishes, *A. nigrofuscus* and *C. striatusz* were the dominant target species inside the MPA while damselfishes (*A. polyacanthus*, *C. margaritifér* and *P. lacrymatus*) were the abundant non-target species. Damselfishes (*A. polyacanthus* and *C. margaritifer*) were also the dominant nontarget species outside of the MPA while *C. binotatus* was the abundant target species.

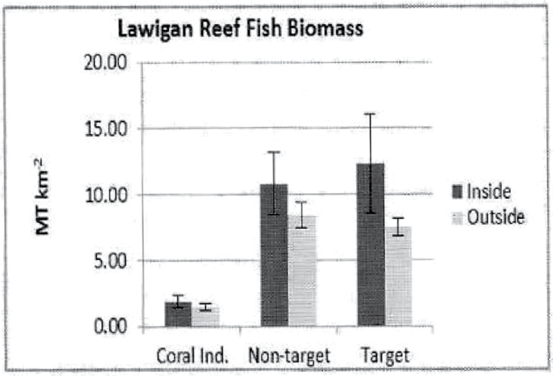

Figure 5. Comparison of reef fish biomass inside and outside of Barangay Lawigan MPA. Error bars = ± S.E.

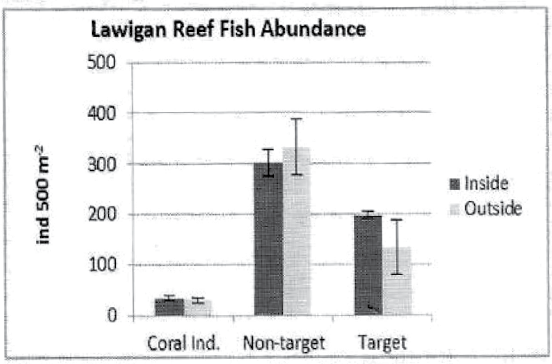

Figure 6. Comparison of reef fish abundance inside and outside of Barangay Lawigan MPA. Error bars = ± S.E.

Rising Sun MPA, Barangay San Ignacio, Manay

Fish biomass inside and outside the MPA did not differ much from each other (Figure 7) except in composition. The biomass of non-target species inside the MPA was almost doubled than that of the outside while biomass of target species outside the MPA was more than twice the biomass inside (Figure 7).

There were also more coral indicator species inside the MPA.

Results showed more individual life forms were outside the MPA than inside (Figure 8), The almost comparable biomass despite the higher abundance outside of the MPA was due to the greater number of schooling fishes outside of the MPA dominated by fusiliers (Pterocaesio sp. and Caesio sp.) and snappers (Lutjanus gibbus).

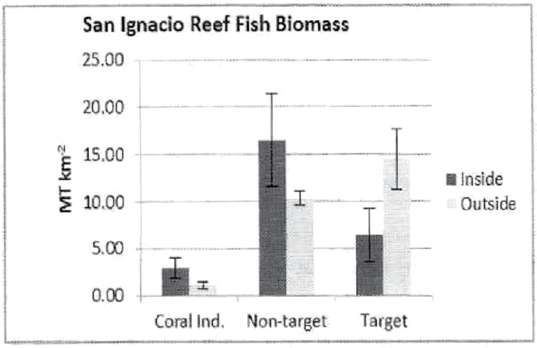

Figure 7. Comparison of reef fish biomass inside and outside of Barangay San Ignacio MPA. Error bars = ±S.E.

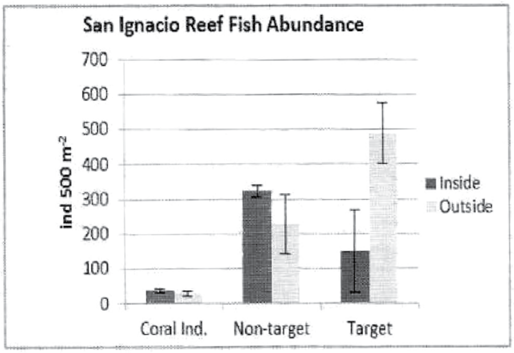

Figure 8. Comparison of reef fish abundance inside and outside of Barangay San Ignacio MPA.Error bars =±S.E.

