DIVERSITY OF FISH LARVAE ON SEAGRASS BEDS AT SALUT LAGOON, SABAH

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DECLARATION

I declare that this thesis contains my original research work. Source of findings reviewed herein have been duly acknowledged.

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ABSTRACT

A study of larval fishes in an area of seagrass beds at Salut Lagoon, Karambunai was conducted with three objectives: To identify the fish larvae family in the seagrass beds; to study the abundance and diversity of fish larvae in the study area; compare the result in both stations. Light trap were deployed at two stations for three consecutive nights for three month starting August 2004 until October 2004. Station 1 was an area of seagrass beds near mangroves area. Station 2 was an area of seagrass beds which is far from mangrove area. Altogether 297 fish larvae were caught for the whole sampling. Larvae of 10 families were captured of which Ambassidae was the most abundant. This was followed by Gobiidae (n=75), Atherinidae (n=30), Engraulidae (n=24), Leiognathidae (n=17), Synodontidae (n=7), Belonidae (n=6), Terapontidae (n=6), Eleotrididae (n=4) and Lethrinidae (n=4). There were 8 families found in station 2, which does not include Belonidae and Eleotrididae. Fish larvae captured on area of seagrass beds near to mangrove were higher (n=196) compare to the area of seagrass beds alone (n=101). By using the Shannon-Weaver Diversity Index (H'), the estimates value for diversity, evenness and richness among fish larvae was found higher in station 1 compared to station 2 but the independent t-test showed no significant difference in diversity estimate value for both area ($p > 0.05$). This may be due to the close distance between stations.

ABSTRAK

DIVERSITI LARVA IKAN DI KAWASAN RUMPUT LAUT DI LAGUN SALUT, SABAH

Kajian tentang larva ikan di satu kawasan di Lagun Salut, Karambunai telah dijalankan berdasarkan dua objektif utama; untuk mengenal pasti famili larva ikan yang terdapat di hamparan rumput laut; untuk mengkaji kelimpahan dan diversity larva ikan di kawasan kajian; membandingkan hasil di kedua-dua stesen. *Light trap* ditempatkan di dua stesen selama tiga malam berturut-turut dalam tiga bulan, bermula dari bulan Ogos, September dan Oktober, 2004. Stesen 1 adalah kawasan rumput laut yang berdekatan dengan kawasan paya bakau. Stesen 2 pula adalah kawasan rumput laut yang semakin ke tengah sungai dan berjauhan dengan kawasan paya bakau. Sebanyak 297 larva ikan telah ditangkap sepanjang persampelan. 10 famili larva ikan telah dikenal pasti, di mana Ambassidae mempunyai kelimpahan tertinggi. Ini diikuti oleh Gobiidae (n=75), Athrinidae (n=30), Engraulidae (n=24), Leiognathidae (n=17), Synodontidae (n=7), Belonidae (n=6), Terapontidae (n=6), Eleotrididae (n=4) dan Lethrinidae (n=4). Terdapat hanya 8 famili larva ikan di stesen 2, di mana Belonidae dan Eleotrididae hanya didapati di stesen 1.Didapati larva ikan di kawasan rumput laut yang berdekatan dengan kawasan paya bakau adalah lebih banyak (n=196) berbanding larva ikan di kawasan rumput laut yang berjauhan dari paya bakau (n=101). Dengan menggunakan Indeks Diversiti Shannon-Weaver (H') didapati nilai diversiti, kesamarataan dan kekayaan larva ikan adalah lebih tinggi di stesen 1 berbanding stesen 2. Namun begitu, ujian t tidak bersandar tidak menunjukkan perbezaan ketara antara diversiti larva ikan di kedua-dua stesen ($p>0.05$). Ini adalah kerana jarak antara stesen yang dekat.

