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Assessment of the Shellfish Resources of Balete Bay, Davao Oriental

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Abstract

Assessment of shellfish resources in Balete Bay, Davao Oriental was made from March 1994 to January 1995 to determine their status and level of exploitation of most commercially exploited species in the area. Sampling followed a modified technique of the standard procedure for soft-bottom organisms. Monthly size measurements of *Strombus urceus* and *Placuna placenta*, the most commercially exploited species were made. Representative samples of other species were collected for identification purposes while some abiotic factors were also monitored. About 55 species were identified With total density ranging from less than 1 to 7 inds./m^2 . S. urceus was the most dominant species being the highest in both total density (7 inds./m^2) and relative abundance (24%). They were most abundant in S3 and S4 that have sandy-muddy to sandy substratum with vegetation. P. *placenta*, with a total density of 3 ind./m^2 and relative abundance of 9% was mostly confined in the muddy substratum of S1 and S2. Some species were ubiquitous while others were restricted in occurrence. Shannon's Diversity Index revealed that S2 and S3 were more diverse areas and S6 had low diversity. Rarefactions Method showed that S3 was high in species richness while Sl and S5 were less rich in species. Frequency and size frequency distribution of *S. urceus* and *P. placenta* showed a fluctuating trend throughout the sampling period and correlation test on physico-chemical parameters showed their community zonation is strongly influenced by granulometry gradients from landward to the seaward zone. Salinity, pH and temperature fluctuate within the normal range where these species are normally found.

Keywords: community zonation, diversity, richness, granulometry gradients, *Strombus urceus*, *Placuna placenta*

Introduction

It is common knowledge nowadays of a shift in focus from the land to sea to answer humanity's need for food. At present, however, decreasing fishery products is paving the way to shift the attention to other marine products such as the shellfish or the shelled molluscs.

Shellfish are soft-bottom non-segmented animals enveloped by mantles soft coverings of living tissue that secrete the protective shell (Nichols and Bartsch, 1945). It is one group of molluscan fauna, which has economic importance aside from their role in the ecological balance (Gomez and Chavez, 1987). These are widely utilized as food and serve as raw materials for cottage industries. Some species command a high prize among shell collectors.

Because of their importance, there has been massive efforts at culturing them, but culture farms, at least in the Philippines, have been concentrating on a few species such as the mussel and oysters (Fortes, 1990). Authorities, however, are now looking at the possibility of other species such as clams, cockles, scallops, abalone, venerid shells and window-pane shells (Gomez and Chavez, 1987; Fortes, 1990; Darvin, 1992b,c). In fact, one of the priority areas looked into by the research and development efforts in the Philippines is the development of technology for the mariculture of culturable species (Gabral-L1ana, 1987; PCARR, 1986).

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In Balete Bay, these resources are also present and its harvesting unregulated. Aside from fishing, coastal residents glean on the intertidal shores for shellfish especially during low tides both for the family's sustenance and additional income. Because these are widely utilized by the coastal residents and neighboring towns, danger of overexploitation is considerable. Particular is the window-pane shell or kapis shells which, according to local fisherfolks, were abundant that served a good cottage industry in the area many years back. Before these resources are thus depleted, it is important that they are properly managed. To do so, however, is difficult without baseline information.

This study assessed the status of shellfish resources so that conservation measures and management plan could be appropriately drawn up.

Objectives of the Study

1. 1.Assess the species diversity, distribution and characterize the status of shellfish resources;
2. 2.Determine environmental parameters that influence the growth and population of the shellfish resources; and
3. 3.Identify potential species and sites for the culture and mass production of shellfish resources.

Methodology

Study Area and Sampling Sites

The study was conducted in Balete Bay, a smaller bay within Pujada Bay. Its mouth faces Pujada Bay waters and the bay lies between 60 52' to 60 55' N latitude and 1260 09' longitude. Six sampling stations were established in the area, two stations

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representing each of the inner, outer, and middle portions of the bay (Fig. 1).

Data Collection

Sampling followed the standard procedure for soft-bottom organisms (English et al., 1994) with modification on the apparatus used. Since apparatus was unavailable, sediment samples were manually collected using plastic containers and ordinary net bags as sieve.

