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Ecology And Some Notes on The Biology of Mantis Shrimp, *Lysiosquilla maculata Fabricius* in Guang-Guang, Mati, Davao Oriental and Its Adaptability to Brackish water

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Abstract

Relationships between population density and distribution of mantis shrimps were identified along with some notes in biology. Physico-chemical parameters like water depth, temperature, salinity, soil pH and substrate grain size as well as the flora and fauna were determined in the littoral zones of Guangguang, Mati, Davao Oriental. The adaptability and survival capacity of mantis shrimp to brackish water was also determined. Population density of mantis shrimp, *Lysiosquilla maculata*, as evidenced by the number of burrows, was positively influenced by salinity and soil pH but not grain size of the substrate. Results showed that this species could survive in brackish water with 75% survival at a salinity level of 12 ppt while water temperature and water depth had negligible effects. Mantis shrimp showed a contiguous or clumping distribution pattern that suggests habitat selection.

Keywords: *Lysiosquilla maculata*, crustaceans, community structure, habitat, intertidal zones, survival, brackish water

Introduction

Crustaceans as a fisheries commodity constitute a considerable volume of our protein food supply. These are important export items and are considered delicacies throughout the world.

Mantis shrimps (Stomatopods, Crustacean) are a group of animals with many extraordinary traits in their sensory organs, nervous systems, and behavior (Schiff, 1990). These marine organisms are predatory crustaceans that thrive in shallow waters and intertidal zones characterized by fine sand •substrate (AngSinco et al., 1986).

Mantis shrimp, *Lysiosquilla maculata*, commonly known as "*alupihangdagat*", "*amuntaha*" or "*hanilitik*', has a hard exoskeleton. and a formidable defensive weapon in its raptorial claw (Plate 1). It is one of the more valued crustaceans probably because it is an exotic delicacy in Hawaii, Australia, Japan and other Asian countries.

This shrimp is not common in the Philippines; however, it has been found in some parts of Mindanao but not much is known about its ecology and biology.

Plate 1. Mantis shrimp, *Lysiosquilla maculata* Fabricius

A knowledge about its ecology and biology will serve as baseline data ‘or the shrimp’s conservation; enhancement and possible mass culture as well as bases for further studies.

Research and development studies on marine resources, particularly on crustaceans should be given more emphasis for there is a necessity to develop the prawn industry and that of other commercially important crustaceans.

This study was conducted from January 1997 to June 1998. The ecological observations were done from January to December 1997 while the biological observations in the artificial environment was from July 1997 to June 1998.

Materials and Methods

Establishment of the study. area. The study was conducted in the littoral zones of Guang-guang, Mati, Davao Oriental (Fig. 1) where marine organisms are diverse. Five sampling stations (50m x 100m each in size) were established in the study site.

Ecological ‘study. Field sampling was conducted once a month for one year. Different physico-chemical parameters like water salinity, water temperature, water depth and soil pH were determined. The population density and distribution patterns were determined by counting the number of burrows. Relationships between different

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physico-chemical parameters and the number of burrows were also established.

Biological study. Ten pairs of mantis shrimps were collected from the field and transferred into 3 aquaria (1m x 1m x 0.5m). Life cycle, mating habits, feeding behavior, prey preference and other relevant biological observations were obtained.

Adaptability to brackish water. A pair of mantis shrimp (male and female) were used in determining the adaptability and survival capacity of this species in six small aquaria. The shrimps were acclimatized by regulating water salinity every after 2 weeks with a decrease in salinity of 2 ppt.