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%	Percentage
∑	Total
>	more
<	less
mm	millimeter
m	meter
cm	centimeter

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CHAPTER 1

INTRODUCTION

1.1 Introduction of Fish Larvae

Studies on species composition and density of the ichthyoplankton of tropical coral reefs have been well researched, unfortunately only a few has been done in subtropical and tropical Indo –Pacific estuaries, except for areas of east Africa and Thailand (Blaber *et al*., 1996). Seagrass beds are known as an important habitat and nursery ground for many marine organism especially fishes. Though some species enter these areas as juveniles, some may enter as larvae (Beckley, 1985; Whitfield, 1989; Gaughen *et al*, 1990; Strydom, 1998). Many species from deep sea, swim into these areas and lay eggs in seagrass or in close proximity to seagrass. Previous studies have proved that seagrass beds could be nursery ground for fish and other organism when catches there are mainly small fishes and crustaceans in their juvenile stages (Bell & Pollard, 1989; Dolar, 1991; Oñate *et al*., Vergara & Fortes. 1991).

1.2 Objectives

Objectives of this study are :

1. To identify the fish larvae family in the seagrass beds.
2. To study the abundance of fish larvae in the study area.
3. To compare the diversity, evenness and richness of fish larvae in both station.

1.3 Importance

1. To show the important of seagrass beds in study area as habitat for fishes.
2. It is hoped that data from this study could be used for future reference.

1.4 Hypothesis

$\mathbf{H_1}$ = There are significant differences in the value of Diversity Index, Evenness Index and Richness Index between station 1 and station 2.

$\mathbf{H_0}$ = There are no significant differences for the value of Diversity Index, Evenness Index and Richness Index between station 1 and station 2.

CHAPTER 2

LITERATURE REVIEW

2.1 Fish Larvae

The term "larvae" does not necessarily imply small size. It can be defined as the developmental stage between hatching and attainment to full external meristic complements such as fins and scale and loss of temporary specialization such as yolk-sac (Leis & Rennis, 1983). A few characteristics such as the arrival of any mobile structure such as dorsal fin at its ultimate position and the loss of temporary specialization to pelagic life, showed the end of the larval stages (Russell, 1976). Young larvae can be referred to-as developments prior to completion or formation of caudal fins. After a complete process of caudal fins, they are now old larvae (Leis, 1991). On the other hand, according to Leis and Rennis (1983), the juvenile is the developmental stage from attainment of full external meristic complements. This is followed by the loss of temporary specialization for pelagic life to sexual maturity.

Since the beginning of larval studies by ecological and biological scientist, larvae were thought as passive plankters. This means that their entire movements and distributions were entirely controlled by currents. However this traditional view has been discarded (Leis & Goldman, 1984). For example an investigation on acanthurid larvae and their movements to shore. Demonstrated that the returning to-shore of these larvae may not be completely passive. This investigation showed that at the end of pelagic stage, they are capable of swimming (Buri & Kawamura 1983).

There are a few factors that determine the distribution of fish larvae: behavior of the larvae, larval mortality and growth and their variation of space and time, duration of a pelagic period and spawning behavior of adult (Leis, 1983).

Tests have been carried out to study the behavior of pelagic larvae using both laboratory and field methods. Data on larval movement were measured (Leis & Carson, 2001). Other factors including predation which plays a major role in the survival of pelagic larvae (Chambers & Tripple, 1997) were also considered. The results proved that at some stage of the pelagic larvae, they become strong swimmers with the ability to control their swimming speed, depth and direction (Leis and Carson, 2001)

2.2 Fish Migration

According to Roff (1998), migration stands for the action of fish that come and go between habitats. Northcote (1978) viewed migration as movements that results in an alternation between two or more separate habitats which occur with a regular periodicity and involve a large proportion of the population.

Migration takes fishes to habitats that are suitable for feeding and for reproductions (figure 2.3). Fish also migrate to and from habitats that forms refuges from unfavourable environments, due to the presence of predators (Harden Jones, 1968; Mc Dowell, 1988).