Inside the MPA, fusiliers (Pterocaesio sp. and Caesio sp.) dominated among the target species. Non-target species that dominated outside the MPA are damselfishes (A. polyacanthus, D. reticulates, Chromis margaritifer and Plectroglyphidodon lacrymatus) same as inside the MPA.

Jovellar MPA, Barangay Jovellar, Tarragona

Generally, fish biomass and abundance inside of the MPA was considerably lower for non-target and coral indicator species (Figures 9 and 10) except for target.

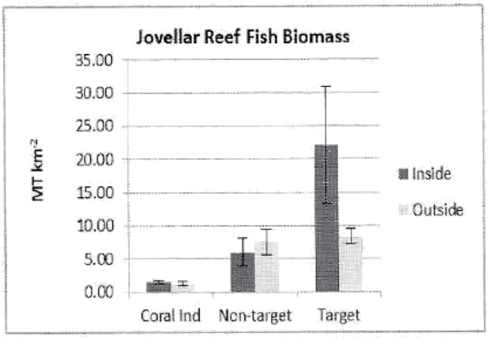

Figure 9. Comparison of reef fish biomass inside and outside of Barangay Jovellar MPA. Error bars = ± S.E.

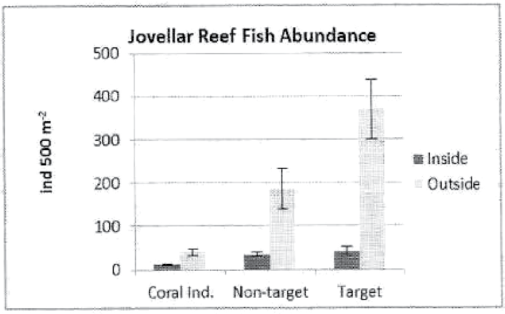

Figure 10. Comparison of reef fish abundance inside and outside of Barangay Jovellar MPA. Error bars = ± S.E.

The high biomass and abundance den sity of target species in non-reserve areas was due to the observed schooling of carnivorous snappers (Lutj anidae) and fussilers (Caesionidae). Surgeonfishes (Acanthuridae), goatfishes (Mullidae) and parrotfishes (Scaridae) also added to the increased biomass and density of target species outside the MPA.

Patterns and trends

A summary of the results of the status is given in Tables 3 and 4 to demonstrate comparison between sites. Table 3 reports fish abundance in terms of number of individuals (ind) 500 m-2 and fish biomass in metric tons per square kilometer (mt km-2). Using the categories for fish abundance used by Hilo men and others 10 and adopting that for fish biomass used by Nanola's group,11 the sites surveyed were thus compared as shown in Table 4.

Table 3. Comparison of reef fish status between Inside and Outside MPA

Sites	Fish Abundance (ind 500 m^{-2})						Fish Biomass (mt km^{-2})					
	In			Out			In			Out		
	T	*NT*	*CI*	*T*	*NT*	*CI*	*T*	*NT*	*CI*	*T*	*NT*	*CI*
Luban	254	422	31.25	184	346	29	15.66	10.74	0.67	8.58	7.04	0.72
Lanca	146.5	277.5	28.75	221.75	415	33.25	3.88	5.10	0.82	9.08	6.02	1.01
San Ignacio	148.75	323.5	36.25	489.5	226.75	28.75	4.29	11.01	1.92	9.62	6.92	0.76
Jovellar	231.5	83.5	18.3	370.75	185.75	40.5	8.21	3.52	0.96	6.66	5.03	0.83
Lawigan	197.25	301.5	34	134	333	30.25	8.21	7.22	1.25	5.01	5.62	1

Table 4. Site classification in terms of reef fish abundance and biomass using the categories of Hilomen et al.[10] and Nañola et al.[11]

Sites	Fish Abundance		Fish Biomass	
	In	*Out*	*In*	*Out*
Luban	Moderate	Moderate	High	Medium
Lanca	Moderate	Moderate	Low	Medium
San Ignacio	Moderate	Moderate	Medium	Medium
Jovellar	Poor	Moderate	Medium	Medium
Lawigan	Moderate	Moderate	Medium	Medium

The MPA in Barangay Luban has the highest fish abundance for target, non-target, and coral indicator species among the five MPA sites. It also has the greatest number of targets or commercially important species at 254 ind 500 m-2. Interestingly, the highest abundance of reef fish was found outside the MPA of San Ignacio which has the highest number of target species at 489.5 ind 500 m-2. The target species outside of this MPA sites, however; are small-bodied fishes which translated to a fish biomass of 9.62 mt km 2 comparable with the estimated biomass outside the MPAs of Lanca and Luban.

