RESEARCH PAPER

Temporal abundance of major macroinvertebrate phyla in Sto, Tomas Cove, La Union, Philippines

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Abstract

The marine waters of the Philippines contain significant marine habitats- coral reefs, seagrass beds, mangrove forests and the deep seas. This study aimed to provide a status on the abundance and distribution of invertebrates in the body of water in Sto. Tomas Cove, La Union, Philippines. A once a month survey was conducted using a modified trawl gear, locally known as karkar, by dragging a net at each station for a distance of 1000 meters in four established sampling stations in the cove: Station I at Brgy. Damortis-Tubod (N16° 14.208', E120° 23.377'); Station II at Brgy. Casantaan-Ubagan (N16° 13.736, E119 49.905'); Station III at Brgy. Narvacan-Sungyot Point (N16° 14.25' E120° 23.256') and Station IV at Brgy. Tubod-Damortis (N16° 15.142' E120° 23.219'). From 2013 to 2016, collected samples were sorted, identified, and catergorized. The abundance and distribution of invertebrates in the area identified were: Mollusks, Arthropods, Echinoderms and Cnidarians. Results showed that the temporal distribution of these macromacroinvertebrates from 2013 to 2016 shows that of these macroinvertebrate phyla, mollusks were the most diverse, widespread and common group throughout the sampling months. The mollusks consist of three groups in the collections: Bivalves, Gastropods and Cephalopods. Arthropods were also abundant in the collected samples and consisted primarily important species such as shrimps (*Metapenaeus* spp.); crabs: *Charybdis* sp., *Portunus* sp., *S. serrata* and other species of Portunidae. *S. mantis* is also common and abundant in the collected samples. Others were collected in small quantity. Echinoderms were less common and represented by two species of sea cucumbers (*H. ocellata* & *H. scabra*). Few samples of Cnidarians were collected and may come from other source or carried by water currents into the cove.

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Introduction

The Philippines marine waters contain significant marine habitats, such as coral reefs, seagrass beds, mangrove forests and the deep seas. These habitats are estimated to host at least 2,000 species of fish, 5,000 species of clams and other mollusks and crustaceans, 22 species of whales and dolphins, more than 900 species of seaweed, and more than 400 species of corals. Because of this rich diversity in marine life, some experts have acknowledged the Philippines as the global center of marine biodiversity (http://www. green peace.org/seasia/ph).

Lingayen Gulf has diverse coral reefs system and a home to onze of the most diverse marine communities in the world, but it also provide livelihood to hundreds of thousands of inhabitants of towns that surround the Lingayen Gulf (http://www.worldfishcenter.org/libinfo). The Sto. Tomas Cove, also known as Raois Cove, is an important body of water in Northern Luzon and is located at the southwestern part of the municipality of Sto. Tomas, La Union. Philippines. It is about 600 hectares of fertile seascape, receiving water from Lingayen Gulf and intermittently from seasonal runoff. The chosen site is also a part of the Agoo-Damortis Protected Landscape and Seascape (ADPLS) established by the Department of Environment & Natural Resources (DENR).

The cove is surrounded by 10 barangays, extending from Brgy. Damortis at its southern most end to Brgy. Narvacan in the eastern side. The western side is where the populace resides. Together with other barangays, they partially enclose the northern part of the cove. Mostly shallow, along with its narrow shores and deepens abruptly at its middle parts. Sto. Tomas cove not only provides foods for the villagers but also supplies fresh seawater to vast tracts of fishponds and cages where commercially important fishes and crustaceans are cultured, the major industry of the municipality. The cove is also a navigational highway for the coastal communities, as shelter for fishing vessels, and unloading dock for construction supplies and coals among other.

In the 90's onward, a noticeable decline in landings was observed. Particularly, after a smaller version of trawl net suited in coastal areas was introduced. Locally known as "karkar", the gear is very effective in collecting bottom fauna. Several of these gears are operating in coastal areas of the province. Years after its introduction, landings of fishes and other fauna started to decline. It would take added effort to fish for family consumption. Invertebrates are dominated by important crab species, prawns and shrimps, sea mantis, echinoderms and various species of mollusks. They were numerous then and of good sizes. However, the increasing populations of coastal villagers have exerted too much pressure on these resources. With gear improvements and improper harvesting, resources of Sto. Tomas cove rapidly decreased. Small fishes such as the Leiognathids, Mugilids, Apogonids, all less valuable are now dominating the ichthyofauna. Invertebrates are also becoming scarce, with some important species becoming less in abundance due to over and improper harvesting.

Concern on the future of the cove and its sustainable use is the main reason why this study was conceptualized. This study aimed to provide a picture of the present composition of major macro vertebrates and their status in this important body of water, thus the findings may be of help to policy makers in the management of our coastal resources by providing benchmark information on the present status of the cove when it comes to macro invertebrates.