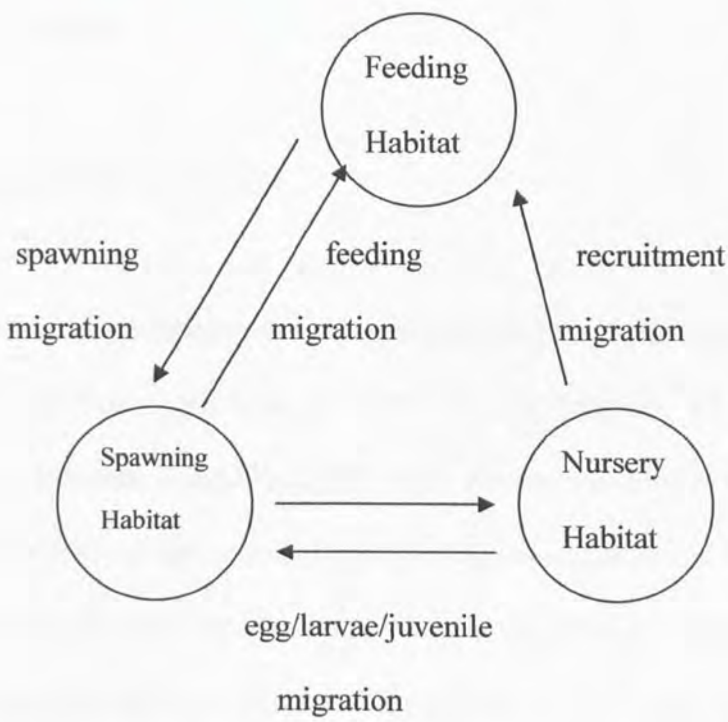

Figure 2.2 Basic pattern of migration between feeding, spawning and nursery habitats.

Migration from open waters to benthic habitats occurs at the end of the pelagic stages. This is also known as settlement (Sale,1991). According to Kingford (1988), the term pelagic refers to pre-presettlement for most reef fishes. Doherty (1981) reported that during pelagic stage, the adult population size may be determined. Meanwhile after investigation, larval distribution are reported to be important in determining adult distribution over tens of kilometers (Doherty and Williams, 1988a).

The study of the probability of fish migrating from nearby coral reefs and mangroves to seagrass beds have been carried out by Dollar (1991). Grunts and snappers were example of fishes that are often found migrating from the habitat of seagrass bed and reefs (Helfmen *et al.* 1982).

2.3 Seagrass Beds

2.3.1 Seagrass Beds in Sabah

Seagrass are monocotyledonous flowering plants that have the ability to grow completely submerged in seawater (den Hartog, 1970). Overall there are 60 species of seagrass belongings to 12 genera, 4 families and 2 orders known world wide. Fortes (1989) viewed the Indo-West Pacific as the centre of generic richness and diversity of seagrass as well as mangrove and coral reefs. He also stated that all of the seven seagrass considered as tropical genera can be found in the Indo West Pacific.

At least 12 species of seagrass can be located along the Sabah coastline. They are *Enhalus acoroides* Royle, *Halophila decipiens* Osterf. , *Halophila ovalis* (R.Br.) Hook.f., *Halophila* minor (Zoll) Den Hartog, *Cymodocea rotundata* Ehreb. and Hempr. Ex Aschers., *Cymodecea serrulata* (R.Br.) Aschers. and Magnus, *Thalassia Hemprichii* (Ehrenb.) Aschers. and *Syringodium isoetifolium* (Aschers.) Dandy (Japar et. al., 1997). Among all, *Halophila ovalis* (R. Br.) J.D was the most frequent species found, followed by *Thalassia hemprichii* (Ehernb) Aschers and *Enhalus acoroides* (L.f) Royle (Japar Sidik *et al*. 2000).

Buesa (1974) reported that the turtle grass *Thalassia* were found most abundant and are significant in areas of tropical waters. In fact, the seagrass beds at Salut Lagoon were dominated by *Thalassia* sp. and *Enhalus* sp. These plants can be found on sand or muddy bottoms in various depth depending on the species and sunlight penetration (Margaleft Rivero, 1959; Stephens, 1966).