In terms of fish biomass, the MPA in Barangay Luban still has the highest, with target species making up most of it at 15.66 mt km-2. The MPA with the least number of targets and the lowest fish abundance among the five sites is the MPA in Barangay Lanca; it also has the lowest fish biomass. Barangay Luban and Barangay Lawigan have significantly higher abundance and biomass inside the MPA than outside. Table 4 showed all sites outside the MPA have moderate fish abundance using the categories of Hilomen's group10 and medium fish biomass employing the classification of Nanola and others.11 Inside the MPAs, only MPA Barangay Jovellar has poor fish abundance despite having medium fish biomass. This indicates that although fewer fishes were encountered, these were comparably bigger in size. However, MPA Barangay Lanca has low biomass even if it has a moderate fish abundance. This implies that majority of the fish counted were small-sized.

Generally, small-bodied fishes are more dominant even among the target species. A look at the composition of target species would also reveal that top carnivores and herbivores were under represented in all the sites. This suggests that such species are already over-exploited and depleted in these waters.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

During the conduct of participatory coastal resource assessment along the coastal areas of Mati City in 2003 and 2004, fishers conveyed that fish catch has been decreasing over the years. This was largely due to poor implementation of the law that prohibits the use of illegal fishing methods such as fine mesh nets, blast fishing and cyanide. Interviewed fishers said that their present catch in the reef area averaged only 2 kg/fisher/trip.12 It is this declining trend that convinced fishers to support the establishment of MPAs in their localities.

In the conduct of this study, community members also revealed that illegal fishing is still rampant, especially in Barangay Luban and Barangay Lanca. Specifically, compressor fishers from other areas have been known to encroach in the said barangays, often fishing within the MPAs or its buffer zone. Com pressor fishing is particularly detrimental to reef fishes and their habitats because it allows the diver to fish in a highly selective manner and high valued and rare marine organisms are often targeted.13 Moreover, compressor fishing is often accompanied by the use of cyanide which forces the fishes out of their habitats and also poisons the corals. As compressor fishers conduct their activity during nighttime, it is difficult for the MPA enforcement teams to apprehend or even to identify the instigators. Illegal fishers thus remain unpunished, especially as MPA management lack the resources to do so.

Through the ICRMP, MPAs were provided materials and equipment needed to strengthen enforcement and management (e.g., buoys, patrol boats, signage, etc.). The capabilities of enforcement teams were also enhanced and alternative livelihood opportunities given. The project also heightened the community's awareness and appreciation for the establishment of MPAs. Community involvement is critical to the success of MPA but it is also usually tentative during the early stages of MPA establishment as benefits from protection are as yet intangible.14-16 It is hoped that the mechanisms the project put in place would be sufficient to sustain the participation of community members to effectively govern marine sanctuaries. Where the conservation of the marine reserve and the recovery of habitat and species are sustained, the community will eventually realize that this translates to benefits that redound to them.17

While the MPA sites studied here as well as the areas around them still have moderate fish abundance and moderate fish biomass, managers should not be too complacent. A closer look at the composition (Table 3) would reveal that for some of the sites, non -targets and not the target species make up most of the biomass. This is also an indicator that the area has been overexploited, and commercially viable demersal fishes are already dwindling. Managers have to be extra vigilant in enforcing protection within marine reserves if they wish to reverse the declining trend. The outlook is optimistic, as studies have shown MPAs to be effective in conserving sedentary fish (e.g., groupers, snappers, etc.). These species show high site fidelity and within a few years, fish abundance and fish biomass of these high-valued species have been shown to increase.16,18 Fishers benefit from this increase through the spill-over effect or the exportation of biomass and larvae to fished areas adjacent to the MPA. This enhances as well the fish populations of those areas. 19,20 Moreover, the species composition will change and become more selective towards the target species, thereby increasing the market value of fishery.17

