



Marine Resources and Utilization in Buug, Dumanquillas Bay, Philippines

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Abstract

A pioneering study was done in Buug, Dumanguillas Bay to identify marine species and its utilization. Lack of information about the bay's marine species resources and its utilization serve as a basis for the conduct of this study for sustainable coastal management. The identification of marine species and its utilization in Dumanguillas Bay is reported here. The fish landing method was employed to get the fish species from the fishermen to catch in the bay. Documents archival and direct observation were done to collect species of other marine resources. Key informant interviews (KII) and focus group discussions were used to get information on the utilization of marine resources. Finfish are of 40 species representing 29 families, 39 fish species were muddy/substrate thriving fish. Fish were directly sold to middlemen for income, used for feed on priced fish, and some were dried. Mangrove consists of eight species, seagrass consists of five species, whereas coral consists of four species and seaweeds consist of 10 species. Seagrass beds and coral reefs were already destroyed due to siltation and sedimentation although there are small patches present. Mangroves were protected but a very small area remained. Ecosystem Approach to Fisheries Management (EAFM) should be the anchor on the management of coastal and marine resources in the bay.

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Introduction

The Philippines as an archipelago consists of 7,100 islands and islets with a coastline of about 18,000 kilometers (Ong *et al.*, 2003). Its territorial waters cover about 2.2 million square kilometers, twelve percent of which is coastal while eighty-eight percent is oceanic, including the Exclusive Economic Zone (EEZ) (Camacho *et al.*, 2001). The Philippine coastal ecosystem is comprised of biologically productive habitats such as mangroves, seagrasses and coral reefs that support the country's marine fisheries (Anoneuvo and Zaragosa, 1986; Floren 2003).

Marine species diversity recorded indicates that there are 468 scleractinian corals (Gomez *et al.*, 2002; Werner & Allen., 2002; Fishbase 2008), 1,755 reef-associated fishes (Herre, 1953; Dela Paz & Gomez, 1995; Fishbase 2008), 648 species of mollusks (Fishbase, 2008); more than 40 species of mangrove plants (Zamora, 1995; Calumpong, 1994), 19 species of seagrass (Fishbase, 2008) and 820 species of algae (Fishbase, 2008). Carpenter and Springer (2005) noted that there is a higher concentration of species per unit area in the Philippines than anywhere in

Indonesia and Wallacea and that, the Philippines is the center of marine shore diversity in the world.

Dumanguillas Bay, a body of water in Southern Mindanao has abundant marine resources. Unfortunately, fish and other marine species are not documented and assessed thus, create difficulty among conservationists to manage and protect the marine resources. The result of the study is helpful in policy and decision-making processes and guidelines for sustainable coastal and marine resources management in the bay.

Materials and methods

The study was conducted in the coastal barangay of Pamintayan in the municipality of Buug which is a major municipality of Dumanquillas Bay. Dumanquillas Bay Protected Landscape and Seascape (DBPLS) is a national protected area established on April 10, 1999, under Presidential Proclamation No. 158 according to the provisions of the Republic Act 7586, the National Integrated Protected Area System (NIPAS) Act of 1992. DBPLS has a total area of 29, 662.98 hectares.



Fig. 1. Location map of the study. (Modified from Google Earth maps).

It covers 2 provinces, 6 coastal municipalities, and 41 coastal barangays. Its coordinates are 7° 37'43.1" in the north latitude and 123°6'9" in the east longitude. The Protected Area Management Board (PAMB) is the governing body of the bay which is composed of DENR-PAMB, P/M/BLGU's and other partner agencies (BFAR, PNP, PCG, NGO, and PO's. They are tasked with the protection, conservation, and sustainability of DBPLS. It has 70 regular PAMB members.

The study was conducted in July 2015 after complying with all the technical and ethical considerations of research. The fish landing method was done to collect the fish specimens on July 22-23, 2015 from the fishermen. Permission was asked from the fishermen to collect a sample of fish species from their catch. Collected fish species were documented and were identified by a marine biologist expert. Key informant interview (KII), focus group discussion (FGD), direct observation (DO), document archival were also conducted to determine other marine species in the bay and its utilization. After data gathering, data were coded, disassembled, sorted, and sifted. Data were compared and contrasted to each of the things that have been noticed to discover similarities and differences, build typologies, or find sequences and patterns.

