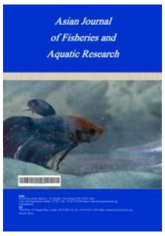

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Abundance, Species Diversity, and Conservation Status of Reef Fishes in Dumanquillas Bay, Zamboanga, Philippines

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Zamboanga is one of the significant fishing grounds in the Mindanao Region, but little is known about the conservation status of reef fishes, particularly in Dumanquillas Bay, Zamboanga. Thus, this study assessed the abundance, species diversity, and conservation status of reef fishes in the bay. The assessment was conducted within eight sampling stations from May 6 to May 16, 2014. Reef fishes were censused using a line-intercept method. Fourteen thousand fifty individuals and 140 fish species belonging to 30 families were recorded—dominated by the family Pomacentridae. The number of fish individuals was significantly more abundant in Triton Island Station than in other sampling stations, while Muyong Island has the most diverse reef fishes. Almost all species are classified as the least concern category, except for *Plectropomus areolatus* of Cabog Island, which is under the vulnerable (VU) category. The number of less-valued species was higher than the commercially high-valued species. Therefore, it may indicate the overharvest of the latter group of species. This comprehensive study on reef fishes in Dumangquillas Bay may serve as a reference for fisheries resource management planning or for drafting fisheries policies in the bay.

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Keywords: Biodiversity; reef fish conservation and management; Mindanao.

1. INTRODUCTION

Globally, the ever-increasing loss of marine diversity may result in the collapse of most taxa that are currently fished by the mid-21st century [1]. Over the past decades, fisheries grew significantly in terms of mechanical input (e.g., boat, increasing horsepower or fleet) and advanced fish finding equipment that led to an increase of catch at a rapid rate [2]. While the human population is growing, the demand for fish as an alternative, relatively cheap source of protein is also increasing [3]. Therefore, demand for additional fish supply in the market may increase, leading to the expansion of fishing activities. Additionally, different human activities (e.g., commercial fishing, subsistence fishing, recreational fishing, aquaculture, tourism, waters sports, coastal development, shipping, and industry) threaten the marine environment [4]. To address these problems, the government carried out the management intervention for fishery resources conservation, such as establishing marine protected areas, marine zoning, close seasons, and catch regulations. Through these practices, it is expected that the catch from stock will be ecologically sustainable in the long run and that the benefits of marine resources to the community will be gradually maximized [4]. For these purposes, scientific studies are needed, particularly in the local areas [5], such as municipal fishing grounds where various fishing gear are used. However, many marine areas in the Philippines have little or no scientific information to form a basis for managing their fisheries. In Zamboanga, although a closed fishing season for sardines is being implemented by the government [6], an assessment of the conservation status of other equally important commercial and ecologically important fish species in the region is lacking.

Larger pelagic species (e.g., *Thunnus* spp.) are inclined with long-range migration, while most coastal species migrate to and from nursery and spawning areas [4]. Coastal species are more susceptible to overfishing and disturbances; thus, marine diversity losses are higher in coastal areas [7]. Further, an upwelling phenomenon is observed along the coast of the Zamboanga Peninsula [8], which is associated with nutrient-rich surface water [4]. Therefore, seasonal accumulation of diverse faunal communities may be expected at different depths. Since Zamboanga is one of the significant fishing grounds in the Mindanao Region, it is necessary to assess the status of the fish species to support proper policy implementation. Although previous studies were carried out in the waters of Zamboanga that focused on marine resources and utilization [9], there is still limited information about the conservation status of reef fishes in the area. Thus, this paper aims to examine the species diversity, abundance, and conservation status of reef fishes in Dumanquillas Bay, Zamboanga,Philippines.

