THE UTILISATION OF SEAGRASS AREA BY FISHES AND MACROINVERTEBRATES IN SULAMAN LAGOON

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR OF SCIENCE

MARINE SCIENCE PROGRAMME
SCHOOL OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA SABAH

MARCH 2008
BORANG PENGESAHAN STATUS TESIS

JUDUL: THE UTILISATION OF SEAGRASS AREA BY FISHES AND MACROINVERTEBRATES IN SULAMAN LAGOON

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ACKNOWLEDGEMENT

First and foremost, I would like to take this opportunity to express my heartiest gratitude to my supervisor, Mr. Muhammad Ali Syed Hussein for giving me a chance to work under him. His guidance, understanding and kind advices are very much appreciated.

I would also like to thank all the lecturers of Borneo Marine Research Institute for what they have taught me. The cooperation and help of the lab assistances is also not forgotten. I thank the lab assistance of Marin Ecosystem Lab for his willingness to let me use the lab even late at night and during weekends.

I am also grateful to the two strong men Lim Shung Zer and Teoh Hong Wooi who help me in my sampling trip. Without them, my sampling would not be possible. Not to forget Christiana Loh Sze Xying for her ideas and help in various aspects. My gratefulness also goes to my fellow coursemates and friends for their advices.

Last but not the least is my parents and my family members who always support me from a far, giving me all the encouragement and mental support which is very much required.

ONG JAY JIM
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ABSTRAK

The utilisation of seagrass area by fishes and macroinvertebrates were studied at Sulaman Lagoon. Sampling of fishes and macroinvertebrates from both seagrass and non-seagrass area was done using a beam trawl. A total of 38 species of fish and 9 species of macroinvertebrates were caught at the seagrass area compared to only 10 species of fish and 9 species of macroinvertebrates caught at the non-seagrass area. Some of the common occurring fishes and macroinvertebrates caught such as *Lutjanus russellii*, *Gazza minuta*, *Leiognathus splendens* and *Thalamita crenata* shows a smaller size compared to their adult size indicates that these specimens are still at their juvenile stage of life. These juvenile species uses the seagrass area as their nursery ground to grow up before migrating to another habitat. Besides that, the seagrass area can also act as a feeding ground for these organisms. The gut content of the specimens shows that they are dependent on the source of food found at the seagrass area. Some of the fishes and macroinvertebrates caught such as *Archamia buruensis*, *Apogon amboinenses* and *Thalamita crenata* are found to be carrying eggs. Although most of the specimens which are carrying are caught at the seagrass area, however it is not clear that the seagrass area is used as their spawning ground or the adjacent areas. This study has proven that the seagrass area is an important area which plays various roles and functions for fishes and macroinvertebrates.
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LIST OF SYMBOLS

\%

Percentage

USD

US Dollar

m

meter

A

Area

$H'$

Shannon-Wiener's Index

$H_{\text{max}}$

The maximum value of the Shannon-Wiener's Index

$n_i$

Abundance of species $i$

N

Total number of individuals

S

Total number of species

$J'$

Evenness of species abundances (Pielou's index)

$p_i$

ratio of individual in species $i$

ln

Natural logarithm

<

less than

$\text{km}^2$

Kilometer square
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CHAPTER 1

INTRODUCTION

1.1 Marine Plants

A wide variety of marine flora that can be found distributed in the marine environments all around the world. They can be found in the form of unicellular phytoplankton to macroalgae and angiosperms which includes the seagrasses and mangroves.

1.2 Seagrass

Seagrasses are immersed aquatic plants which have true stem and root system. It is the only fully immersed angiosperms in the marine habitat (Dawes, 1998). Seagrass is believed to have evolved around 65 to 40 million years ago. The total seagrass species found in the ocean make up only 0.001% of all the angiosperm species known (Dawes, 1998). Most seagrasses are sub-tidal (Blaber, 1997), which vary from short sparse beds to dense stands. Estuarine seagrass beds are often found shoreward of muddy shores, and are not always associated with coral reefs (Poiner et. al., 1989). They are
most common in soft sediments or semi-sheltered areas where depth and turbidity conditions allow sufficient light penetration for the growth of these plants (Day et al., 1989). It can be found distributed along various gradients in space and time, including geographical, vertical, seasonal, and longitudinal along the salinity gradient.