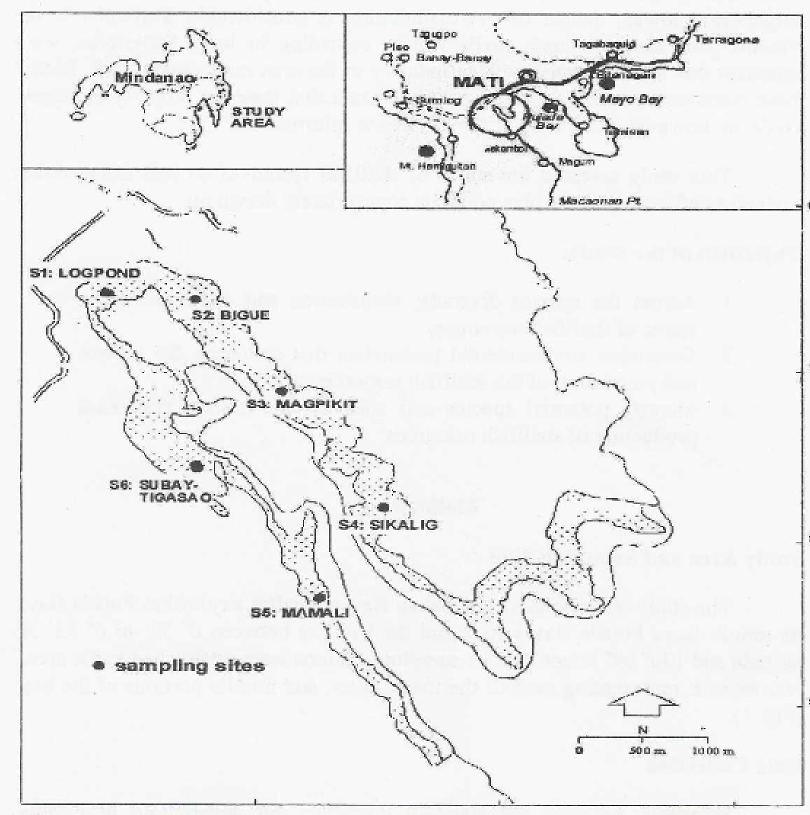

Fig. 1. Map showing the location of the study area and the six sampling sites

At each of the six stations, sampling areas were established using the transect-quadrat technique. Transects were laid 20 m apart from the shore to the reef crest and 1m quadrats were laid in duplicate along each transect placed at 10 to 20 m apart from each other depending on the length of the intertidal zone. Sample substrates at a depth of 7-8 cm within each, quadrat was collected and sieved on site. Shellfish remaining within the quadrat were identified and counted. Representative samples were collected and brought to the Davao Oriental State College of Science and Technology

(DOSCST). laboratory for identification and documentation purposes. Monthly size measurements of *Placuna placenta* and *Strombus urceus*, the most commercially exploited species, were also monitored for about six months from July 1994 to January 1995. Sampling was not done in June and December 1994.

Some abiotic factors were determined in situ whenever possible. Otherwise, samples were collected and brought to the laboratory for analyses. Standard apparatus and procedures were used in the measurements of these parameters.

Sampling in six stations was conducted only for the first quarter (March to May 1994). Thereafter, sampling was confined to the most commercially exploited species and within the sites where they were mostly found, that is, at SI and S2.

Species Identification

Invertebrates were identified up to the species level whenever possible, otherwise, generic or group names were used. The following published species catalogue and tgxonomic references were used: Sotto and von Cosel, 1982; Hinton, 1972; Kira, 1965; Nichols and Bartsch, 1945; Springsteen and Leobrera, 1968; Walls and Taylor, 1979; Zeigler and Por 1969; de Guzman, 1990; and Dance, 1974.

Unidentified specimens were sent to University of the Philippines Marine Science Institute (UP-MSI) laboratory and National Museum of the Philippines for confirmation.

Statistical Analysis

Analyses were done using the complete community data list and the abundance data of the two identified commercially important and exploited species of shellfish. The ECOSTAT program that includes numerous quantitative methodologies dealing with the exploration of patterns in biotic communities was used in the analysis (Ludwig and Reynolds, 1988). It is a popular program on mathematical or quantitative ecology that encompasses both population dynamics and community patterns such as spatial dispersions of species “within” a community, relationships between many species “within” and among many species “between” communities.

The Shannon’s Diversity Index was used to calculate species diversity using the species composition and abundance data while Margalefs Richness Index R and the Rarefraction Method were used in determining the richness of the area (Ludwig and Reynolds, 1988).