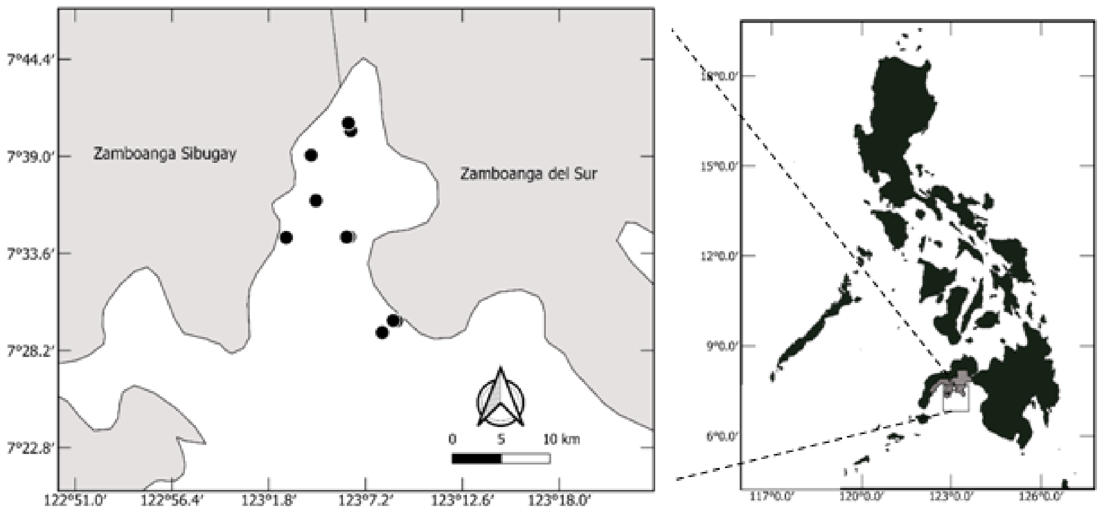

Fig. 1. A map showing eight (8) sampling stations (dots) in Zamboanga, Mindanao Philippines

2. METHODS

2.1. Study Area

The assessment was carried out in eight stations from May 6 to May 16, 2014. Fish census were conducted using standard coastal resource assessment methods [10] in the municipalities of Margosatubig [Sibanog Reef (SR), Talanusa (TL) and Nipa-Nipa (NN) Station], Vincenzo Sagun [Triton Island (TI) and Lumbal Marine Protected Area (LMPA) Station], Lapuyan (Cabog Island), Buug [Lampiningan Island (LI)], and Malangas [Muyong Island (MI) station] of Zamboanga del Sur and Zamboanga Sibugay (Fig. 1). Coordinates of the stations are presented in Table 1.

2.2 Coordinates of Sampling Station

Table 1. Coordinates of the sampling station in Dumanquillas Bay, Zamboanga, Philippines

Station	Coordinates
Triton Island (TI)	N 07˚29’12.4" E 123˚08’07.3"
Cabog Island (CI)	N 07˚40'25.8" E 123˚06'22.4"
Lampinigan Island (LI)	N 07˚39'14.4" E 123˚04’09.8"
Lumbal Inside Marine Protected Area (LMPA)	N 07˚29’52.1" E 123˚08'55.2"
Lumbal Outside Marine Protected Area (LMPA)	N 07˚29'52.6" E 123˚08'44.4"
Moyong Island (MI)	N 07˚34'29.2" E 123˚02'46.1"
Nipa-Nipa (NN)	N 07˚36'32.7" E 123˚04'25.7"
Sibanog Reef (SR)	N 07˚34'31.5" E 123˚06'18.2"
Talanusa (TL)	N 07˚34'30.9" E 123˚06’08.5"

2.3 Fish Visual Census

To assess the fish species, we used the Fish Visual Census (FCV) survey method of English et al. [10] using SCUBA. Two scuba divers carried out the FCV on both sides of the transect, with another diver doing documentation. Each diver covered a 5 m wide area along a 100 m transect, thus covering an area of 500 m^2 at both sides of the transect line. All fishes encountered were listed, counted, and estimated the total length. Species were identified using the works of Myers [11], Lieske and Myers [12], Kuiter and Tonozuka [13], and Gonzales [14, 15] up to the lowest possible taxon.

Assessments were done in all stations except Kumalarang and Dansulaw. Kumalarang station in Cabog Island has less than approximately two meters of visibility. The Dansulaw station in Malagas was likewise silted and covered with seaweeds farm lines, which made it difficult to conduct the underwater assessment. Scientific names of the fish species were validated using the World Register of Marine Species (http://www.marinespecies.org/index-php) website [16].

2.4 Data Analysis

The paleontological statistical software package (PAST) version 4.04 was used to estimate the Shannon diversity index (H’) of the samples [17]. While the species richness (S) was determined by using the number of species within the specified sampling station [18]. Kruskal-Wallis H test was used to determine the differences in species abundance per sampling station and the post hoc Nemenyi test for pairwise samples. The analyses of the latter test were conducted using Statistical Package for the Social Sciences (SPSS) version 20 and Microsoft excel 365 ver. 2111. The conservation status of each species was based on the respective website of FishBase [19] (www.fishbase.org) and IUCN [20], with the species categories such as Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinction in the Wild (EW), and Extinction (EX) [21] were used.