Seagrasses has close relations and share some of the characteristics with plants from the class Helobiae (Tomlinson, 1982). Although seagrasses exhibits some common morphological and anatomical features of freshwater hydrophytes, there are some variations in reproduction and physical structures. These would explain the independent evolution of both groups (Dawes, 1998). In early taxonomical research done by Den Hartog (1970), only 49 species and 12 genera of seagrasses were recorded in two families, which are Hydrocharitaceae and Potomogetonaceae of the class Helobiae (Monocotyledonae). In the later research (Kuo and McComb, 1989), a total of 58 species and 12 genera were described, divided into four families (Hydrocharitaceae, Posidoniaceae, Cymoaceae and Zosteraceae), two orders (Hydrocharitales, Potomogetonales), and one class (Liliopsida).

1.3 Factors Affecting the Distribution of Seagrass

According to the study done by Yale Dawson (1966), there are several abiotic factors that influence the distribution and the well being of seagrass community. The abiotic factors which affect the seagrass distribution in the estuarine area are frequently fluctuating according to seasonal changes. Kuo & McComb (1989) have discovered that there are nine common marine stress factors which affect the distribution and abundance of seagrasses. They are salinity, temperature, water motion, anaerobiosis,
nutrient limitation (nitrogen, phosphorus and carbon), epiphytes, irradiation, infection and herbivory.

Some examples of the abiotic factors are salinity, temperature, degree of protection from the wave energy, sedimentation type and rate, volume of fresh water input and also nutrient from terrestrial input. In order to survive and thrive in the marine environment, the morphological adaptation of the seagrass in its salt water habitat includes (Dawes, 1998):

i. Regulation of the osmotic pressure
ii. Obtaining carbon dioxide and nutrient
iii. Intensity of sunlight penetration
iv. Mechanical drag of aqueous drag
v. Usage of aquatic medium for pollen and seed dispersion

Seagrass are naturally adapted to the natural disturbances such as hurricanes (Preen et al., 1995), and wave–induced blowouts (Patriquin, 1975). Furthermore, the recolonisation of a seagrass community after a perturbation such as hurricane and blowouts has been demonstrated to take place done successfully.

The still water of an estuarine environment is more conducive to the growth of macrophytes and marginal vegetation including seagrass that provide a habitat for fishes (Blaber, 1997). A series of biotic factors can determine the abundance and survival of the seagrass community in an area. These factors include parasitism, mutualism, commensalisms, competition and predation (Dawes, 1998).
1.4 Seagrass Sediment Ecology

Seagrass beds can acts as baffles (Ward et al., 1984; Komatsu, 1996) to trap sediments in the area. The physical structures of seagrass attenuates wave and tidal energy, resulting in enhanced deposition and burial of suspended particulates (Harlin et al., 1982), and reduction of water column turbidity (Ward et al., 1984).

Seagrasses and mangrove trees can acts as sediment stabiliser. The presence of seagrass areas can prevent shore and beach erosion by minimising the wave and tide energy. Hence, it can have pronounced effects on sediment characteristics by creating local hydrodynamic changes (Jones & Jago, 1993), which may also promote larval settlement (Eckman, 1987). It provides a better and more stable habitat for juvenile fish. This stable area is also the choice for spawning fishes to deposit their eggs. They also provide a refuge from predation for small epibenthic species.

1.5 Types of Estuarine Seagrass Inhabitants

According to Nelson (1984), the region with the greatest diversity of coastal fish species is the tropical Indo–west Pacific. The fishes which can be found at this region can be divided into several groups which include the true estuarine species, marine migrants, anadromous species, freshwater migrants (Blabber, 2000). Other groups of animals are molluscs, crustaceans, echinoderms, crustaceans, and nematodes.

The study area selected is an estuarine seagrass bed with surrounding mangrove. The inhabitants of estuarine seagrass habitats are those that can withstand
wide physical fluctuation such as salinity, tidal change and flooding. The mentioned physical fluctuation can be short term, long term or even seasonal. Although species composition change according to seagrass species or habitat type, a number of species however are common at all areas (Blaber, 1997). This may due to the difference is food availability and shelter provided by different species of seagrass.