For the determination of species dominance (relative abundance), the following formula was used:

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$$\text{Dominance (\%)} = \frac{\text{No. of individuals of a given species}}{\text{Total no. of organisms in a given area}} \times 100$$

Correlation tests between the community zonation and the measured abiotic factors were also done.

Results and Discussion

Species composition and abundance

About 55 species under three classes were collected and identified along with some unidentified species (Table 1). Most were gastropods and bivalves with total shellfish density ranging from less than 1 to 7 inds. /m^2 (Fig. 2). Two species, *Placuna placenta* (kapis/lampirong) and *Strombus urceus* (aninikad), were most Table 1. List of shellfish resources identified in Balete Bay

Species	English Name	Local Name	Species	English Name	Local Name
Bivalve			**Bivalve**		
*Anadara granosa**	blood clam	*litob*	*Mercenaria mercenaria*	hard clam	*tuway-tuway*
*Anadara maculosa**	ark	*bakalan*	*Modiolus metcalfei*	brown bay mussel	*amahong*
			Pallium sp.		*tahong*
Anodontia edentula		*embao*	*Perna viridis*	mussel	*tahong*
Anomalodiscus sp.	venerid		*Pharella sp.*		
Circe sp.	venerid		*Pinctada sp.*		
Corculum sp.	heart cockle		*Pinna sp.*	pen shell	*wasay-wasay*
Crassostrea iredalei	oyster	*sese*	*Placuna placena**	window-pane shell	*kapis, lampirong*
Fulvia sp.			*Spondylus ducalis*		*tikod-tikod*
Katylesia hiantina	short-necked clam	*punao*	*Sari squamosa*		
Laevicardium flavum	cockle		*Septifer sp.*		
Lioconcha sp.			*Tachycardium sp.*		
Mactra sp.			*Tellina linguafelis*		
Malleus sp.			*Tellina sp*		
Gastropod			**Gastropod**		
Cancilla praestantissima			*Pseudovertagus sp.*	cerithids	
Clypeomorus traillii	cerithids		*Strombus canarium*	conch	
Conus sp	cone		*Strombus sp*	conch	*bongkawil*
Cymatium sp.			*Strombus urceus**	conch	*Aninikad*
Cypraea sp	cowry		*Telescopium telescopium*	horn shell	*bagongon*
Lambis sp.	conch		*Terebellum terebellum*	bullet conch	
Haliotis sp.	abalone		*Trochus maximus*	top shell	*samong*
Murex sp.			*Turbo marmoratus*	turban shell	
Nassarius spp. (4)			*Turbo sp.*	torbo	*bulatok*
Oliva sp.			*Turris sp.*		
Oliva tesselata	egg shell		*Vexillum sp.*		
Natica onca					
Polinices spp.	moon shell				
Scaphopod					
Dentalium sp.	tooth shell				

* = commercially exploited in the area

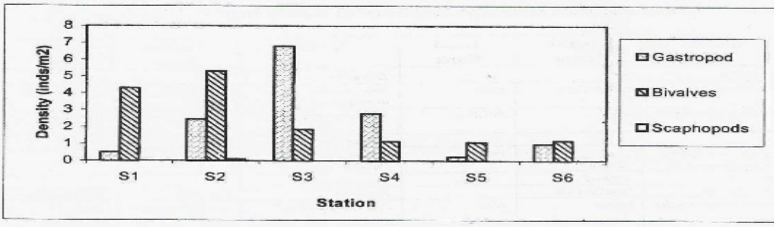

Fig. 2. Densities (inds./m^2) among the three identified shellfish classes

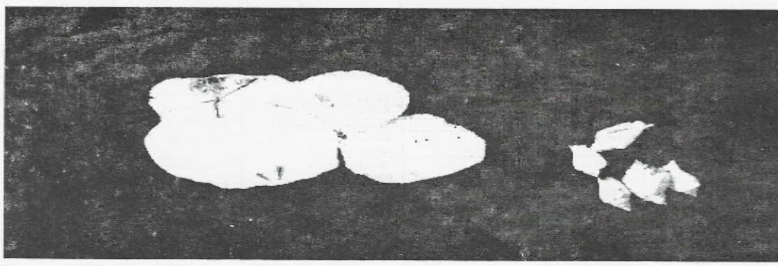

Plate 1. *Placuna placenta* (*kapis*) and *Strombus urċeus* (*aninikad*)

Strombus urceus was the most dominant species being the highest in total density (7 inds. /m2) (Figs. 3 and 4) and relative abundance (24%) (Fig. 5). Other dominant species include: Circe sp,, *Placuna placenta, Nassarius spp*., *Crassostrea iredalei* and *Anadara spp*.