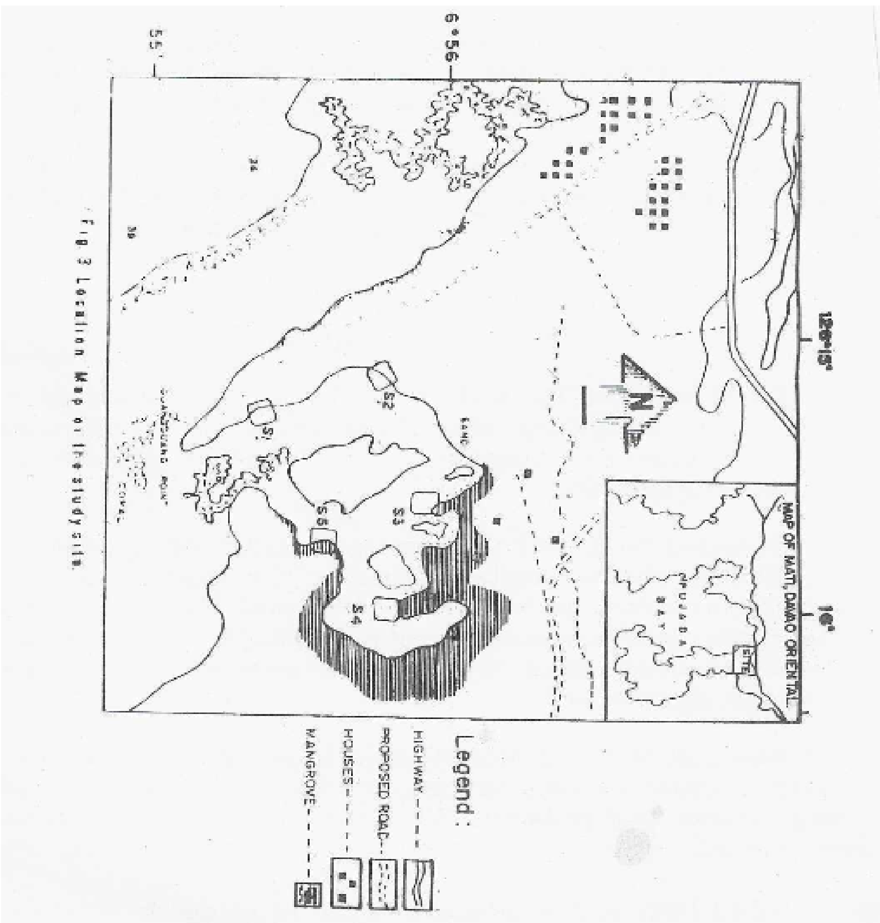

Fig 3 Location Map of the study site.

Statistical analysis. Two factorials in RCBD were used in determining the population density of mantis shrimp in different sampling stations (Gomez and Gomez, 1976) while variance mean ratio test was used in identifying the distribution pattern between the burrows (Elliot, 1971).

The analysis of variance (ANOVA) was used to test the significant differences among substrate grain size and no. of burrows. The Duncan Multiple Range tests (DMRT) was employed to test further the significant differences among means. The test for correlation coefficient (r2) was used to determine the relationships between different physico-chemical parameters and population density.

Results and Discussion

To fishes and other marine organisms, water is their abode, playground, nursery, school board, drink and their graveyard. TO them the most important aspects of water are temperature, dissolved oxygen, pH and salinity (Tenedero, 1977). A number of environmental mechanisms such as physical or chemical factors may affect the distribution and population density of mantis shrimp.

Ecological profile of the study area. Three replicates of water and soil samples were collected from different sampling stations. Some physico chemical parameters like water temperature, water salinity, water depth and soil pH were determined (Figure 2).

The differences in water temperature were very minimal with a range of 28.5 to 35.3^{0}C (Fig. 2A). This observation is consistent with the statement of Odum (1971) that it takes great amount of energy to change water temperature particularly ocean temperature,

The variations in salinity were very slight (Fig. 2B) although 25 ppt was observed during rainy days. Open sea salinity varies within very narrow limits Odum (1971).