3. RESULTS AND DISCUSSION

3.1 Species Diversity and Abundance

A total of 14,050 individuals comprising 140 species belonging to 30 families were recorded in the Dumanquillas Bay (Fig. 2). Of 30 families, the family Pomacentridae was the most dominant, which accounted for 22.86%, followed by Labridae (12.86%) and Serranidae (7.14%).

While 13 families were found to have the lowest percentage (0.71%) of representative species (i.e., Aulostomidae, Blenniidae, Ephippidae, Haemulidae, Leiognathidae, Lutjanidae, Microdesmidae, Ostraciidae, Pinguipedidae, Plotosidae, Priacanthidae, Scorpaenidae, and Zanclidae).

The dominant family Pomacentridae is not included in the species with high commercial value [22] (Table 2), while some other species of the family, Pomacentridae (e.g., *Amphiprion perideraion*, *Amblyglyphidodon aureus*, and *Chromis multilineata*) are considered as a minor component of subsistence fisheries [23, 24, 25]. In this study, the reef fishes in Dumanquillas Bay with high commercial value (Table 2) have a lower percentage (range .7%- 7.14 %) than the less-valued species such as Pomacentridae (22.86%), among others. It is implied that the higher commercial valued species are more likely to be fished out than the less-valued species in the bay; this is probably because these reef fishes (Table 2) command a high market value which is affordable to the coastal community as a livelihood and alternative source of protein [4]. The record shows that the total catches of some commercially high-valued reef-associated fishes (i.e., Mullidae, Siganidae, Scaridae, Caesionidae, Lutjanidae, Serranidae, and Nemipteridae) in Zamboanga from 2009 to 2013 were 64,016.24 metric tons, with a declining trend of catch each year (i.e., 2009; 13,869.12 MT, 2010; 12,534.25 MT, 2011; 13,677.72 MT, 2012; 11,571.83 MT, and 2013; 12,363.32MT) [59]. It indicates that the population of the commercially valuable reef fishes in the bay is dwindling; hence regulation must be in place.

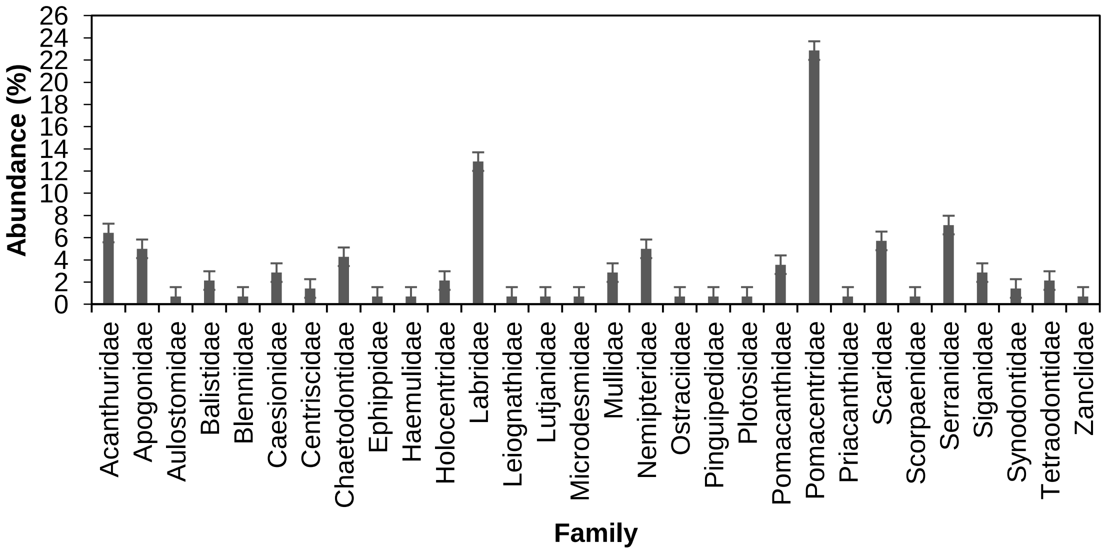

Fig. 2. Abundance of the recorded families of reef fishes in Dumanquillas Bay, Zamboanga, Philippines

Table 2. Percent Composition of common Reef fishes with commercial value from Dumanquillas Bay, Zamboanga