MPAs play crucial and multiple roles within the context of an integrated management of coastal and marine resources. It acts as a biodiversity conservation strategy, as a fisheries management tool, as security for future livelihood, as buffer against environmental perturbations, and as a potential eco-tourism site. This study was conducted to assess the present status of the MPAs in terms of the abundance and biomass of its reef fish assemblage. As the MPAs are still in their infancy, the impacts of protection are not as yet apparent. Future monitoring and comparison with adjacent areas similarly exposed will determine whether MPAs are achieving the objectives they were established for. Experiences and lessons from other well governed MPAs, show much promise and should motivate support for this conservation and management strategy.

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Supplemental Data

Fish composition of the five MPAs

Species	Lawigan	Luban	Lanca	Jovellar	San Ignacio
Abudefduf septemfasciatus				✓	
Abudefduf sexfasciatus	✓	✓	✓		
Abudefduf sordidus				✓	
Abudefduf vaigensis				✓	
Acanthochromis polyacanthus	✓	✓	✓	✓	✓
Acanthurus sp.	✓				
Acanthurus auranticavus				✓	
Acanthurus blochii	✓	✓		✓	
Acanthurus fowleri			✓	✓	
Acanthurus guttatus			✓		

Species	Lawigan	Luban	Lanca	Jovellar	San Ignacio
Cheilinus fasciatus		✓			✓
Cheilinus green	✓				
Cheilinus oxycephalus	✓				
Cheilinus trilobatus			✓		
Chello inermis	✓		✓		
Cheilodipterus singapurensis		✓	✓		
Chlorurus bleekeri	✓		✓	✓	
Chlorurus sordidus	✓	✓	✓		✓
Chromis weberi		✓			
Chromis agilis	✓		✓	✓	
Chromis amboinensis	✓	✓	✓	✓	✓
Chromis atripectoralis		✓			✓
Chromis margaritifer	✓	✓	✓	✓	✓
Chromis sp.	✓				
Chromis ternatensis	✓	✓	✓	✓	✓
Chromis viridis	✓	✓	✓	✓	✓
Chromis weberi					✓
Chrysiptera rex	✓			✓	✓
Chrysiptera talboti		✓			✓
Cirrilabrus cyanopleura		✓	✓	✓	✓
Coris gaimard	✓	✓	✓		
Ctenochaetus binotatus	✓	✓	✓	✓	✓
Ctenochaetus flavissimus	✓				
Ctenochaetus striatus	✓	✓	✓	✓	✓
Ctenochaetus tominiensis		✓	✓	✓	✓
Dascyllus reticulates	✓	✓	✓	✓	✓
Dascyllus trimaculatus	✓	✓	✓	✓	✓
Diphloprion trifasciatum	✓				
Epibulus insidator		✓	✓		
Epinephelus coioides					✓
Forcipiger flavissimus			✓		
Forcipiger longristis	✓	✓	✓		✓

Gnathodentex aureolineatus		✓		✓	✓
Gomphosus varius	✓	✓	✓	✓	✓
Halichoeres hortulanus	✓	✓	✓	✓	✓
Halichoeres melanochir	✓	✓	✓	✓	
Hemigymnus fasciatus	✓			✓	
Hemitaurichthys polylepis			✓		✓
Heniochus chrysustomus	✓	✓	✓	✓	✓
Heniochus varius	✓	✓	✓	✓	
Kyphosus vaigiensis				✓	
Labrichthys unilineatus	✓	✓	✓		✓
Labroides bicolor	✓				