Results and discussion

Each coastal communities have unique marine and coastal resources in their area. Each of them may have similarities or differences in the utilization of these resources. The following section will present the marine resources and its utilization in Dumanquillas Bay.

Fish

Fish are the major source of protein by Filipinos (White & Cruz-Trinidad, 1998; Pomeroy *et al.*, 2006). The Philippines is blessed with rich marine resources including diverse types of fish. The Table 1 shows the list of fish found in the bay. Based on the fish landing method, 40 different fish species were observed consisting of 29 fish families. Five fish families

existed as dominant which includes *Clupeidae*, *Engraulidae*, and *Mugilidae*, with three fish species each. Thirty-nine (39) species are substrate/muddy thriving fish and only one fish species, *Abudefduf vaigiensis* exists as a coral reef thriving fish.

Of the 40 fish species identified in Pamintayan, Buug, Dumanquillas Bay this fish species number is higher compared to 23 fish species identified belonging to 19 genera and 12 families in Tubay, Agusan del Norte, Philippines (Alima & Patricio, 2010), and is lower compared to the rich fish species in Oas, Albay with 136 reef fish species and 23 families, Rapu-rapu, Albay with 131 species and 22 families, Pio Duran, Albay with 128 species and 20 families, Ligao, Albay with 127 species and 20 families, and Libon, Albay with 101 species and 17 families (Mendoza, 2015). Moreover, fish species in Pamintayan is lower compared in Sibunag, Guimaras with 50 species representing 32 families (Abroguena *et al.*, 2012), Panguil Bay with 135 finfish species belonging to 71 families (Jimenez *et al.*, 2009), and in Lopez Jaena, Misamis Occidental with 146 species representing 23 families (De Guzman *et al.*, 2009).

Feeds for priced fish

Caught fish that are small in sizes about 2-3 cm in length are usually used as feeds for priced fish. The number of fish species used for feeds on priced fish is 11 species. "Ibis", "guno", "sapsap", and other caught fish in small sizes are used as feed to priced fish. The fishermen feed the small-sized fish to priced penned fish like "trakito" and "lapu-lapu".

Commercial/market distribution

Fish of different species on their marketable sizes are sold directly for income. Fish species directly sold to the market for income are 25 species which includes "matambaka", "salaysalay", "kabalyas", "timbongan", and among others. "Trakito" and "lapu-lapu" are fish species that are highly-priced due to its high commercial value. These fish species are being raised in a fish pen. Fingerlings of these fish species when caught in the sea are put in the fish pen to grow and mature.

Table 1. Inventory of fish species in Buug, Dumanquillas Bay.

Family	Species	Local Name	*Habitat
<i>Apogonidae</i>	<i>Apogon sp.</i>	Mo-ong	Substrate/muddy
<i>Arridae</i>	<i>Arius manellinses</i>	Ito	Substrate/muddy
<i>Atherinidae</i>	<i>Atherina lacunosa</i>		Substrate/muddy
<i>Belonidae</i>	<i>Tylosurosa cusmelanotes</i>	Balu	Substrate/muddy
<i>Carangidae</i>	<i>Decapterus russelli</i>		Substrate/muddy
<i>Clupeidae</i>	<i>Sardinella fimbriata</i>	Malangsi	Substrate/muddy
	<i>Dussumiera acuta</i>	Hilos-hilos	Substrate/muddy
	<i>Sardinella melanura</i>	Tamban	Substrate/muddy
<i>Carangidae</i>	<i>Selar boops</i>	Salaysalay	Substrate/muddy
<i>Drepanidae</i>	<i>Drepane punctate</i>	Alibangbang	Substrate/muddy
<i>Engraulidae</i>	<i>Stolephoru scommersonii</i>		Substrate/muddy
	<i>Scutongraulis sp.</i>		Substrate/muddy
	<i>Valamugil cunnesius</i>	Gisaw	Substrate/muddy
<i>Exocoetidae</i>	<i>Cypselurus oligolepis</i>	Bangsi	Substrate/muddy
<i>Gerreidae</i>	<i>Gerres filamentosus</i>	Putian	Substrate/muddy
	<i>Ceazza minuta</i>	Damol	Substrate/muddy
<i>Gobiidae</i>	<i>Gnatholopis puntagoides</i>	Barungoy	Substrate/muddy
	<i>Scutengraulis sp.</i>	Tigi	Substrate/muddy
<i>Leiognathidae</i>	<i>Ceazza minuta</i>		Substrate/muddy
<i>Lutjanidae</i>	<i>Lutjanus decussatus</i>	Aluman	Substrate/muddy
<i>Larrangidae</i>	<i>Ulua mentalis</i>		Substrate/muddy
	<i>Scomberodes lysau</i>	Lapes	Substrate/muddy

Table 1, continued.