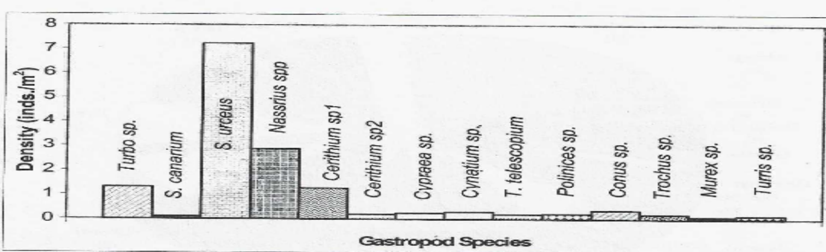

Fig. 3. Density of gastropods in Balete Bay

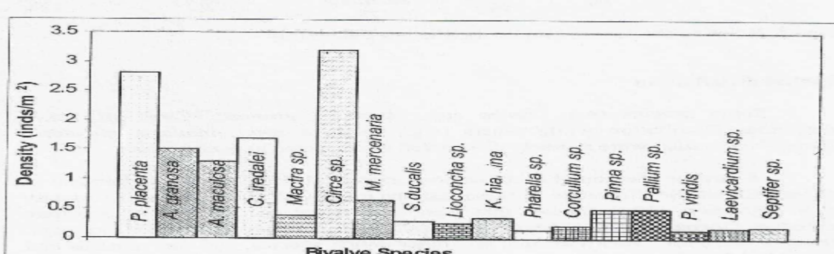

Fig. 4. Density of bivalves in Balete Bay

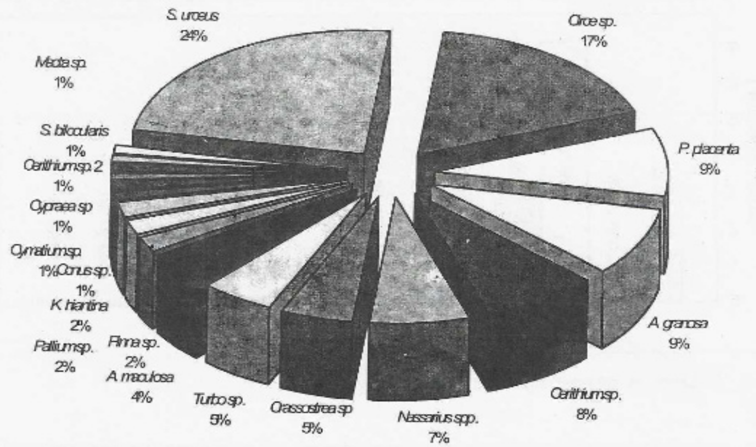

Fig. 5. Relative abundance (%) of shellfish in Balete Bay

Spatial distribution

Some species (e.g., *Turbo spp*., *Anadara granosa*, *Circe sp*.) have ubiquitous distribution while others (e.g., *Cypraea spp., Anadara maculosa, Spondylus ducalis*) were sparsely distributed or restricted in occurrence.

S. urceus was found in all stations except S1 but were most abundant in stations S3 and S4. Substrate in these stations is generally sandy-muddy to sandy with Vegetation. Other species that were also found in this type of substrate included *Lioconcha spp., Laevicardium flavum, Pallium sp., Polinices spp., Trochus maximus., Tachycardium sp.*, other conch species, and the venerids and cerithids. *P. placenta* was found only in Sl and S2 where the substrate is generally muddy. Other species that were also found in this type of substrate include *Crassostrea iredalei, Anadara spp. and Nassarius spp*.

Species Diversity

Shannon's Diversity Index showed that S2 was the station with the highest diversity while S6 was the least. S3 was also high in species diversity. Results on Margalers Richness Index and the Rarefraction Method showed that S3 was high in species richness while Sl and S5 had low (Fig. 6).