1.6 Seagrass Ecological Roles

Seagrass communities have at least 13 ecological roles (Dawes et al., 2004). Seagrasses support important grazing and detrital food webs, stabilise sediment, and are important in global carbon and nutrient cycling. Furthermore, hundreds of planktonic, epibenthic and infaunal species are dependent upon grass beds for survival (Virnstein, 1987; Jackson et al., 2001).

Seagrasses are vital primary producers. It acts as a direct and indirect food for diverse fauna. Seagrasses only serves as a direct food source for a small numbers of species (Odgen, 1980; Thayer et al., 1984; Klumpp et al., 1989) but as an indirect food source through detritus production and a substrate for epiphytes (Klumpp et al., 1989). Seagrass beds also have been described as crucial sources of nutrients that maintain a high degree of secondary productivity in the coastal areas they inhabit (Alfaro, 2005). Furthermore, these submerged flowering plants can be used to monitor the “health” or well being of the entire coastal and estuarine communities (Dawes, 1998).
Three broad hypotheses have been advanced to explain the high densities of fish and the dependence of certain species on tropical estuaries (Blaber, 2000) including the seagrass beds. They are related to:

i. Reduced predation linked with turbidity and depth.
ii. Increased food supply for post-larvae and juveniles.
iii. Shelter for post-larvae and juveniles.

The hypotheses are not mutually exclusive and in many instances are inextricably connected.

The occurrence of seagrass area at the estuary area exerts a marked influence on the fish fauna (Blaber, 2000). Regardless of latitudinal differences, these vegetated ecosystems are widely valued as habitats for diverse fish and invertebrate populations, as subjects for scientific inquiry, as sites for human recreation, and as sensitive indicators of human population and perturbations (Kemp 1983).

1.7 Human and Seagrass Interaction

Seagrass areas are able to bounce back to their original population size even with the effect of natural disturbances (volcanic activity, violent blowouts) and biological damage (overgrazing by sea urchin, bioturbation), however not for the case of human activities. Seagrass communities are in serious stress with anthropogenic activities such as pollution, net trawling, propeller cutting (Dawes, 1998). The lost of seagrasses in eutrophicated water can frequently be attributed to secondary pollutions, e.g. suspended particulate material, toxic ingredients (Schramm & Nienhuis, 1996). These
are all introduced into the seagrass areas from industrial and household untreated sewage as well as agricultural fertilisers.

In many cases, seagrass declines are related to overgrowth by epiphytic diatoms and filamentous macroalgae. Although epiphytic algae are an important element of healthy seagrass beds, providing the base for key food-chains (Klumpp et al., 1992), excessive algal accumulation causes significant attenuation of light available for growth of the host plant (Twilley et al., 1985). This phenomenon is due to the presence of agriculture activities from the near by areas which triggers the growth rate of diatoms and macroalgae.

Generally, if only leaves and above-ground vegetation are impacted, seagrasses are usually able to recover from damage within a few weeks; however, when damage is done to roots and rhizomes, the ability of the plant to produce new growth is severely impacted, and plants may never be able to recover (Fonseca et al., 1998).

1.8 Seagrass Areas in Malaysia

Malaysian climate can support a wide variety of seagrass species. There are many seagrass ground distributed at the east coast of Peninsular Malaysia, Johor and also Sabah. Figure 1.1 shows the major distribution of seagrass area in Malaysia.
1.9 Importance of Study

This study is carried out to have a better understanding about the role played by the seagrass area. Through this study, we can understand the interaction and dependence between the fauna with its environment and how important the seagrass are to its inhabitants. Hence, we can promote the conservation effort to protect the area and keeping the population of fishes and macroinvertebrates healthy in that area.
1.10 Objective of Study

This study is done to learn more about the species the seagrass area, knowing the common organisms that inhabit and hence utilising the seagrass area of Sulaman Lagoon, Tuaran. The objectives of the study are:

i. To determine diversity, abundance and biomass of fishes and macroinvertebrates found in the seagrass area and non seagrass areas at Sulaman Lagoon.

ii. To compare the diversity, abundance and biomass of fishes and macroinvertebrates utilising seagrass and non seagrass areas at Sulaman Lagoon.

iii. To determine and compare the gut content of some common fishes utilising the seagrass and non-seagrass areas at Sulaman Lagoon.
REFERENCES


