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Fish communities from seagrass bed of Merchang Lagoon, Terengganu, Peninsular Malaysia

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Abstract—A study on the fish communities of seagrass bed in Sungai Merchang (5°01'N and 103°19'E) Terengganu were carried out to investigate the number of species of fishes present in this selected mangrove associated seagrass beds. Sampling of fishes was carried out using 3-layered trammel nets and cast nets and was done at 2 hourly intervals for 24 hours. The seagrass bed's area is a brackishwater lagon about 2 km^2, sheltered from the sea and experienced diurnal tidal movement. The bed is dominantly vegetated with *Halophila ovalis* and *Halodule pinifolia*. A total of 22 fish species belonging to 14 families were collected from the study area. Tetraodontidae, Siganidae and Leiognathidae were the dominant families and in term of species, *Tetraodon nigroviridis* (33.8%), *Siganus guttatus* (11.4%), *Leiognathus equulus* (10.3%) were the three most species gathered. Periodical sampling showed different sets of fish species between day and night catches. Most of the specimens captured were juveniles with size ranging from 5.2 to 17.4 cm. The study forms part of the efforts taken by UPM in establishing the data base on diversity of fishes of seagrass ecosystem.

Key words: seagrass fauna, fish communities, fish diversity

Introduction

Fish resources in the seagrass ecosystem have increasingly been receiving greater focus by the Malaysian government and its fishery agency due to the importance of the resources to the low income fishermen especially in the east coast of Peninsular Malaysia. This is further highlighted lately when the trend of landings by the artisinal fishermen has been declining over time both due to high competition amongst the operators, declining shallow water fish resources and limited capability of their fishing boat and gears. North east monsoon which begins in November and lasts till February further limits the operation of this group of fishermen. In view of the present situation and the need to further understand the fish resources of the seagrass ecosystem, a study was undertaken to assess the fish communities in a mangrove associated seagrass beds of Merchang located in the state of Terengganu, east coast of Peninsular Malaysia. The seagrass area lies adjacent to the fishermen village; a brackish water lagoon of about 2 km^2 in area. It is used as the regular fishing spot particular during the monsoon period when fishermen are unable to go out to sea due to rough weather. The present study adopted a more intensive sampling approach including the night sampling. This was planned to investigate the difference between day and night fish catches composition.

Materials and Methods

The study area is located at 5°01'N and 103°19'E in Merchang brackish water lagoon (Fig. 1) that is dominated by seagrass *Halodule pinifolia* and *Halophila ovalis*. Sampling of fishes was carried out by using trammel nets of 230 mm, 40 mm and 20 mm mesh size and cast nets (20 mm mesh size). Two sets of sampling programs were implemented; the first were aimed at only determining the species composition at the Merchang seagrass beds while the other was specifically designed to investigate the day-night fish catch composition. Day sampling involved the deployment of trammel nets and cast nets. In the case of day-night fish study, trammel nets were laid down for 24 hours and sampling proceeded at an interval of two hours. The sampling regime for day-night study started at 1400 hr and finished by 1200 hr the following day. Sampling involved the lifting of trammel nets and removing the fishes manually. Cast net catches are aimed at complementing the species that were not sampled by the trammel nets.

Measurements were made on the total and standard length and weight was also accordingly recorded. Image of

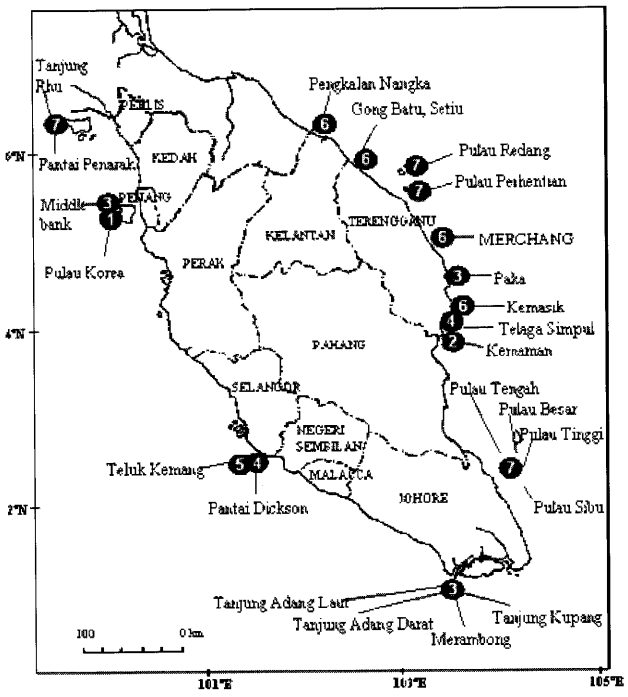

Fig. 1. Location and habitats of seagrasses in Malaysia. 1-Sub-tidal, 2-Mangrove associated, 3-Sub-tidal shoal, 4-Shallow inter-tidal, 5-Coral reef associated, 6-Lagoon and 7-Off-shore island. Merchang (study site) is located in the state of Terengganu.

the fish was photographed and samples were brought back for further investigation. Identification was mainly referred to Satapoomin and Poovachiranon (1997), Carpenter and Niem (1999a, 1999b), Matsuura et al. (2000) and Mohsin and Ambak (1996).

