PRELIMINARY SURVEY ON THE DISTRIBUTION OF GASTROPODS AT KOTA KINABALU CITY BIRD SANCTUARY

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ABSTRAK

Tinjauan awal telah dijalankan di Kota Kinabalu City Bird Sanctuary (KKCBS) dari Julai 2004 sehingga Ogos 2004 dengan menggunakan kuadrat sebesar $1m^2$ dalam empat plot $100m^2$. Kajian ini bertujuan untuk mengetahui perbezaan jenis spesis dan kepelbagaian gastropoda di kawasan kajian Rhizophora dan Avicennia. Persekitaran kajian juga direkodkan. Terdapat 7 family dengan 9 spesies gastropoda yang telah dikenalpasti. Terdapat 7 spesies gastropoda yang dijumpai di kawasan Rhizophora manakala 8 spesis yang dijumpai di kawasan Avicennia. Daripada kajian yang dijalankan, Cerithium sp merupakan spesies yang paling dominant dan banyak didapati di kedua-dua kawasan kajian. Lebih daripada 90% gastropoda yang dijumpai adalah Cerithium sp. Kawasan Avicennia mempunyai kepelbagaian dan kelimpahan yang lebih tinggi. Pada keadaan air pasang yang berlainan, lebih banyak gastropoda yang dijumpai semasa air pasang perbani. Data yang didapati daripada kajian penting untuk kajian-kajian pada masa akan datang

ABSTRACT

A preliminary survey on the distribution of gastropods was carried at Kota Kinabalu City Bird Sanctuary (KKCBS) from July 2004 to August 2004 by using quadrat $1m^2$ in each of four $100m^2$ plot, two each at different vegetations. This survey was conducted to know the different of species and diversity at two study sites, namely *Rhizophora* and *Avicennia* site. Environmental variables also recorded. 7 gastropods species were found at *Rhizophora* site while 8 species were found at *Avicennia* site. From the survey, *Cerithium* sp was the dominant species and can be found at both study sites. They occupied more than 90% of the total gastropods found. Diversity and abundance were higher at Avicennia site. At different tide levels, there were more gastropods found during neap tide. The data of this study provide a valuable baseline for future use of this site.

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H'	Shannon-Weaver Diversity Index
E	Pielou Index
°C	Celsius
Σ	Total
m^2	meter square

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CHAPTER 1

INTRODUCTION

1.1 Background

Sabah is located at the Northern tip of Borneo, the world's third largest island. Its coastline of 14,400 km (900 miles), bordered by the South China Sea on the West and the Sulu Sea and Celebes Sea on the East, encloses an inland area of 74,500 sq km (23,399 sq miles).

Kota Kinabalu is the state capital with average rain of 2,633 mm per year, with hot and humid climate (Lim, 2004). The average temperature is 23°C to 30°C. Kota Kinabalu City Bird Sanctuary (KKCBS) is located at latitude 5° 59'N and longitude 116° 05'E which is two kilometers away from the Kota Kinabalu town (The Formulation of a Development and management Plan for the Likas Wetlands, 1997 volume 1: Site establishment).

At Kota Kinabalu City Bird Sanctuary (KKCBS), it is found out that typical mangrove gastropods include the species of *Ellobium aurisjudae*, *E. aurismidae*, *Cassidula* and on the tree at least one species of *Littoraria* (Spring, 1997). A tiny red-shelled snail also can be found on the surface of the mud. However, gastropods that

can be found here are generally not for consumption and are not commercially important as food (Spring, 1997).

Gastropod is one of the marine organisms in the mangrove that belongs to the Phylum Mollusca. They are the largest and most successful group of molluscs. They are found in the deepest ocean basins to the highest mountain tops (Woodward, 1993) and with about 40,000 species comprising over 80% of living molluscs. Gastropod feeding habits are extremely varied, where most species make use of their radula in some aspect of their feeding behavior (Hickman *et al.*, 2004; Arnold & Birtles, 1989).

They have to survive varying salinity, high temperature, anoxia and avoid desiccation. Species distribution is related to the environment factors. Jiang & Li (1995) stated that salinity is the most important environment factors that determine the sustainability of the gastropod compared to other factors such as temperature, tides and sediments. However, Hogarth (1999) suggested that clustering of many species of mangrove gastropods in shady positions among mangrove roots is to the avoidance of heat stress and accompanying water loss.

