

SPATIAL-DISTRIBUTION PATTERN OF FISH LARVAE IN THE EAST COAST OFF PULAU PAYAR MARINE PARK, KEDAH, MALAYSIA

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Abstract: A study on larval fish had been done in the 1970s and more papers have been published since then. They give important information to biologists and fisheries management, for instance, spawning location, habitat requirement, eating behaviour and recruitment patterns. To that end, the spatial-distribution pattern of fish larvae in the west coast of Pulau Payar Marine Park, Kedah, Malaysia, was examined for four months, from August to November 1999. Samples were taken using bongo net with 0.5 mm mesh size 150 to 300 m offshore (Site A) and one nautical mile of east coast off Pulau Payar Marine Park (Site B), using the oblique technique. A total number of 1 971 larval fish were caught, representing 18 families. Total densities did not show significant differences between Site A and Site B, that is 108.58 and 11.67 ind./m³, respectively. The three most dominant families for both Site A and B were Apogonidae, Clupeidae and Gobiidae.

KEYWORDS: fish larvae, spatial distribution, coral reef.

Introduction

Coral reefs are highly-important marine ecosystems because of their high diversity and are important either for fishing, tourism or recreational activities (Reef Relief: Protect Living Coral, 2008). Worldwide, coral reefs are estimated to cover approximately 284,300 square kilometers of the ocean and Malaysia contributes about 0.013% of the area (Splading et al., 2001). It is estimated that 4 000 species of fish inhabit coral reefs, and the reefs play important roles as the food source and nursery for juvenile and fish larvae.

Fish larvae are defined as pre-settlement fish that live as plankton and show morphological adaptations, such as a transparent body, for certain reef habitats (Victor, 1991). Studies by Stobutzki & Bellwood (1994, 1997) and Leis & Fisher (2006) show that fish larvae are capable of swimming and can move actively, with a swimming ability that may reach up to 23.3 hr/day (Leis & Clark, 2005). The definition of fish larvae as passive plankton that depend on current to move from one place to another is thus no longer acceptable.

Studies on fish larvae have been done worldwide, especially in the Great Barrier Reef and the Caribbean, ranging from larval behaviour to temporal/spatial distribution, such as the spatial distribution in the coastal areas of New Caledonia (Carassou & Ponton, 2007) and in the southern Gulf of Mexico (Sanvicente-Anorve et al., 2000).

Fish larvae studies in Malaysia are quite recent, starting in the late 1990s by the Department of Fisheries and were incorporated within the Oceanography and Acoustic Study in the Straits of Malacca and the east coast of Peninsular Malaysia project. Subsequent to this, a five years project (2006-2010) on fish larvae was established by the Department of Fisheries.

Malaysia has five Marine Parks and Pulau Payar Marine Park is the only one in the west coast of Peninsular Malaysia. Pulau Payar Marine Park is situated in the north-west of Peninsular Malaysia, approximately 35 nautical miles north of Pulau Pinang. It was declared as a marine reserve in 1985, and consists of four small islands. These four small islands are namely Pulau Payar (the biggest), Pulau Kaca, Pulau Lembu and Pulau Segantang (Figure 1).

The establishment of Pulau Payar as an area completely protected from fishing will improve fish productivity and fishery catches to the adjacent areas through larval recruitment. Despite this importance, there is no data on dynamic recruitment of reef-fish larvae in the west coast of Peninsular Malaysia. This project aims to assess and correlate reef-fish larvae and their spatial settlements. This project will give a better understanding of the importance of Pulau Payar Marine Park in fish recruitment, which will be useful in fishery management.

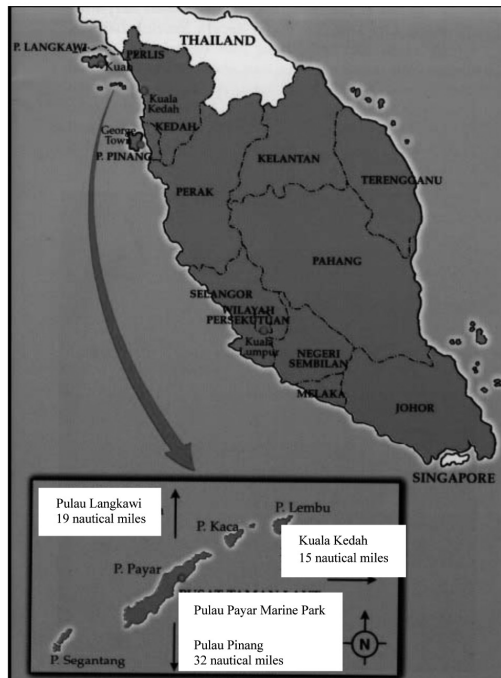


Figure 1. Location of Pulau Payar Marine Park.

Materials and Methods

Two sampling sites in the east coast off Pulau Payar Marine Park were chosen in this study. The first one is named Site A (100.0430° N, 6.0630° E) approximately 150 to 300 m from the coastline, and the second one is named Site B (100.0500° N, 6.0630° E) about one nautical mile offshore. The depth at Site A is between 15 - 25 m and that for Site B is between 20 - 30 m. These two sites were chosen because of their differences in distance from the island.