Materials and methods

The sampling areas are within the Santo Tomas cove, a vast expanse of partially enclosed body of water in the western side of the province of La Union. Part of this body of water is bounded by sandbar on the east, the northern part is mostly large tract of fishponds while the eastern side is where the populace resides. The southern part serves as entry and exit of water into and from the cove. Fishing and aquaculture are the major industries. Agriculture consists mainly of rice, tobacco and vegetables farming.

Four sampling stations were established in the cove: Station I at Brgy. Damortis-Tubod (N16° 14.208',

E120° 23.377'); Station II at Brgy. Casantaan-Ubagan (N16° 13.736, E119 49.905'); Station III at Brgy. Narvacan-Sungyot Point (N16° 14.25' E120° 23.256') and Station IV at Brgy. Tubod-Damortis (N16° 15.142' E120° 23.219'). Table 1 presents the general features of the sampling stations. A once a month sampling at the four established stations was conducted using a modified trawl gear, locally known as Karkar. It is similar to the trawl fishing gear but much smaller. The gear has a mesh size of #8 for the wings, #10 for the body and #14 for the bag. It is also equipped with wooden boards. The net was dragged at each station for a distance of 1000 meters. Collected samples were emptied into plastic containers (Fig. 4) and brought to the laboratory for sorting, identification and measurement. Representative taxa were preserved in five percent buffered seawater formalin for identity verification. Identification was made by comparing the samples with those published in the literatures. Abundance is expressed as number collected per station while distribution is based on where the fauna

is collected. The data presented was for a period of three years, starting from August 2013 to July, 2016.

Results

Major Groups

Various species of invertebrates were collected in the cove. About 4184 individuals were collected from 2013 to 2016 samplings (Table 2). The invertebrates were classified into 4 major groups and about 50 species. However, the number of invertebrate species may be even more. There were many unidentified species in the samples. Samples collected only represented areas Thus near shore areas (less than 1 meter) were not effectively sampled. This explains why the tailed mussels, blood cockles, carpet shells, etc. were few in the collections. Also those reported here are those retained by net, thus small invertebrates that pass thru the net were under estimated. The four major groups identified are the Mollusks, Arthropods, Cnidarians and Echinoderms.

Table 1. General features of the sampling stations.

Stations	Substrate type	Distance from shore (MTS)	Water depth (MTS)	Location
I	Silty and muddy, and sandy in shallow parts	140-150	4-7	West of Damortis near fishport, dense coastal populace, Partly fringed with mangroves
II	Mud, sand	120-140	2-5	Inner area of the cove, used as oyster beds
III	Sandy, muddy, rocky in some part, vegetated	150-160	3-5	Eastern side of Sungyot, rather shallow at low tide, quite protected
IV	Muddy	200-220	>6	Located at the mouth to the cove, deep, serves as entry and exit of water

Total abundance of major invertebrates varied widely during the samplings (Table 2). Abundances for 2013 to 2016 were not complete since samplings started in August of 2013 and ends in July 2016. Abundance of mollusks was highest in 2014 to 2015 and is about half in other years. Arthropods were highest in 2013 and 2016 and less in 2014 and 2015. The echinoderms were few in 2013 and 2016 while the cnidarians were highest in 2014 and was absent in 2016.

Species composition

The mollusks are the most diverse of the invertebrates. They include the snails, octopuses, squids, clams, scallops, oysters and chitons. They are important members of ecological communities.

They can be found in various habitats to include terrestrial mountain tops to hot ocean vents and cold seeps of deep seas. They varied in sizes from about 20 meters long to microscopic forms. They are important as human foods, jewelry, tools and even pets. Shells of some species are quite beautiful and of high value.

The mollusks were also the most specious and abundant in the samples (Table 2a-b & Fig 1.), contributing 52% to the total invertebrate catch. About 25 species were identified during the survey. Seven are from the bivalve group, with *Amussium pleuronectes* (Moon shell) dominating the group; ten from the gastropods with *Turitella terebra* (True augers) the most abundant and *N. olivaceus*, common

in the samples; and three from cephalopods, with *Loligo* sp. as the common species.

T. terebra is eaten as delicacy in the area. Catches are easily sold in the community and local market. Other species of commercial importance is *A. pleuronectis*. This species is the most expensive of the bivalve in the area. Several sizes of the species are found in the cove, emphasizing the importance of the cove as important habitat for moon shells.

Other species of the Bivalvia and Gastropoda were collected in small numbers. They were quite irregular in their occurrences (e.g. *Atrina pectinata, Faciolaria filamentosa, Placuna placenta, Strombus canarium, Turris babylonia*), possibly because of various reasons. One is that their preferred habitat is not reached by the sampling gear or because of their small size that they easily pass thru the meshes of the gear during sampling.