Mangroves are trees and shrubs that flourish in an inhospitable habitat between sea and land. It is an easily recognized habitat along tropical and subtropical coastlines and brackish estuaries and deltas, where evergreen trees and shrubs thrive in tideland mud or sand flats inundated daily with sea water. They not only flourish but have own high primary production and physical create a habitat for terrestrial and marine organisms. Jiang & Li (1995) stated that molluscs (Hogarth, 1995) and crustaceans are the predominant animal group in the mangrove ecosystem.

The fate of the remaining mangrove forests is very much dependent on human. As we glaze on the ecological importance of sustaining the biodiversity of living plants and animals and its role of protection against shore erosion, we have to be responsible of sustaining the area. It is vital to enforce stricter local governmental regulation, enforcement to protect mangroves, and also involvement of local communities in sustaining, managing and protecting their coastal resource base, including the nearby mangrove forests.

1.1 Aim

The aim for this study is to provide an ecological baseline data on gastropod assemblages at Kota Kinabalu City Bird Sanctuary (KKCBS). As this is a preliminary survey, it is hoped that by providing the data of the gastropod in the area, this will be a reference for future study to be carried out.

1.2 Objective

The main objectives of this research are;

1. To know the abundance, diversity and distribution of gastropods in KKCBS
2. To compare the abundance, diversity and distribution of gastropods under different mangrove vegetation.
3. To investigate the gastropod composition under different tide type.

CHAPTER 2

LITERATURE REVIEW

2.1 Background study status of gastropods in Borneo

2.1.1 Sabah

Study of gastropods in Sabah started earlier since 19 centuries. In 1964, Gore had recorded 30 species of gastropod from family *Cypraeidae* on coral reef around Kota Kinabalu, Sulug Island, Mamutik Island, Manukan Island, in Sapi Island and Tanjung Aru beach. Four gastropods species cowry were found later in 1965. Apart from these, in 1995, Gore (1964) also managed to collect 35 species from the Family Conidae around the coastal and reef area in Kota Kinabalu.

In 1978, Malley *et al* had reported a few genera such as *Lambis, Murex, Tonna, Strombus* and *Cassis* in the reef areas of west coast of Sabah. Malley *et al.* (1978) also managed to record gastropods that were found in mangroves areas around west coast of Sabah in Menumbok, Menggatal, Mengkabong and in Kuala Abai. Most of the gastropods were found in the areas which were more exposed to the wave action.

Bellwood (1988) also investigated freshwater gastropods and marine gastropods in Baturong cave and Madai, Sabah and reported that there were 5 species of freshwater gastropods and 12 species of marine gastropods. Abdul Waris (1991) who conducted a study in a few islands in Taman Tunku Abdul Rahman had found 102 species of gastropods in the islands.

Apart from that, Lim (1992) who carried out a community study of gastropods in Mengkabung Bay, Mananting Island, Bohayan Island, Silumpat Island, Tabawan Island, Manjinkil Island and Bohey Island around Darvel Bay recorded that there were 7 famili and 80 species of gastropods in Mengkabung Bay compared to 28 families and 109 species in Darvey Bay.

Ridzuan (1993) also investigated 22 species of gastropods which were important as foods in three villages in Kuala Penyu. Rosniza (1993) had studied taxonomy of gastropods that were collected since 1984 to 1992 in the Marine Science museum of University Kebangsaan Malaysia, Sabah campus. She had successfully made a report of pictures, species identified and habitat of the gastropods she studied.

In Kuala Penyu, Noor Hasliza (1995) found out that there were 118 species of gastropod from 26 families in the intertidal zone in her preliminary survey of the area. She found there were significant difference in diversity of gastropods found during the day and night.

Shabdin *et al.* (1998) had conducted a survey of marine gastropods and bivalves from 12 islands in Darvel Bay and at the coastal area adjacent to Mount

Silam on July 1991 and September 1995. The survey indicated that at least 125 species of gastropods were found in the coral reefs and mangroves areas. The high number of identified species found indicates that the region supports a highly diverse mollusk population.