Species	Lawigan	Luban	Lanca	Jovellar	San Ignacio
Labroides dimidiatus	✓	✓	✓	✓	✓
Letrinus sp.					✓
Lutjanus gibbus	✓		✓	✓	✓
Lutjanus kasmira				✓	
Lutjanus evulatus				✓	✓
Macolor macularis					✓
Macropharyngodon meleagris	✓	✓	✓	✓	✓
Malacanthus latovittatus			✓		
Melichthys vidua			✓		
Monotaxis grandoculis	✓	✓	✓	✓	✓
Myripristis hexagona	✓	✓	✓	✓	✓
Myripristis murdjan	✓	✓	✓		✓
Naso black	✓			✓	
Naso caeruleacauda		✓			✓
Naso lituratus	✓	✓	✓	✓	✓
Naso unicornis			✓	✓	
Nemateleotris magnifica	✓	✓	✓		
Neoglyphidodon melas				✓	
Neoglyphidodon nigroris	✓	✓		✓	
Neoniphon samara			✓		
Neopoma azysron			✓	✓	
Novaculichthys taniourus					✓
Ondonus niger	✓		✓		
Ostracion meleagris	✓	✓	✓		
Oxycheilinus diagrammus			✓		✓
Oxycheilinus unifasciatus	✓	✓	✓		
Paracanthurus hepatus			✓		
Paracirrhites arcatus	✓	✓	✓		✓
Paracirrhites forsteri	✓	✓	✓	✓	
Parapercis elatrata	✓	✓			✓
Parapercis clatrata	✓	✓			✓
Parupenaeus barbarinus	✓	✓	✓		✓
Parupeneus bifasciatus	✓	✓	✓	✓	
Parupeneus cyclostumos	✓			✓	✓
Parupeneus multifasciatus	✓	✓	✓	✓	
Pempheris vanicolensis	✓	✓			
Platax teira				✓	

Plectroglyphidodon dickii	✓	✓	✓	✓	✓
Plectroglyphidodon johnstonianus	✓	✓	✓		✓

Species	Lawigan	Luban	Lanca	Jovellar	San Ignacio
Plectroglyphidodon lacrymatus	✓	✓	✓	✓	✓
Plectroglyphidodon leucozonus				✓	
Plectropomus leopardus	✓			✓	
Plectropomus maculates				✓	
Pomacentrus grammorhyncus					✓
Pomacanthus semicircularis				✓	
Pomacentrus auriventrus	✓	✓	✓		
Pomacentrus bankanensis	✓	✓		✓	✓
Pomacentrus brachialis	✓	✓			
Pomacentrus coeleste					✓
Pomacentrus lepidogenys	✓	✓			✓
Pomacentrus moluccensis				✓	✓
Pomacentrus philippinus	✓			✓	
Pomacentrus vaiuli	✓	✓	✓		✓
Pseudocheilinus diagrammus			✓		
Pseudocheilinus hexataenia	✓	✓	✓		
Ptereleotris evides	✓	✓	✓	✓	✓
Pterocaesio pisang				✓	✓
Pterocaesio terres				✓	✓
Pterocaesio tile			✓	✓	✓
Pygoplites diacanthus			✓	✓	✓
Sargocentron diadema	✓	✓	✓		
Sargocentron melanospilos					✓
Sargocentron microstoma					✓
Sargocentron tiere					✓
Sargocentron yellow	✓				
Scarus bleekeri	✓			✓	
Scarus bowersi	✓	✓	✓	✓	
Scarus chameleon	✓	✓			
Scarus globban					✓
Scarus globiceps	✓	✓	✓	✓	
Scarus hypselopterus		✓			
Scarus niger		✓	✓	✓	
Scarus spinus			✓		
Scolopsis bilineatus	✓				
Siganus sp.	✓				
Siganus sp.	✓				✓
Stegaster sp.					✓
Stethojulis bandanensis	✓	✓	✓	✓	✓
Sufflamen chrysopterus	✓				

Species	Lawigan	Luban	Lanca	Jovellar	San Ignacio
Sufflamen fraenatus			✓		
Thalassoma lutescens	✓		✓		
Thalassoma Hardwicke	✓	✓	✓	✓	✓
Thalassoma jansenii	✓	✓	✓	✓	✓
Thalassoma lunare		✓	✓	✓	✓
Thalassoma quinquivittatum	✓		✓	✓	✓
Valenciennea strigata	✓	✓	✓	✓	✓
Variola (grouper)	✓				
Zanclus cornutus	✓	✓	✓	✓	✓
Zebrasoma scopas	✓	✓	✓	✓	✓
Zebrasoma veliferum		✓			
TOTAL	**115**	**107**	**105**	**97**	**95**