Common Commercially important Reef fishes	Percentage
Acanthuridae	6.429
Balistidae	2.143
Caesionidae	2.857
Serranidae	7.143
Haemulidae	.714
Lutjanidae	.71
Mullidae	2.857
Nemipteridae	5.000
Scaridae	5.714
Siganidae	2.857

Consequently, the uncontrolled harvesting of fish may impact the livelihood of the fishers. For example, the intensive harvesting of large piscivorous and herbivorous fish appears to be responsible for the widespread macroalgal growth of coral reefs [26]. If the overgrowth of macroalgae suppresses the coral, then coral may experience smothering, which is harmful to its community, affecting the reef fishes' structure [4]. Moreover, based on the trophic level, if the higher-level consumer decreases because of pervasive overfishing, the lower-level consumer increases; thereby, food has become limited for the latter consumer, so they are forced to forage in the seagrass beds, whereby they shift habitat [26]. In effect, fisher may experience some decline in catch of commercially important fishes from the reefs, which may be due to the displacement of habitat due to an imbalance of the marine ecosystem. This circumstance causes the fish population in that particular area to take time to recover. All fishes are subjected to overfished and depleted, but highly valuable species that remain profitable are more susceptible than others [4, 27]. While the species with low abundance and distributions are primarily susceptible to local extinctions [28, 29, 30].

The reef fishes in Dumanquilas Bay are less diverse in terms of species and families compared to that of Iligan Bay in Northern Mindanao [31]. While in Tawi-Tawi, the species number is higher, while the number of the family is lower compared to this study. The 140 species accounted for in this study represent approximately 19.41% of the total reef fish species and 57.69% of the total reef fish family in the country [33]. While it is 37.33% and 62.5% [34], and 38.36% and 68.18% [29] respectively, in other studies.

Hence, reef fishes in Dumanquillas Bay form a large portion of the reef fish diversity in the country in terms of species and family. As for the dominance, the highest number of family Pomacentridae in this study was similar to the West Philippine Sea [35], Honda Bay and Puerto Princesa Bay [36], Iligan Bay, Northern Mindanao [31], Nocnoc Island, Surigao [37], but differ from the Pag-asa Island, Palawan [38], and Tawi-Tawi Islands, southern Philippines [39]. While Pag-asa Island was dominated by the family Labridae [38] and Tawi-Tawi Island by the family Siganidae [22].

Such diversity and abundance vary across the different geographical locations. On the other hand, some species vary in richness, relative abundance, and density depending on the environmental condition and tropical latitudes. For example, herbivorous fish frequently increases with decreasing latitude in a region [40, 41, 42].

In Dumangquillas Bay, Moyong Island (MI) (H'=28.85) has the highest species diversity, followed by Sibanog Reef (SR) (H'=2.80) and Nipa-Nipa (NN) (H'=2.66), while the lowest diversity was found in Talanusa (TL) (H'=1.05) (Table 3). The differences in species diversity may be due to environmental variability and hydrological conditions, which have a remarkable impact on the diversity of fish [43, 44]. In addition, the coral cover influences the abundance of coral-reliant organisms, whereby the complex structure of coral reefs provides shelter, food, and spawning ground for various reef fishes [45, 46, 47, 48]. Therefore, the high diversity index of MI reef fishes may be attributed to the conditions of corals in the area. Natural and anthropogenic disturbances which may occur in coral reefs also harm the community structure of the reef fishes [45, 49, 50, 51].

In the case of Dumanquillas Bay, the Sibanog station with the highest live coral cover (69%) [58] among the stations has a relatively high Shannon Diversity Index. In contrast, this station has the least number of individuals recorded (Table 3). On the other hand, the Triton station also has a 69% [58] live coral cover has a remarkably high number of individuals and a lower Shannon diversity index (Table 3) compared to the equally high live coral cover Sibanog station. Hence, coral cover is not only the factor that influences the diversity and abundance of coral-associated fishes but also many other ecological factors that may interplay in the process.

The fishing ground where species are very diverse, fishers may have a stable catch compared to the fishing ground where only single species can be exploited [52, 53, 54]. Therefore, failure to manage the fish biodiversity in bays will impact fisheries and the livelihood of the coastal community. The estimated diversity index of reef fishes in this study (range 1.046 – 2.848 H') was lower than that of Iligan Bay, Northern Mindanao (range 2.965 – 3.844 H') [31]. While the range of diversity index in Nocnoc Island (range 2.358 – 2.653 H') [37] was similar to the result of this study (range 1.046 – 2.848 H') (Table 3).