Overall, the study of gastropods still rare and limited compared to any other marine animal although it is comparably larger population than others.

2.1.2 Elsewhere in Borneo Island

Apart from Sabah, since 1954 to 1958, there were four classes of gastropods being found in the Niah caves which were used as artifact, for assumption and also for decoration. Solem (1964) had identified some gastropods taken from Bukit Gomantang from 1880 to 1890. However, only 37 species are recorded and many more were not recorded due to the lack of knowledge in the particular area.

A survey was carried out in the Matang mangrove forest by Othman & Arshad (1991) to study the macrobenthos communities in the area and mollusc was the second largest population found. In 2002, a new species of *Biotia praetermissa* was found in Borneo (Kohler & Glaubrecht, 2002). Ashton *et al.* (2003), had conducted a baseline study of the ecology and molluscan macrofauna in Sematan mangrove forest and found there were forty-four mollusc species in the study plots. According to her, *Assiminea brevicula* reached the highest density and this was followed by *Melampus* sp.

2.2 Evolution of gastropod

The ancestors of gastropods had bilateral symmetry; that is, they had balanced right and left sides. Early gastropods have each whorl lying completely outside the preceding one (Hickman *et al.* 2004). This coiling however, makes the gastropod imbalance. Thus, they adapted two ways to counteract this problem which are inclination, the reorientation of the spire upwards and detorsion of the shells that swings the spire of the shell back over the body (Arnold & Birtles *et al.* 1989). Eventually, gastropod has evolved to become asymmetric.

The most distinctive modification of gastropods is torsion and is a unique feature to class gastropod (Arnold & Birtles, 1989; Hickman *et al.* 2004). It happens when the mantle cavity and osphradium make its appearance behind the visceral hump during the larva stage will later at the particular stage rotates in a counter-clockwise direction through the angle of 180° (Arnold & Birtles, 1989; Bhamrah & Balvinder, 1999; Hickman *et al.*, 2004).

After torsion, the anus and mantle cavity have shifted to the anterior and open above mouth and head. The original right gill, kidney, heart auricle and nerve cords twisted at figure eight from right to the left (Hickman *et al.*, 2004). Detorsion has been observed in opisthobranchs and pulmonates.

The torted gastropod has the ability to sense water as it moves forward than it could be with the osphradium located at the posterior end. Also, the sediment stirred up by the snail's movement is less likely to clog the gills if they are located in the front

of the organism. However, torsion may create sanitation problem by creating the possibility of wastes being washed back over the gills (Hickman *et al.*, 2004).

2.3 Gastropod Biology

Gastropods range from microscopic forms to giant marine forms such as *Pleuroploca gigantae*, a snail with a shell up to 60 cm long. Another gastropod such as sea hares, *Aplysia* can reach 1 m in range. There is also some record of fossil gastropod as much as 2 m in length (Hickman *et al.*, 2004).

2.3.1 Mantle and shell

The shell of the gastropod is produced by a special secretion from the animal's outer skin or mantle which is composed of a protein material called conchiolin. This shell is basically formed of calcium carbonate (Wye, 1991). The colour of the shell results from pigments in the periostratum, which is a skin-like covering that can totally obscure any colour and pattern beneath (Wye, 1991). Mantle also possessed the capacity to 'repair' holes and cracks on the shell.

According to Abbot & Dance (1991), a shell is composed of one, two or eight pieces and its overall shape that gives us the first clue to its identity. However, a typical shell is formed of one piece and is coiled around an imaginary axis, usually clockwise course from apex to aperture. The successive turns of the shell are called whorls, the largest being the last formed (Abbot & Dance, 1991).

Gastropod is said to be sluggish, sedentary animals because most of them have heavy shells and slow locomotion (Hickman *et al.*, 2004). There is not only protected by their secrective habits and coloration but their shell is they chief defense.

Many gastropods possess the ability to pull their head and foot inside the shell, if the situation warrants it. They are protected by an operculum, a horny plate that covers the shell aperture (Hickman *et al.*, 2004) and some gastropod such as *Strombus* bears a sharp operculum as protection against predators.

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