Majority of the mollusks species are eaten and therefore there exist fishing pressure on these resources. However, they are now few in the samples. Cephalopods are considered as luxury food item, much relish by the fishermen and are often eaten immediately when caught.

The diverse Molluskan fauna reflects the suitability of the cove as habitat. The substrates in the cove are usually muddy, some has fine sand. Other areas near shore are rocky while some contain excellent growth of seagrasses. This explains the diverse molluskan fauna of the cove. Their little abundance however, may reflect the high fishing pressure of these resources.

Arthropods are invertebrate animals with exoskeleton and segmented body and are represented by the insects, arachnids, myriapods and crustaceans. They are found on land, sea and air. They are distributed from the deep sea to mountain peaks and ranges in size from King crab with its 12 foot arm span to microscopic insects and crustaceans. Their preferred habitat is not reached by the sampling gear or because of their small size that they easily pass thru the meshes of the gear during sampling.

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They ranked second in abundance and in number of species in the collection, contributing 43% of the total invertebrates (Table 2 a & b and Fig. 1). Sixteen (16) species were identified, nine (9) species of crabs, 3 of shrimps and prawns, one (1) mantis shrimp and many unidentified decapods and portunids. Of importance are the shrimps and prawns (*Metapenaeus* spp. and *Penaeus monodon*) and the portunid crabs (*S. serrata, Portunus pelagicus, P. sanguinolentus* and *Charybdis* spp.). These species are commercially exploited. Some in the unidentified samples are not eaten. They are generally collected as juveniles, similar with the other portunids. This observation may reflect the importance of the cove as nursery area for these species. Included in this group are unidentified species of portunids. The rough skin Echinoderms were also present in the samples sharing 2% to the total invertebrates. Echinoderms are represented by two species of sea cucumbers: *Holothuria ocellata* and *H. scabra;* an unidentified form of echinoderm; three species of starfishes and a sea urchin. Except for the *H. scabra*, all are

unimportant. *H. scabra* in the locality are dried and sold as "trepang", a very expensive delicacy in Chinese cuisine. *H. ocellata* are smaller than *H. scabra*. Its body is thinner and contains plenty of horny-like projections. They are considered as nuisance species because they are abundant and are usually caught together with the target species. However they may be utilized for some nutraceutical products.

Cnidarians comprises the jellyfishes in which two species were identified, contributing 2.5% to the total. All are predators of young fishes and other zooplankton in most cases the pattern of abundance of the abundant taxa coincided with those of the total number of invertebrates. An obvious similarity can be seen in November 2013, April and October and December 2014 and April 2015 for the mollusks. Abundance of Arthropods does not follow those of the total invertebrates and generally, they are the opposite (November 2013, July-October 2014, in most months of 2015). Their abundance follows those of the total in 2016.

Table 2. Temporal and percentage abundance of the major macro invertebrate phyla from 2013 to 2016 in Sto, Tomas Cove, La Union, Philippines.

Macro vertebrate Phyla	Year					
	2013	2014	2015	2016	Total	%
A. Number of Individuals						
1. Mollusks	158	746	784	495	2184	52
2. Arthropods	307	390	419	1817	1814	43
3. Echinoderms	17	41	8	8	84	2
4. Cnidarians	25	59	0	0	103	2.5
Total	507	1236	1240	1201	4184	
B. Percentage abundance						
1. Mollusks	31.1	60.3	63.2	41.2		
2. Arthropods	61.0	31.6	33.8	58.1		
3. Echinoderms	3.3	3.3	1.4	0.6		
4. Cnidarians	4.9	4.7	1.5	0		
	100	99.0	99.0	99.9		

Table 3. Description on similarity and diversity indices for the four stations of Sto Tomas Cove, La Union, Philippines.

Shannon Diversity Index				
Stations	I	II	III	IV
DI	81	83	97	83
b. Jaccards similarity index				
I	-	42.8	45.0	46.0
II	-	-	42.8	42.5
III	-	-	-	42.5
IV	-	-	-	-
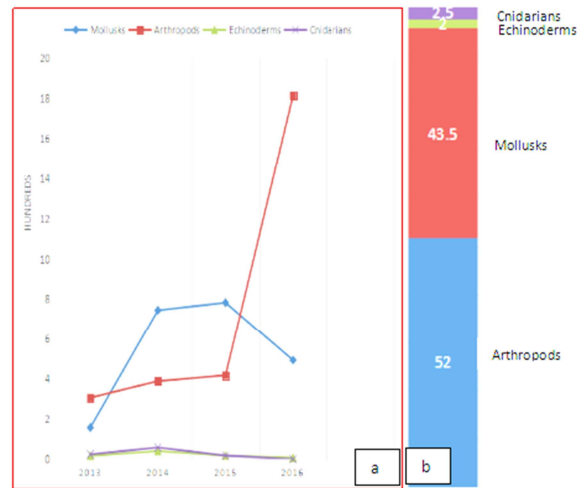
Fig. 1. (a) Temporal Abundance of Mollusks, Arthropods, Achinoderms and Cnidarians; (b) at Sto Tomas Cove, La Union, Philippines from 2013-2016.