<i>Mugilidae</i>	<i>Mugil cephalus</i>	Banak	Substrate/muddy
	<i>Ulua mentalis</i>	Samin-samin	Substrate/muddy
	<i>Valamugil cunnesius</i>		Substrate/muddy
<i>Mullidae</i>	<i>Lipeneus sulphureus</i>	Timbongan	Substrate/muddy
<i>Nemipteridae</i>	<i>Nemipterus marginatus</i>	Lagaw	Substrate/muddy
<i>Platycephalidae</i>	<i>Platycephalus isacanthus</i>	Sunugan	Substrate/muddy
<i>Pomacentridae</i>	<i>Abudefduf vaigiensis</i>	Sapsap	Coral reef
<i>Scatophagidae</i>	<i>Scatophagus argus</i>	Langkia	Substrate/muddy
<i>Sphyraenidae</i>	<i>Sphyraena obtusa</i>	Rumpi	Substrate/muddy
<i>Scaridae</i>	<i>Scarus sp.</i>		Substrate/muddy
<i>Siganidae</i>	<i>Siganas vermiculatus</i>	Kitong	Substrate/muddy
	<i>Sigmus spinus</i>		Substrate/muddy
<i>Scombridae</i>	<i>Rastrelliger faughnii</i>	Kabalyas	Substrate/muddy
<i>Serranidae</i>	<i>Latues calcarifer</i>	Laya	Substrate/muddy
	<i>Epinephelus taurina</i>	Pugapo	Substrate/muddy
<i>Sillaginidae</i>	<i>Sillagos ihama</i>	Asoos	Substrate/muddy
<i>Theraponidae</i>	<i>Therapun jarbua</i>	Boga-ong	Substrate/muddy
<i>Trichinridae</i>	<i>Trichiurus haumela</i>	Diwit	Substrate/muddy
Families: 29	Fish Species: 40		

Food preservation

When fish are caught in huge number and is too cheap to market, these were dried for a better price. In the studied area, fish species dried are 8 species. Fish that could be dried includes “bolinao”, “ebis”, “tamban”, “pulauan”, “dulong-dulong”, “timbongan”, “tabilos” and “guno”. “Bolinao” is the most common fish species being dried due to its high market price.

Table 2 shows the list of fish and their utilization. Some fish species are not utilized while others are used in different ways.

Mangrove

Eight mangrove species under four families were found in the bay which includes “bakawan lalaki”, “bakawan babae”, “tangal/tungog”, “piapi”, “pagatpat”, “pedada”, “tinduk-tindukan”, and “saging-saging” (ICM, 2014). The Table 3 shows the mangrove species found in the area with its family and scientific names. The mangrove species number in Buug, Dumanquillas Bay was lower compared with the rich mangrove ecosystems in the country, such as Bacolod, Lanao del Norte [11 species (Benecario *et al.*, 2013)]; Pagbilao Bay in Quezon Province [37 species

(Almazol *et al.*, 2013)]; Panay [34 species (Primavera *et al.*, 2004), Guimaras [30 species (Sadaba *et al.*, 2009)], Davao Gulf [30 species (Flores, 2003)], Bohol [26 species (Mapalo, 1992)], Samar Island [22 species

(Mendoza & Alura, 2001)], Ibabay in Aklan Province [22 species (Primavera, 2000)], Palawan [22 species (Arquiza, 1999)] and Danao Bay [20 species (De Guzman, 2004)].

Table 2. Fish and utilization in Buug, Dumanquillas Bay.

Fish Species	Utilization		
	Used as Feed	Directly Sold for Income	Made into Dried Fish
<i>Apogon sp.</i>	•		
<i>Arius manellinses</i>		•	•
<i>Atherina lacunosa</i>			
<i>Tylosurosa cusmelanotes</i>		•	
<i>Decapterus russelli</i>			
<i>Sardinella fimbriata</i>			•
<i>Dussumiera acuta</i>	•	•	
<i>Sardinella melanura</i>	•	•	•
<i>Selar boops</i>	•	•	•
<i>Drepane punctate</i>	•	•	
<i>Stolephoru scommersonii</i>			
<i>Scutongraulis sp.</i>		•	
<i>Valamugil cunnesius</i>	•	•	
<i>Cypselyrus oligolepis</i>		•	

Table 2, continued.