Table 3. Number of taxa, number of individuals, and diversity index estimation for reef fishes per sampling station in Dumanquillas Bay, Zamboanga using PAST software

Sampling Station	Taxa (S)	Individuals	Shannon Diversity Index (H')
Triton Island (TI)	78	8,535	1.996
Cabog Island (CI)	21	590	2.221
Lampinigan Island (LI)	30	1,699	1.592
Lumbal Marine Protected Area (LMPA)	59	1,304	2.623
Moyong Island (MI)	42	352	2.848
Nipa-Nipa (NN)	26	217	2.657
Sibanog Reef (SR)	25	96	2.796
Talanusa (TL)	30	1,252	1.046

Table 4. P-value of Nemenyi post hoc test on species abundance at different sampling stations in Dumanquillas Bay, Zamboanga

	CI	LI	LMPA	MI	NN	SR	TL
TI	.000*	.000*	.31	.001*	.000*	.000*	.000*
CI		.99	.003*	.50	1.0	1.0	.99
LI			.044*	.93	1.0	1.0	1.0
LMPA				.56	.012*	.005*	.05
MI					.75	.58	.95
NN						1.0	1.0
SR							1.0

Asterisk (*) indicates a significant difference. TI = Triton Island, CI = Cabog Island, LI = Lampinigan Island, LMPA = Lumbal Marine Protected Area, MI = Moyong Island, NN = Nipa-Nipa, SR = Sibanog Reef, TL = Talanusa

Reef fishes differed significantly across the eight sampling stations (Kruskal-Wallis H test, P = .00) in terms of fish abundance per area. It could be due to environmental and fishing disturbances [4]. Among the eight sampling stations, Triton Island (TI station) has the highest number of species (Table 4). Triton Island is a protected area, likely to have rich fish species.

3.2 Conservation Status

The majority of the species identified in Dumanquillas Bay (68.38%) were categorized as least concern (LC), with only one species (0.74%) from the family Serranidae, *Plectropomus areolatus* (squaretail coral grouper) was categorized as vulnerable species (VU) (Table 5), recorded in Cabog Island (CI Station). The remaining 29.41% have no evaluation (NE) report from the IUCN, while 1.47% were data deficiency (DD). Over the past three generations, 30-40% of the population of *P. areolatus* has experienced global-level declines due to overfishing [55]. Furthermore, Encarnacion et al. [42] found nearly threatened species of several groupers in Isabela waters: duskytail grouper (*Epinephelus bleekeri*), orange-spotted grouper (*Epinephelus coioides*), brown-marbled grouper (*Epinephelus fuscoguttatus*), Malabar grouper (*Epinephelus malabaricus*), Hawaiian grouper (*Hyporthodus quernus*), leopard coral grouper (*Plectropomus leopardus*), and some species of parrotfish such as Bower's parrotfish (*Chlorurus bowersi*) and Yellowtail parrotfish (*Scarus hypselopterus*). The "Boom and Bust" exploitation scheme of the high-valued grouper, *Plectropomus leopandus*, in Taytay Bay, Palawan, was also recorded [56], where heavy exploitation of grouper led to stock depletion. While Go et al. [29] reported one vulnerable grouper species (*Cromileptes altivelis*) and an endangered species (*Cheilinus undulatus*) in the Philippines.

To manage and conserve the reef fishes in Dumangquillas Bay, the local government units located in the bay and the Department of Environment and Natural Resources (DENR) have developed a management plan (Dumanquillas Bay Protected Landscape and Seascape Management Plan) [58]. The coral reef fish survey was one of the components of the plan developed by the DENR.