Water depth ranged from 0 to over 60 cm (Fig. 2C). Samplings were conducted during low tide for easy location of the burrows. Mantis shrimps were

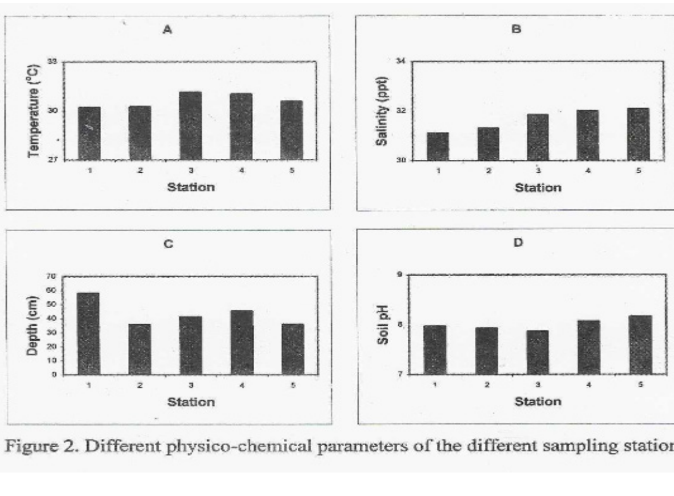

Figure 2. Different physico-chemical parameters of the different sampling stations

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observed to thrive in shallow waters and intertidal zones (AngSinco et al. 1986).

The soil pH had a range of 7.9 to 8.2 with a mean of 8.0 (Fig. 2D). The pH value is within the normal range of marine environment that is slightly alkaline (Tenedero, 1977).

Substrate samples collected from the study site were sent to the Soils laboratory of the Department of Agriculture in Davao City for grain size analysis. Results are shown in Figure 3. All stations are composed mostly of very fine sand followed by coarse sand, then fine and tool sand. Station 1 had ae highest amount of very fine sand (32.7g) and the least in coarse sand (8.1 g). station 4 had the highest amount of coarse sand (16.2g).

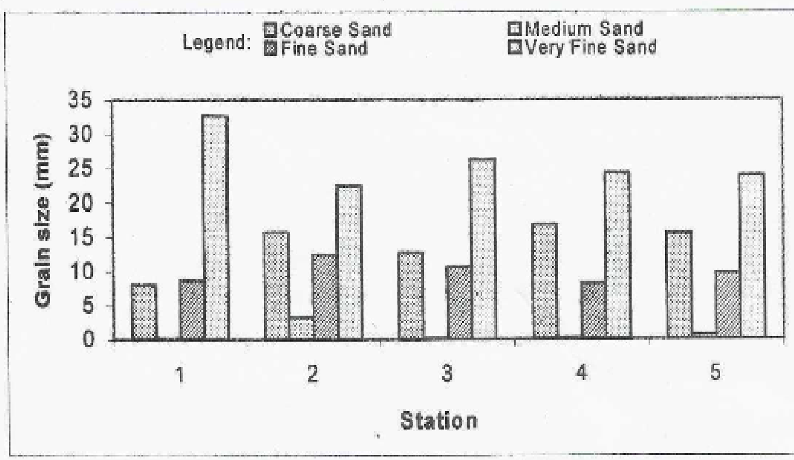

Figure 3. Grain size analysis based on 50 grams of soil samples

The preference to a certain substrate type can be accounted to their burrowing nature. Fine grains can support their needs for survival for it has a greater water holding capacity that is suitable for burrowing (Matsuura and Hamano, 1984). Besides, burrowing organisms require substrate that are penetrable but stable that may not collapse easily (Basch and Engle, 1989).

Table 1. Substrate grain size

Description	Mesh size (mm)	Mean
Coarse sand	>1	13.79 [b]
Medium sand	20	0.87 [c]
Fine sand	40	9.93 [b]
Very fine sand	<60	25.94 [a]

Means with a common letter are not significantly different at 0.05 level using DMRT

Water depth and temperature had a negligible effect on the number of burrows probably because crustaceans have a wide range of tolerance to these parameters. In the study of Basch and Engle (1989) on mantis shrimp, data suggest that the occurrence of mantis shrimp is influenced by substrate type (Table 1). Preference to a certain substrate is related to their burrowing to support their needs for survival. Basch and Engle (1989) stated that possible habitat selection for specific characteristics of the sediment may allow • for successful recruitment, building and maintenance of burrows.