<i>Gerres filamentosus</i>		•	
<i>Ceazza minuta</i>	•	•	
<i>Gnatholopis puntagoides</i>		•	
<i>Scutengraulis sp.</i>			
<i>Ceazza minuta</i>			
<i>Lutjanus decussatus</i>	•		
<i>Ulua mentalis</i>			
<i>Scomberodes lysau</i>	•		•
<i>Mugil cephalus</i>		•	
<i>Ulua mentalis</i>		•	
<i>Valamugil cunnesis</i>			
<i>Lipeneus sulphureus</i>	•	•	
<i>Nemipterus marginatus</i>		•	
<i>Platycephalus isacanthus</i>			
<i>Abudefduf vaigiensis</i>	•	•	•
<i>Scatophagus argus</i>		•	
<i>Sphyraena obtusa</i>		•	
<i>Scarus sp.</i>			
<i>Siganas vermiculatus</i>			
<i>Sigmus spinus</i>			
<i>Rastrelliger faughnii</i>		•	
<i>Latues calcarifer</i>		•	
<i>Epinephelus taurina</i>		•	
<i>Sillagos ihama</i>		•	•
<i>Therapun jarbua</i>		•	
<i>Trichiurus haumela</i>		•	•

This difference could be attributed to the environmental factors present in each area (Tomlinson, 1986), and likewise the size of the mangrove area. The Philippines harbors at least 40 species belonging to 14 families of around 54 true

mangrove species worldwide (Primavera *et al.*, 2004). This means that mangrove species in Buug, Dumanquillas Bay is considered very low in terms of diversity from the total number of Philippine mangroves.

Mangrove density in Buug is 2,357 trees per hectare (ICM-Buug, 2014). This mangrove structure is lesser than in Liloan, Cebu which has 6,033 trees ha (Dacles *et al.*, 1995) and Liangan East, Poblacion, and Rupagan in Bacolod, Lanao del Norte with 76,900 trees ha., 71,700 trees ha., and 65,000 trees ha. Respectively (Benecario *et al.*, 2016). Regeneration of mangrove trees in Buug is 250 seedlings and 1,273 saplings per hectare (CRM-Buug, 2014). This number is lower compared to Poblacion and Liangan East of Bacolod Lanao del Norte with a total number of seedlings per hectare of 45,800 and 41,300

respectively. On the other hand, Rupagan, Poblacion and Demologan of Lanao del Norte had a higher total number of saplings compared to Pamintayan with some 77,300, 67,200 and 64,500 saplings, respectively. Gan (1995) recommended a density of 5000-10000 seedlings per hectare to ensure good regeneration potential for the cleared area while Srivastava & Ball (1984) cited that a minimum of 2,500 seedlings per hectare is required to qualify natural regeneration as being sufficient. In this case, the regeneration potential of mangroves in Buug is relatively low.

Table 3. Mangrove species in Buug, Dumanquillas Bay.

Family	Common Name	Scientific Name
<i>Rhizophoraceae</i>	<i>Bakawan Lalake</i>	<i>Rhizophora apiculata</i>
	<i>Bakawan Babae</i>	<i>Rhizophora mucronata</i>
	<i>Tangal/Tungog</i>	<i>Ceripstagal sp.</i>
<i>Aviceniaceae</i>	<i>Piapi</i>	<i>Avicennia officinalis</i>
<i>Sonneratiaceae</i>	<i>Pagatpat</i>	<i>Sonneratia marina</i>
	<i>Pedada</i>	<i>Sonneratia caseolaris</i>
<i>Mrtaceae</i>	<i>Tinduk-tindukan</i>	<i>Aegiceras corniculatum</i>
	<i>Saging-saging</i>	<i>Aegiceras floridum</i>
Families: 4	Mangrove Species:	8

Mangroves have many ecological and utilitarian functions. In Buug, they have an ordinance to stop the cutting of mangrove trees. Before mangrove cutting used for charcoal making was rampant. Charcoal from mangrove trees was known for its high heating value (Melana *et al.*, 2000) and has long been preferred for both domestic cooking fuel and fuel for commercial bakeries (Wernstedt & Spencer, 1967; Jara, 1987; Walters, 2004). But today, mangroves are protected by the people. A mangrove tree planting activity was conducted annually in the coastal area of Buug to protect and conserve the coast.