Table 5. Families of reef fish species, total number of samples per sampling area, and the conservation status of each representative species based on International Union for Conservation of Nature and Natural Resources (IUCN) in Dumanquillas Bay, Zamboanga, Philippines

Family/Species	Total no. of samples per Sampling Area								IUCN Red List Status
	TI	CI	LI	LMPA	MI	NN	SR	TL	
Acanthuridae									
Acanthurus auranticavus	41	1	-	7	-	-	1	-	LC
Acanthurus grammoptilus	-	-	-	1	-	-	-	-	LC
Acanthurus japonicus	1	-	-	-	-	-	-	-	LC
Acanthurus pyroferus	1	-	-	-	-	-	-	-	LC
Acanthurus sp.	-	-	-	-	6	-	-	-	
Acanthurus thompsoni	2	-	-	1	-	-	-	-	LC
Ctenochaetus binotatus	59	-	-	8	-	8	9	-	LC
Ctenochaetus striatus	17	-	-	12	1	-	1	-	LC
Zebrasoma scopas	37	-	-	7	-	-	-	-	LC
Apogonidae									
Ostorhinchus angustatus	-	-	-	-	-	-	-	18	NE
Ostorhinchus compressus	34	-	-	1	-	-	-	-	LC
Ostorhinchus nigrofasciatus	-	-	-	-	-	-	5	-	NE
Fibramia thermalis	-	-	6	-	-	-	-	-	NE
Taeniamia fucata	-	18	-	-	15	-	-	-	NE
Cheilodipterus artus	100	47	-	1	5	-	-	-	NE
Cheilodipterus quinquelineatus	1	25	1	35	122	-	-	3	NE
Aulostomidae									
Aulostomus chinensis	1	-	-	-	-	-	-	-	LC
Balistidae									
Balistapus undulatus	4	-	-	7	1	-	-	-	NE
Balistoides viridescens	4	1	-	-	-	-	-	2	NE
Sufflamen chrysopterum	-	-	-	-	-	7	-	-	NE
Blenniidae									
Meiacanthus grammistes	-	-	-	-	-	-	1	-	LC
Caesionidae									
Caesio caerulaurea	1,009	-	37	-	-	-	-	-	LC
Caesio cuning	-	12	51	-	-	9	-	-	LC
Pterocaesio pisang	1,025	-	-	-	-	-	-	50	LC
Pterocaesio trilineata	-	-	-	-	-	-	-	18	LC
Centriscidae									
Aeoliscus strigatus	-	2	-	-	-	-	-	-	DD
Centriscus scutattus	40	-	-	-	-	-	-	1,000	LC

Table 5. Continued

Chaetodontidae									
Chaetodon ephippium	-	1	-	-	-	-	-	-	LC
Chaetodon kleinii	38	3	1	19	7	4	3	-	LC
Chaetodon melannotus	-	1	-	-	-	-	-	-	LC
Chaetodon octofasciatus	65	10	-	25	1	12	3	12	LC
Heniochus chrysostomus	1	-	-	2	-	-	-	1	LC
Heniochus varius	1	-	-	2	-	-	-	-	LC
Ephippidae									
Platax pinnatus	1	-	-	-	-	-	-	-	NE
Haemulidae									
Plectorhinchus chaetodonoides	-	2	1	1	2	-	-	-	NE

Holocentridae									
Myripristis amaena	-	-	-	-	3	-	-	6	LC
Sargocentron cornutum	-	-	-	-	8	-	-	-	LC
Sargocentron microstoma	3	-	-	-	-	-	1	2	LC
Labridae									
Bodianus mesothorax	1	-	-	1	-	-	-	1	LC
Cheilinus fasciatus	6	-	-	6	8	2	8	3	LC
Oxycheilinus celebicus	19	-	-	3	4	-	-	3	LC
Cirrhilabrus cyanopleura	236	-	9	57	-	-	-	-	LC
Anampses melanurus	1	-	-	2	-	2	-	-	LC
Coris aurilineata	1	-	-	-	-	-	2	-	LC
Gomphosus varius	1	-	-	-	1	-	-	-	LC
Halichoeres argus	1	-	-	6	-	-	-	-	LC
Halichoeres melanurus	3	-	1	1	8	8	-	-	LC
Halichoeres nigrescens	-	-	1	-	-	-	-	-	LC
Halichoeres richmondi	-	-	-	32	19	2	-	4	LC
Halichoeres solorensis	-	-	-	-	7	-	-	-	LC
Hemigymnus melapterus	-	-	-	-	3	-	-	-	LC
Thalassoma lunare	18	-	-	1	2	7	8	1	LC
Diproctacanthus xanthurus	7	-	-	6	-	-	-	-	LC
Labrichthys unilineatus	13	-	-	1	-	-	-	-	LC
Labroides dimidiatus	8	-	1	4	3	-	1	-	LC
Labroides pectoralis	-	-	-	1	-	-	-	-	LC
Leiognathidae									
Aurigequula fasciata	-	-	500	-	-	-	-	-	LC
Lutjanidae									
Lutjanus biguttatus	8	-	-	-	-	-	6	-	LC
Microdesmidae									
Ptereleotris evides	2	-	-	-	-	-	-	-	LC
Mullidae									
Parupeneus barberinus	6	-	3	4	8	10	-	4	LC
Parupeneus heptacanthus	-	-	-	-	1	-	-	-	LC
Parupeneus multifasciatus	10	-	-	2	8	1	-	6	LC
Upeneus tragula	-	-	-	-	-	1	-	-	LC