Seagrass are usually found from the mid intertidal to upper subtidal zone. This is where mixed vegetation of seagrass grow together. However previous study on seagrass beds in Sabah have shown that there is no specific zonation in their distribution especially in the muddy habitat bordering mangroves (Norhadi Ismail, 1993) .

According to previous research by Norhadi Ismail (1993), *E. acoroides* were often located from mid intertidal to a depth of 2m in estuaries Salut lagoon and Mengkabong lagoon. During the low tide a patch of more than 100 meters in diameter of *Sargassum* spp., *Hypnea* sp., *Zanthophora* sp. and *Gracilaria* spp. were found exposed on the muddy and sandy substrate. A patch of *C. rotundata* were also found exposed at low tide on a muddy and fine sandy substrate.

2.3.2 Seagrass beds as habitats for fishes

Seagrass plays a major role in the marine environment. Besides acting as filters, seagrass beds serve as habitats and nursery ground to many marine organisms. According to Fortes (1999) the abundance and diversity of animals on the seagrass beds are related to the seagrass species composition and biomass. Dolar (1991) viewed seagrass beds as an additional habitat besides coral reefs and mangroves for providing food and protection to fishes and other marine organisms.

According to Thayer *et al*. (1984), there are two levels of seagrass habitats. One is a community where they act as a structural framework with interrelations between plants and animals. Seagrass beds then was viewed as an ecosystem where their relationship and discreet process were controlled by the interactive effects of biological and physico-chemical factors.

Cruz (1975) discovered that *Thalassia* beds provided protection and food for more than one hundreds species. He also stated that grunts, parrotfish and snappers are among the juvenile and larval fishes found on *Thalassia* beds, indicating these beds as a nursery ground. Previous study by Salita-Espinosa *et al.* (1994), showed that *Enhalus acoroides* served as a better substrate and provided better food supply to herbivors due to their broad and thick leaves.

The work of Fortes (1994) stated that there are at least 50 families of fish associated with seagrass beds, showing the importance of seagrass beds to the coastal fisheries of South East Nation (ASEAN) countries. Fish catches from seagrass beds are mainly composed of small fish in their juvenile stages (Bell & Pollard, 1989; Dolar, 1991; Oñate *et al.*, 1991; Vergara & Fortes, 1991). The work of Sudara *et al.* (1991) showed that rabbit fish (*Siganus* sp), seabass (*Lates* sp.) and crustaceans and are among the commercially valuable catches which are composed mainly of larval or juvenile stages. This study supports the notion that seagrass beds act as nursery grounds.

In Malaysia as quoted in MPP-EAS (1999), Sasekumar *et al.*, (1998), 4.2% of the annual fish catches can be directly or indirectly related to seagrass beds, which again tend to support the view on contribution of seagrass beds to the coastal fisheries economies. The study also stated that rabbit fish, groupers and seabass are among the important catches in Malaysia.

2.4 Studies on Fish Larvae

Studies on fish larvae especially larvae of coral reef are very important since it provides various information on recruitment and settlement processes (Sale, 1991). To study these behaviors a few techniques have been used. Some fish larvae are attracted to light, thus using lights will encourage these larvae to swim toward the light source. This behavior is known as photopositive (Doherty, 1987 b). From Dohertys 'study, a few tools to catch fish larvae were designed such as plankton net and light trap (Doherty, 1991).

Light traps were initially used in coastal waters in the late 1980s. However this method has become increasingly popular by researcher in sampling technique especially in tropical environments where reefs are most found (Wolanski *et al.* 1997). It is use to catch mobile invertebrates and older nektonic stages of fishes that are competent and non-competent to settle into habitats by attracting them with the fluorescent light. Method using towed nets are not suitable for such taxa because they are fast swimmers (Choat *et al.*, 1993; Hickford and Schiel, 1999).

A study on spatial and temporal patterns in the abundance of pre-settlement fishes from the Great Barrier Reef have proven that light trap is an effectives tools for monitoring the relatives abundance of the pre-settlement stages of various coral reefs fishes (Doherty, 1991). This also indicates that light traps are useful sampling technique to study the linkage between larval supply and recruitment patterns at fixed locations. In

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