Seagrasses

No large area of seagrasses can be found in Buug, rather only patches. Five species of seagrasses were found. *Cymododea serrulata* (toothed seagrass), *Halodule pinifolia* (fiber strand seagrass), *Enhalusa corioides* (tropical eelgrass), *Thalasia hemprichii* (turtle seagrass) and *Syringium isoetifolium*

(syringe grass) (CRM-Buug, 2014) are the seagrasses found in the area. The number of seagrasses is lesser compared to Iligan City [8 species (Orbita & Gumban, 2013)], Panguil Bay [8 species (Roxas *et al.*, 2009)] and Paligue, Hagonoy, Davao del Sur [7 species (Jumawan *et al.*, 2015)]. A total of 13 seagrass species are found in the Philippines (Fortes, 1989 & 1995). This means that not a half number of seagrass species are found in Buug.

The people of Buug did not utilize the different kinds of seagrass. They still have no uses on it. This could be on the submerged state of seagrasses that their role, functions and potentials have often been overlooked (Thayer *et al.*, 1975).

Coral reef

Four coral species are commonly found in the area. It includes *Montipora* (pore coral), *Porites* (hump coral), *Fungia* and *Heliofungia* (mushroom coral)

(CRM-Buug, 2014). The country's coral reefs are home to 500 species of scleractinian (i.e., "stony") corals. Of these, 12 species endemic to the Philippines have been identified (Veron, 1995).

The coral reef species found in Buug constitute 0.8% of the total coral reef species in the Philippines. Pore coral types are being used for decoration in the houses. But these are seldom seen in the coastal village. No large coral reef in the area exist.

Seaweeds

A total of ten species of seaweeds were noted in the area. The ten species include *Acanthopora specifera*, *Actinotrichia fragilis*, *Corium codium*, *Dicyota dentate*, *Dicyota dichotoma*, *Gracilaria salicornia*, *Halimeda macroloba*, *Halimeda tuna*, *Moemeris van bossae*, and *Padina minora* (CRM-Buug, 2014). This seaweed species number is lesser compared to the intertidal zone of Nangaramoan, San Vicente, Sta. Ana, Cagayan [31 species (Baleta & Nalleb, 2016)] and Panguil Bay [72 species (Roxas *et al.*, 2009)] in the Philippines. It is also lesser compared to Kampung, Kuala, Nyalua [28 species (Wong *et al.*, 2012)] and Tanjung, Batu [15 species (Wong *et al.*, 2012)] both in Malaysia.

Other marine organisms

Seashells are used for decoration in the houses among the fishermen in the area. Sea horses are used as lucky charms. These are being dried and hanged in the door and in the kitchen to driving out bad luck. These are dried and are bought about Php 10.00 each by the neighboring municipalities and cities "Pagi" (sting ray), "balu" (mother milkfish), and "iho" (sharks) sometimes entered in "bunsod" and "nyulok".

These marine animals when trapped are sold or consumed domestically by local fishermen. They are caught rarely about once in a year. "Pawikan" (sea turtles) on the other hand, when caught are released by the fishermen. White-spotted whaleshark locally known as "puntik-puntik" about one or two in number are spotted in Purok 6 in Pamintayan once or

twice a year. This marine mammal is protected by the people.

Conclusion

Marine resources in Buug, Dumanquillas Bay are still diverse, but it is less diverse compared to marine and coastal ecosystem in the country. Based on fish landings, 40 different fish species were observed represented by 29 fish families. Fish are utilized in the area by using it as feeds for priced fish, directly sold for income, and others are dried. Eight mangrove species under four families were found. Mangroves' areas are protected. Five species of seagrasses were found. Seagrasses are not utilized by the people. Four coral species are commonly found. Pore coral types are being used for decoration in local fishermen's houses. A total of ten species of seaweeds were noted in the area. Seashells are used for decoration, while pagi (sting ray), balu (mother milkfish), and iho (sharks) when trapped are sold or consumed domestically. Pawikan (sea turtles) on the other hand, when caught on the fishermen's fish trap is released. White-spotted whaleshark locally known as puntik-puntik are protected by the people.

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