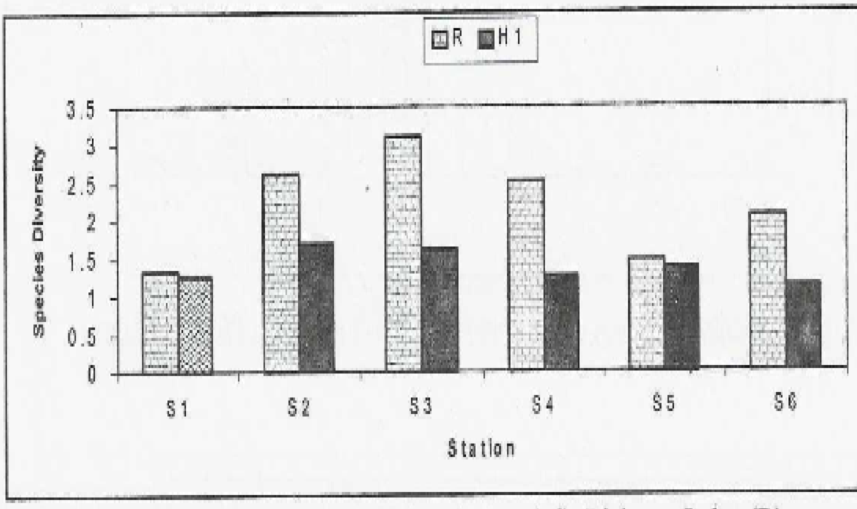

Fig. 6. Shannon's Diversity Index (H1) and Margalef's Richness Index (R) among the six sampling stations (S1-S6)

Distribution of *Placuna placenta*

Data on frequency distribution showed that for P. placenta, highest peak months occurred in August and September which could be due to the preponderance of juveniles. The same trend an also be seen among the dead individuals which could be due to increased freshwater run-off and sedimentation because of high rainfall during these months (Fig. 7).

Size frequency distribution for the juveniles and/or non-marketable (<70 mm sizes) individuals showed an increasing trend from July to September but decreased in later months. Abundance of mature and/or marketable (>71 mm sizes) individuals was high only in July and was low in August to November and in january. For dead individuals, increase abundance of juveniles and/or non-marketable sizes was seen in August but low in other months which could be an indication of lower tolerance of these sizes to low salinity and increased sedimentation load as a result of heavy rainfall. Mature and/or marketable individuals were abundant only in July and were low the rest of the sampling months (Fig. 8).

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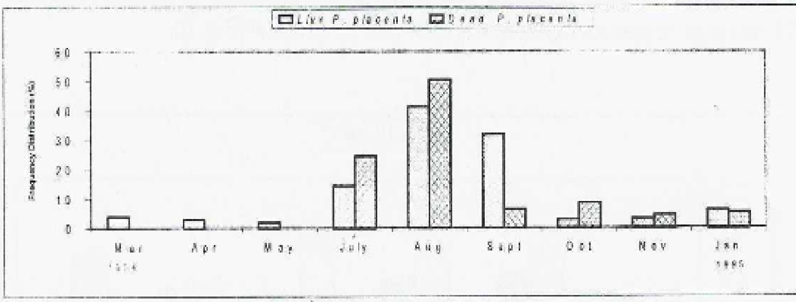

Fig.7. Monthly frequency distribution (%) of live and dead *Placuna placenta*

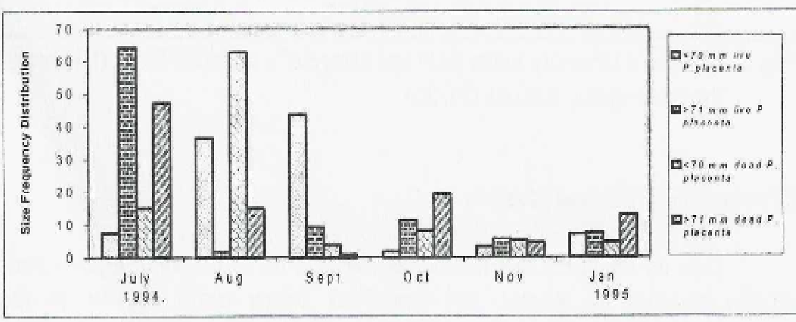

Fig.8. Monthly size frequency distribution (%) of live and dead *Placuna placenta*

Distribution of *Strombus urceus*

For S. urceus, data on frequency distribution showed an increasing abundance from August to October but decreased in November and January (Fig.9). Large-sized individuals (sizes >35 mm) were more abundant in August, October, and November while small-sized individuals (size <20 mm) were more abundant in September and January. Medium-sized individuals were generally low except in September (Fig. 10).