Population density of mantis shrimp. The number of burrows determines the population density of mantis shrimp. Each burrow was assumed to be occupied by a pair of this species (AngSinco et al., 1986 and Sorrosa, 1995).

Figure 4 shows that there were differences in the number of burrows in different sampling stations and different. sampling periods. Among the 5 sampling stations and months, the highest number was observed in station 5 and on the month of March, respectively. But on the month of January no burrow was found in all stations. This could be due to the rain that lasted for several days before and during sampling thus there was difficulty in finding the burrows.

The analysis of variance shows that the differences in the number of burrows in different sampling stations and different sampling months were highly significant. By DMRT, it was found that the mean of station 5 (5.83) is significantly different from stations 3 and 2 with means of 1.42 and 0.17, respectively (Figure 4). The burrows counted on the month of March is significantly different from the months of January, February, October and December but not from the rest of the months.

Correlation between number of burrows and physico-chemical parameters. As shown in Table 2, the occurrence of mantis shrimp is positively influenced by soil pH and salinity. Mantis shrimps are marine organisms; thus, they thrive in an alkaline environment. Data show that as the grain size of the substrate decreases, there is a corresponding increase in the number of burrows.

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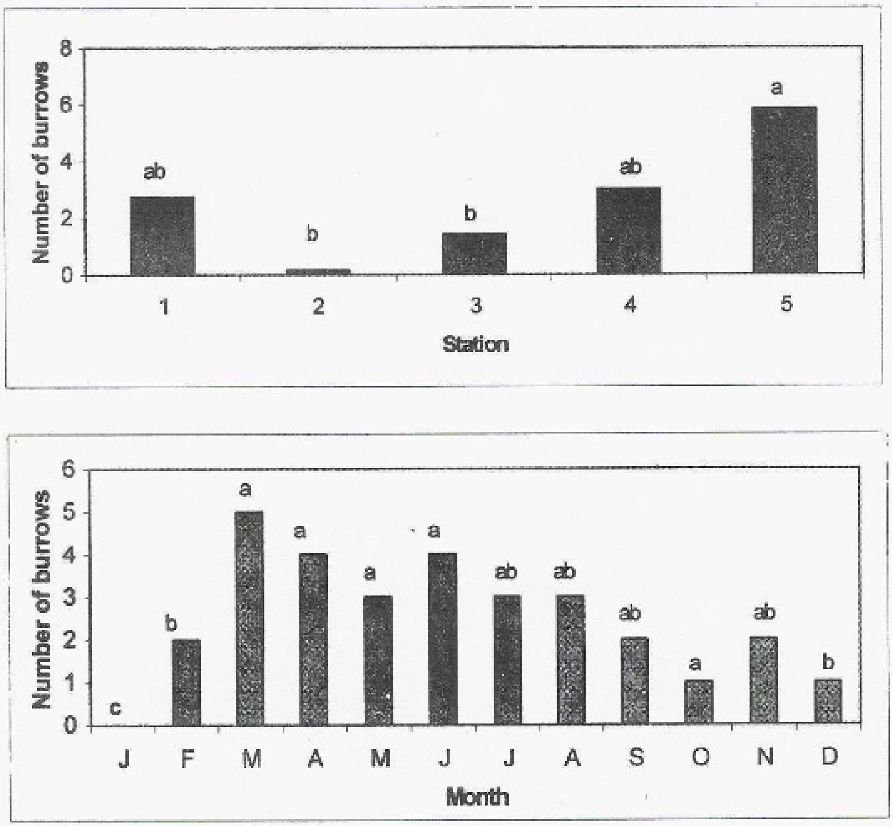

Figure 4. Number of burrows of mantis shrimp as affected by sampling stations and months (Bars with common letters are not significantly different from each other using DMRT at 0.05 level.)