Table 5. Continued

Pomacentridae									
Amblyglyphidodon aureus	-	87	-	-	-	-	-	-	LC
Amblyglyphidodon leucogaster	359	-	-	68	-	32	4	12	LC
Amblyglyphidodon sp.	-	13	1	-	-	-	-	-	
Amphiprion clarkii	4	-	3	-	-	3	-	-	NE
Amphiprion perideraion	-	-	-	-	-	-	3	-	LC
Chromis amboinensis	165	-	-	19	-	-	-	-	LC
Chromis flavomaculata	-	-	-	-	-	-	3	-	NE
Chromis multilineata	4,394	113	110	135	-	-	-	-	LC
Chromis notata	-	-	1	-	-	-	-	-	NE
Chromis retrofasciata	14	-	-	-	-	-	-	-	NE
Chrysiptera brownriggii	127	-	-	-	-	-	-	-	NE
Chrysiptera rollandi	82	-	-	36	9	23	-	2	NE
Dascyllus aruanus	11	-	-	13	-	-	-	-	NE
Dascyllus reticulatus	16	-	-	-	-	-	-	-	NE
Dascyllus trimaculatus	55	-	-	28	-	-	-	-	NE

Pomacentridae									
Dischistodus fasciatus	1	-	-	-	-	-	-	-	NE
Dischistodus perspicillatus	-	-	-	-	1	-	-	-	NE
Neoglyphidodon nigroris	24	-	-	11	-	-	18	1	NE
Neoglyphidodon oxyodon	-	-	-	3	-	-	-	-	NE
Neoglyphidodon thoracotaeniatus	23	-	-	-	-	-	-	-	NE
Pomacentrus alexanderae	112	-	-	104	13	11	-	6	NE
Pomacentrus amboinensis	-	-	-	-	1	-	-	-	NE
Pomacentrus brachialis	78	-	-	20	-	-	-	-	NE
Pomacentrus burroughi	4	-	-	17	1	-	-	53	NE
Pomacentrus chrysurus	-	53	14	-	-	-	-	-	NE
Pomacentrus coelestis	-	-	-	-	-	-	-	6	NE
Pomacentrus cuneatus	-	156	74	-	4	-	-	-	NE
Pomacentrus moluccensis	70	-	-	18	-	-	-	-	NE
Pomacentrus philippinus	8	-	-	1	12	-	-	-	NE
Pomacentrus proteus	-	-	37	-	-	-	-	-	NE
Pomacentrus simsiang	-	-	7	-	2	-	-	-	NE
Pomacentrus stigma	28	-	-	-	-	1	-	-	NE
Priacanthidae									
Priacanthus blochii	-	-	-	-	-	-	1	-	LC
Scaridae									
Chlorurus bleekeri	18	-	-	3	-	-	1	-	LC
Chlorurus sordidus	-	-	-	-	15	-	-	-	LC
Scarus dimidiatus	2	-	-	1	2	48	-	-	LC
Scarus flavipectoralis	-	-	-	1	-	-	-	-	LC
Scarus ghobban	-	-	-	-	1	-	-	-	LC
Scarus globiceps	-	-	-	-	-	-	10	6	LC
Scarus oviceps	-	-	-	18	-	-	-	-	LC
Siganus rivulatus	21	-	-	-	-	-	-	-	LC
Scorpaenidae									
Pterois antennata	-	-	-	-	-	-	1	-	LC