Fish larvae were sampled using bongo net with 0.5 mm in mesh size. During the sampling, bongo net was oblique-towed between 30 to 35 m behind the boat for 10 minutes. The speed of the tow boat was maintained less than 2 knots. A current meter was attached to the bongo net to get the volume of water filtered.

Seven samples were taken from 23 August to 12 November 1999, with three replicates at each site. Samples were immediately fixed in 10% formalin (in sea water) and were then transferred into 95% ethanol for preservation. Fish larvae were later sorted under the dissecting microscope with 10 magnifications and were identified to family level.

The identification of the fish larvae samples was based on Moser & Ahlstrom (1970), Leis & Rennis (1983), Allen (1985), Leis & Trnski (1989), Neira et al. (1998), Chayakul (1990), Konishi (1999) and Leis & Carson-Ewart (2000).

Results and Discussion

A total number of 1971 fish larvae were identified to the family level, with 1621 and 350 individuals in Site A and Site B respectively (Table 1). T-test analysis showed that there was a significant difference in fish-larvae density between Site A (150 to 300 m from the coastline) and Site B (about one nautical mile offshore) ($p < 0.05$). Only 2.3 % of the samples could not be identified as the samples were too small and incomplete. The three most abundant families in Site A and B were Apogonidae, Clupeidae and Gobiidae [Site A - Apogonidae (32%), Clupeidae (23%) and Gobiidae (23%); Site B - Apogonidae (48%), Clupeidae (17%) and Gobiidae (11%)]. This result is in contrast with the finding in Pulau Layang-Layang (Zulkifli et al., 2004), in which the most abundant family is Myctophidae (22.03%) and Acanthuridae (12.5%). The commercial fishes, Bothidae, Carangidae, Cynoglossidae, Lujanidae, Nemipteridae, Sciaenidae, Siganidae and Sphyraenidae, contributed about 10.8 % of the samples. The highest density (24.05 ind./m³) of fish larvae was recorded in Site A on 12th November 1999 (Figure 2). During this time, there was a strong eastern wind which blows annually from November to March. Because of this, it created a fish-larvae retention and accumulation nearer to the shoreline (Marlieve, 1986). Overall, the number of fish larvae were higher at Site A as compared to Site B because of eddies that accumulate the fish larvae and plankton from the open sea to the reef areas (Kingsford et al., 1991).

Table 1. Number of fish larvae by family in Pulau Payar Marine Park, Malaysia, from 10 August to 12 November 1999.

Fish larvae family	Site A (150 to 300 m from the coastline)	Site B (app. one nautical miles offshore)
Ambassidae	26	1
Apogonidae	525	169
Atherinidae	45	6
Bothidae	9	7
Bregmacerotidae	3	0
Carangidae	6	1
Clupeidae	392	60
Cynoglossidae	7	0
Gobiidae	368	38
Leiognathidae	6	2
Lutjanidae	13	0
Mugilidae	29	4
Nemipteridae	84	38
Pomacentridae	2	2
Sciaenidae	19	5

Siganidae	8	3
Sphyraenidae	12	2
Theraponidae	27	7
Unknown	40	5
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Total	1 621	350
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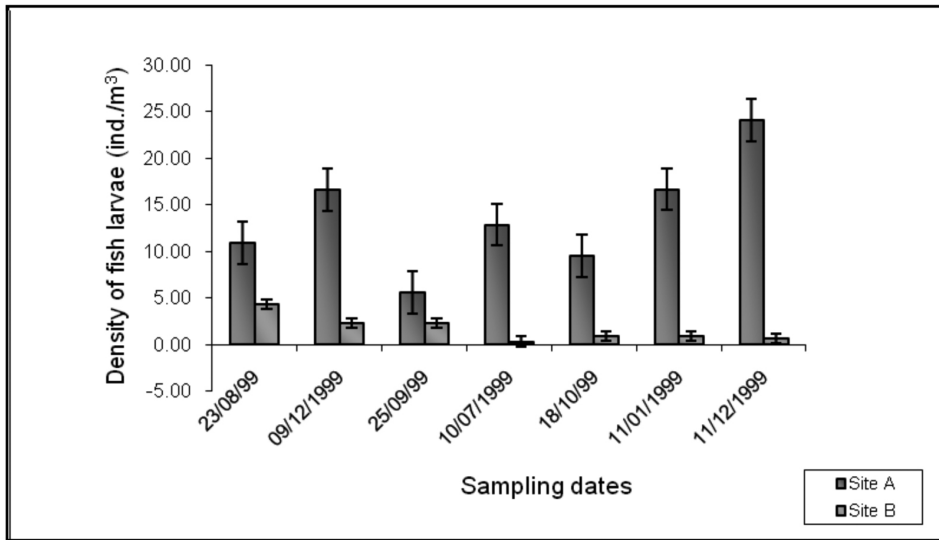


Figure 2. Fish-larvae density (ind./m³) from 23 August to 12 November 1999 at Pulau Payar Marine Park.

In conclusion, the distribution of fish larvae at Site A and B off Pulau Payar Marine Park suggested that more reef-fish larvae accumulated in waters nearshore as compared to open sea. With regards to this situation, establishing Pulau Payar as a marine reserve will improve fish productivity to the adjacent areas through larval recruitment processes.

Acknowledgement

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