Table 2. Relationship between number of mantis shrimp burrows and some physico-chemical parameters

Parameter	r^2 value	Remark
Temperature (°C)	0.024	Negligible
Salinity (ppt)	0.502	Positive
Depth (cm)	0.078	Negligible
Soil pH	0.873	High positive
Tool sand	-0.566	Negative
Fine sand	-0.654	Negative

Hemisquilla, burrows were found at depths ranging from 4 to 30 m. Thus, this organism may survive in shallow or deeper parts of the water.

Plate 2. Burrow of *Lysiosquilla maculata*

Distribution pattern of the burrows. The distribution of the burrows in almost all stations is contiguous or clumping (Plate 2 and Table 3). Data suggest habitat selection by this species which may be determined by any or all of the following: protection from disturbance, sediment characteristics, and/or prey availability. Habitat selection for specific characteristics of sediment may allow for successful recruitment, building and maintenance of burrows (Basch and Engle, 1989; AngSinco et al.,1986).

Table 3. Distribution pattern of the burrows

Station	S^2	X	Distribution pattern
1	6.05	3.36	Contiguous/clump
2	0.15	0.18	Regular
3	1.89	1.54	Contiguous/clump
4	3.29	3.27	Contiguous/clump
5	10.11	6.18	Contiguous/clump
Mean	4.30	2.91	

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Some biological notes. There was difficulty in establishing the life cycle, mating habits and growth pattern of mantis shrimp due to nonreproduction and molting in the provided artificial environment.

The male and female mantis shrimps were noted to occupy the same burrow. The female mantis shrimp is larger than its male counterpart. Developing ovaries of females can be seen as an orange structure running at the dorsal portion of the carapace (Manning, 1978).

The swimming ability of this species is very slow but the springing ability to attack prey using raptorial claws is very fast. Matsuura and Hamano (1985) Found out that the period from prey jumping to prey locking is only 0.03 to 0.3 seconds. Mantis shrimps can be captured by using a bait locally known as *"lit-ag"*.

Adaptability to brackish water. Data shows that all of the mantis shrimps survived up to a salinity level of 18 ppt while the survival rate at 16 ppt and 14 ppt was 91.67%, then 75% at 12 ppt. (Plate 3 and Fig. 5). There was a 16% survival at 10 ppt during the first week but 0% on the second week. Based on these results, it can be inferred that this marine organism can survive in brackish water.

Plate 3. Experimental set-up on the adaptability of *L. maculata* to different salinity levels

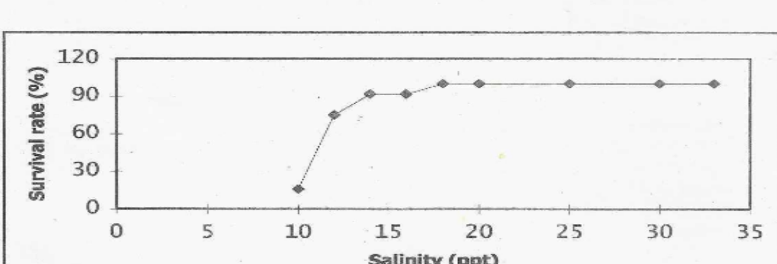

Figure 5. Survival rate of mantis shrimp at different salinity levels

Conclusions and Recommendations

Substrate type is a very important factor in determining the population density and distribution of mantis shrimps. They thrive and select a certain type of substrate suitable for their burrowing nature that would ensure survival. Although mantis shrimps are marine organisms, they can also survive in brackish water.

Mantis shrimp is rarely found in other countries but indigenously grown in the locality. It can attain sizes greater than the other shrimps. Thus, potentially heaper if properly propagated.

Considering the export potential of this species, there is a need for further; studies to be conducted in order to establish the biological data for possible mass production especially that they can survive in brackish water. It is further recommended that the artificial environment for biological study must be improved to obtain reliable data.

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