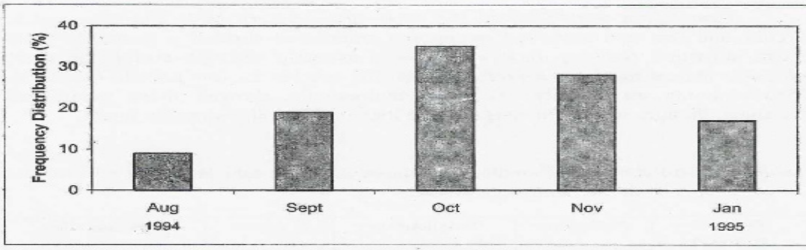

Figure 9. Monthly frequency distribution (%) of *Strombus urceus*

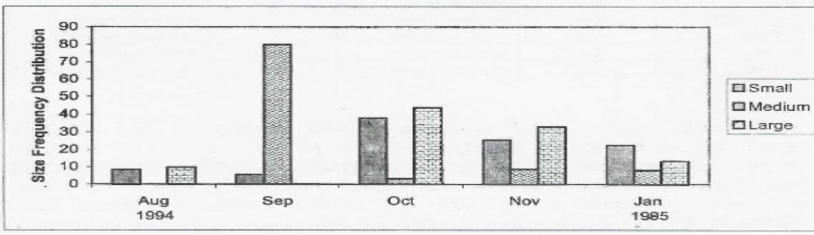

Figure 10. Monthly size frequency distribution of *S. urceus*

Fluctuations in abundance and sizes of *P. placenta* and *S. urceus* could reflect environmental differences in specific area of occurrence. Degree of harvesting of these species could also affect, thus, the data might not reflect their true natural condition.

Correlation test

Correlation tests between the community pattern of *P. placenta* and *S.urceus* and the environmental parameters monitored showed a generally weaker influence. Salinity, however, showed a strong negative correlation to *P. placenta* indicating the non-preference of this species for low salinity (Table 2). Measurements on salinity, pH, and temperature showed these parameters fluctuate, though, within the range where these species are normally found.

Table 2. Correlation coefficients of *Placuna placenta* and *Strombus urceus* and the physico-chemical parameters

Physico-chemical parameter	*P. placenta*	Relationship	*S. urceus*	Relationship
Salinity	-0.88	strong negative	0.11	weak positive
Temperature	-0.18	weak negative	-0.14	weak negative
pH	-0.82	weak negative	-0.29	weak negative
Water depth	-0.85	moderate negative	0.60	moderate positive
% Sand	-0.46	weak negative	0.79	moderate positive
% Silt	-0.15	weak negative	-0.39	weak negative
% Clay	-0.75	moderate positive	0.56	moderate positive

found that this species preferred to thrive in muddy areas free from flooding, siltation, pollution and other disturbances such as fishing operations. Freshwater run-off and soil erosion could bring about these conditions. Though this species can withstand low salinities, they cannot tolerate this condition for longer time periods and will be suffocated by sediment leading to their death (Darvin, 1992a).

For *S. urceus*, seagrass biomass and density, sediment organics and algae abundance were important elements associated with their abundance (Stoner et al. 1995).

Conclusions

Shellfish resources, which were monitored among six stations, were seen in varying quantities. A total density ranging from less than 1 to 7 ind/m gives the impression of low productivity of the Balete Bay area. Results also show that the area is low in shellfish diversity. Only about 55 species were identified although there were some 30 unidentified species.

Two species, P. placenta and S. urceus, were commercially exploited and sold to nearby markets. The community zonation of the shellfish resources Of Balete Bay is strongly influenced or regulated by granulometry gradients from the landward to the seaward zone as well as salinity for P. placenta. Fluctuations in abundance and sizes of P. placenta and S. urceus and the other species, in general, could reflect environmental differences in specific area of occurrence as well as degree of harvesting. Thus, any studies applied related to these resources in the area should consider these parameters.

Recommendations

Based on the results of the study, the following recommendations are set forth:

1. proper regulation or stricter imposition of rules and regulations in gathering commercially important shellfish especially the kapis shell;
2. experimental transplantation studies of kapis shell along the bay be conducted;
3. mangrove reforestation and its effect on kanis and other shellfish resources be determined;
4. regulation studies on the harvesting of *S. urceus* and the use of harmful gears be conducted; and
5. conduct monitoring or follow-up studies in the same sampling areas to determine the direction of change of the shellfish resources in the area.

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