Other groups
Echinoderms and Cnidarians, though were found in most of the samplings were very few in the samples, and that their influence to the pattern of abundance is quite negligible. *Holothuria scabra* occurred intermittently during the survey. Likewise, the cnidarians occurred sporadically and of no definite pattern of occurrence.

Abundant species were also described for the four phyla from 2013 to 2016 (Fig. 1). For the mollusks, *T. terebra* dominated the collections in all years with catch ranging from 54-79%. *A. pleuronectes* was also abundant but only in 2013 and 2014. They make up small collection during 2015 to 2016. Other species: *Bursa rana* contributed 1 to 6 % and was present in all the survey periods. *Nassarius olivaceus* were also present with catch ranging from 2 to 9% while *Nassarius* sp. shared 1 to 5%.

Arthropods were largely contributed by *Portunidae* spp. but with varying percentages during the survey. They were particularly abundant in 2013 to 2015 with catch ranging from 29 to 76%. *Metapenaeus ensis* occurred in all the samplings with catch ranging from 6 to 30%. Contribution *S. squilla* varied little with catch range from 4 to 7% while *P. monodon* shared 2 to 7%. Different unidentified *Penaeus* spp. was also collected during the surveys, sharing 5 to 10% of the total arthropods.

There were few e echinoderms in the collections. *H. scabra* was dominant in 2013 and 2015 with catches ranging from 53 to 59%. *H. ocellata* was also dominant in the samples and abundant in 2013 to 2014, few in 2015 and absent in 2016. *Asteroidea* spp. was common in 2014 and 2015. Other unidentified species were also present. Cnidarians are composed largely of *Aurelia sp.* in 2013. *Chrysophora* sp. appeared only in 2014 and 2015.

Community Indices

Description on similarity and diversity indices were computed for the four stations. Number of species for the stations surveyed ranged from 40 (stn. 2) to 44 (stn. 3) showing less variation of the stations based on the number of species identified.

Diversity index for the 4 stations are shown in Table 2. Values for stns. 1, 2 and 4 are almost similar. Stn. 3 is quite an exception due to the high DI value. Stn. 3 is quite protected being located at the eastern side of large sandbar forming an islet called *Sungyot*. It is quite shallow and contains different substrates. Partly rocky and covered with silt and mud on its deeper areas. Various vegetations are found in these stations but is largely eelgrasses in origin. Decaying vegetations are abundant in this station. The other stations are quite exposed.

Similarity index of the stations surveyed are almost identical for the four stations. This explains the widespread occurrences of the different species particularly of the abundant taxa. The higher value for stns. 1 and 4 maybe because both of them are located near the entrance to the cove. Moreover, the cove may be considered small explaining the less variation in the computed index value. Usually, existence of other ecosystem such as the mangrove may contribute to variation in the similarity index of areas being compared. Station 1 near the eastern coast of the municipality is fringed with mangrove trees, a result of the effort of the municipality for coastal protection. However, the number of species found in this station (N=44) does differ much compared to stations 2 (N=40), 3 (N=43) and 4 (N=44).

Conclusions

The presence of varied species of macroinvertebrates in the cove implies high productivity in the area. However, in terms of economic importance and commercial availability of the resources, the cove is now in poor condition. Only few resources dominated the macro invertebrate fauna. Among the molluscs, only two species (*T. terebra* and *A. pleuronectes*) are important and are still present in viable quantity. Other species were few and occurred sporadically.

Except for *H. scabra*, all the echinoderms collected in this study are of no commercial values. This species is effectively caught by the sampling gear. They are target species and sold as fresh or processed commodity. Other species of echinoderms such as the starfishes and sand dollars proliferate in the cove because they are of no importance and are returned to the water when collected.

Near shore areas are used as source of food by coastal communities. Gleaners, in particular, harvest resources from shallower reefs, flats, mud flats, sandy to rocky areas, sea grass beds and mangrove areas. Some excavate the substrates to get the burrowing species while others overturn boulders to see what lies beneath. More substantial results may therefore be achieved if catch data from gleaners are included. The present use of the cove as mariculture site for finfishes, docking areas for fishing boats, navigation, oysters farm are all important activities in the coastal areas. They add to the coffers of the municipality which in turn are used to improve living standard of the populace. However, majority of the coastal dwellers are artisanal fishermen who rely much on the cove on day to day basis, exerting high fishing pressure on its resources. Unless serious study is done to manage the remaining resources and maintain or improve the present condition of the cove all will lead to the rapid depletion of resources of Sto. Tomas cove.

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