Table 5. Continued

Nemipteridae									
Pentapodus aureofasciatus	-	-	-	4	-	1	-	1	LC
Pentapodus caninus	-	-	-	11	-	-	-	-	LC
Scolopsis bilineata	4	-	-	8	-	-	-	-	LC
Scolopsis ciliata	14	18	4	6	11	12	-	-	LC
Scolopsis lineata	3	-	-	-	-	-	-	-	LC
Scolopsis margaritifera	-	-	-	-	1	-	-	-	LC
Scolopsis xenochrous	-	-	-	-	-	-	-	13	LC
Ostraciidae									
Ostracion meleagris	-	-	3	-	-	-	-	-	NE
Pinguipedidae									
Parapercis lineopunctata	1	-	1	-	4	-	-	-	NE
Plotosidae									
Plotosus lineatus	-	-	800	500	-	-	-	-	NE
Pomacanthidae									
Centropyge bicolor	4	-	-	-	-	-	-	-	LC
Centropyge tibicen	-	-	-	-	-	-	1	-	LC
Centropyge vrolikii	5	-	-	-	-	-	-	-	LC
Chaetodontoplus mesoleucus	-	-	-	1	-	1	1	-	LC
Pygoplites diacanthus	6	-	-	-	-	-	-	-	LC

Serranidae									
Cephalopholis microprion	-	-	1	-	-	-	-	-	LC
Cephalopholis argus	4	-	-	5	-	-	2	9	LC
Cephalopholis boenak	-	-	-	1	-	-	-	-	LC
Cephalopholis microprion	1	-	-	1	-	-	-	-	LC
Epinephelus areolatus	3	1	-	2	-	-	-	-	LC
Epinephelus ongus	-	-	1	-	-	-	-	-	LC
Plectropomus areolatus	-	3	-	-	-	-	-	-	VU
Plectropomus pessuliferus	1	-	-	-	-	-	-	-	VU
Variola albimarginata	-	-	1	-	-	-	-	-	LC
Diploprion bifasciatum	-	23	8	-	11	9	2	2	LC
Siganidae									
Siganus canaliculatus	-	-	20	-	5	-	-	-	LC
Siganus puelloides	-	-	-	-	1	-	-	-	LC
Siganus unimaculatus	-	-	-	-	-	1	-	-	DD
Siganus vulpinus	2	-	-	-	3	-	-	-	LC
Synodontidae									
Synodus binotatus	-	-	-	-	-	-	-	2	LC
Synodus variegatus	1	-	-	-	-	-	-	-	LC
Tetraodontidae									
Arothron nigropunctatus	4	-	-	-	-	-	-	-	LC
Canthigaster solandri	5	-	1	-	-	1	-	-	LC
Canthigaster valentini	1	-	-	3	-	-	-	-	LC
Zanclidae									
Zanclus cornutus	34	-	-	10	12	1	-	5	LC
Mean	**60.97**	**4.21**	**12.14**	**9.31**	**2.54**	**1.55**	**0.69**	**8.94**	

TI= Triton Island, CI = Cabog Island, LI = Lampinigan Island, LMPA = Lumbal MPA, MI = Moyong Island, NN = Nipa-Nipa, SR = Sibanog Reef, TL = Talanusa, IUCN = International Union for Conservation of Nature and Natural Resources, LC = Least Concern, DD = Data Deficient, VU = Vulnerable, NE = Not evaluated

Table 6. Number of reef fish species and families in different areas of the Philippines and all over the Philippines

Areas	Number of species	Number of family	Authors
Dumanquillas Bay Zamboanga	140	30	This study
Bohol	320	44	Anticamara et al. [34]
Tawi-tawi	266	11	Muallil et al. [22]
Nocnoc Island, Surigao	16	12	Eviota et al. [37]
Iligan Bay, Northern Mindanao	286	36	Recamara and De Guzman [31]
West Sulu Sea, Palawan	598	71	Balisco and Dolorosa [35]
Honda Bay, Palawan	121	27	Gonzales [36]
Puerto Princesa Bay, Palawan	105	17	Gonzales [36]
Pag-asa Island, Palawan	251	36	Gonzales [38]
Philippines	367	44	Go et al. [29]
Philippines	375	48	Anticamara et al. [58]
Philippines	721	52	Nañola et al. [33]

4. CONCLUSION

High diversity of reef fishes in Dumanquillas Bay was observed in Muyong Island, while Triton Island has the most number of reef fishes. The Dumanquillas reef fish assemblage is composed of more number of less-valued species than highly commercially important species. A large percentage of less commercial valued species might imply overharvesting of high commercial valued species in the bay. Most of the species recorded in the bay were categorized as least concern under the IUCN, with only one species, *Plectropomus areolatus*, categorized as vulnerable. Therefore, it is recommended to study the exploitation rate and reproductive biology of the reef fishes in Dumanquillas Bay to support the national catch limit policy in the area.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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