Results

Fish Composition of the Merchang Seagrass Beds

A total of 253 specimens were collected using the trammel net and they were made up of 27 species and 18 families. Of the total, 22 species were fishes and the remaining were the crustaceans (Table 1). The dominant families were the Tetraodontidae (45.1%), and this was followed by the Siganidae (12.7%) and Leiognathidae (11.5%). All others accounted less than 3.2% of the total abundance. Within the Tetraodontidae, the dominant species was *Tetraodon nigroviridis* (43.1%). *Siganus guttatus* (12.3%) and *Leiognathus equulus* (7.9%) were the two dominant species of the Siganidae and Leiognathidae respectively. The catches from the cast net amounted to 106 specimens and belonged to 25 different species and 17 families. The Tetraodontidae 24.5%), Leiognathidae (18.9%) and Siganidae (9.4%) were again the three dominant families recorded through this method of sampling. In total, 359 specimens of fishes and crustaceans were collected; fishes represented about 89% of the total catches during the entire study period. A total of ten families of fishes and 11 species of fishes were landed by both the trammel nets and cast net.

Day-Night Fish Catch Composition

A total of 110 fish specimens belonging to 25 species were recorded during the day-light sampling. *Dasyatis sephan*, *Lutjanus argentimaculatus*, *Mugil dussumierri* and *Stephanolepis auratus* (Appendix B) were found to be exclusive fish species landed during the day-light sampling. The night-time sampling resulted in the landing of 219 specimens of 27 different species. Out of these 27 species, seven were only specific to night catches and not recorded during the day-light sampling. The seven night-time species were *Ambassis miops*, *Ambassis urotaenia*, *Moringua javanica*, *Pelates quadrilineatus*, *Tetraodon* sp. *Liza tade* and *Gazza minuta*. A total of 17 fish species belonging to 14 families were found in both the day-light and night-time samples. The dominant species caught during both periods were *Tetraodon nigroviridis*, *Siganus guttatus* and *Leiognathus equulus*.

Length-Weight Study

Majority of the fishes collected from Merchang seagrass beds were relatively small in size and belonged to the late juveniles and young adult categories (refer Appendix A). The range of the total length for majority of the fish species was recorded to be between 5.2–17.4 cm. Weight ranged from 3.9 to 240 g, with the majority less than 50 g. The small-sized species were dominated by the Apogonidae, Tetraodontidae, Leiognathidae and Siganidae. A total of 18 commercial species were identified from this small-sized group and they were mainly comprised of *Leiognathus equulus*, *Siganus guttatus*, *Valamugil cunnesius* and *Tetraodon nigroviridis*. The total length range for the commercial species samples were between 5.3–17.4 cm.

Discussion

The fish survey done in Merchang Lagoon resulted in the total collection of 359 specimens of which 321 specimens or 89.4% of them were fishes. Nineteen families and 32 different fish species were gathered. The three most dominant families were Tetraodontidae (39%), Leiognathidae (16.5%) and Siganidae (13.7%), while the dominant species were *Tetraodon nigroviridis* (36.8%), *Siganus guttatus* (11.4%) and *Leiognathus equulus* (10.3%). A study by Rajuddin (1992) using only a beam trawl of a seagrass bed in Kuala Setiu Lagoon in same state of Terengganu reported on the presence of only 15 fish species. In his study, the dominant species recorded were *Epinephalus* sp., *Tetraodon fluviatilis* and *Siganus canaliculatus*. It is noted that the present results did show a variation in total species gathered but the dominant species recorded during the study showed an overlap-

Table 1. Species composition, abundance and percentage of catches of fishes samples collected from Merchang, Terengganu.

Gears	Trammel net		Cast net	
Family/Species	Abundance	Percentage	Abundance	Percentage
Teleostei				
Ariidae				
Arius sagor	12	4.74	4	3.77
Apogonidae				
Apogon hyalosoma	7	2.77	10	9.43
Belonidae				
Tylosurus annulatus	5	1.98	0	0
Tylosurus strongylura	3	1.18	1	0.94
Total	8	3.16	1	0.94
Carangidae				
Caranx ferdau	2	0.79	1	0.94
Dasyatidae				
Dasyatis sephan	1	0.40	0	0
Gerreidae				
Geres abbreviatus	2	0.79	0	0
Geres filamentosus	0	0	10	9.43
Total	2	0.79	10	9.43
Gobiidae				
Glossogobius giuris	1	0.40	2	1.89
Yongeichtys nebulosus	1	0.40	2	1.89
Total	2	0.80	4	3.78
Leiognathidae				
Gazza minuta	1	0.40	0	0
Leiognathus decorus	8	3.16	3	2.83
Leiognathus equulus	20	7.90	17	16.04
Total	29	11.46	20	18.87
Moringinidae				
Moringua javanica	1	0.40	0	0
Mugilidae				
Liza tade	1	0.40	0	0
Mugil dussumieri	0	0	1	0.94
Valamugil cunnesius	2	0.79	0	0
Moolgarda seheli	0	0	1	0.94
Total	3	1.19	2	1.88
Siganidae				
Siganus guttatus	31	12.25	10	9.43
Siganus virgatus	1	0.40	7	6.60
Total	32	12.65	17	16.04
Soleidae				
Synaptura orientalis	3	1.19	0	0
Sphyraenidae				
Sphyraena jello	1	1.19	0	0
Tetraodonthidae				
Arothron sp.	4	1.58	0	0
Chelonodon patoca	1	0.40	0	0
Tetraodon nigroviridis	109	43.08	0	0
Tetraodon sp.	0	0	0	0
Total	114	45.06	0	0
CRUSTACEA				
Grapsidae				
Episesarma sp.	1	0.40	0	0
Menippidae				
Myomenippe hardwicki	5	1.98	0	0
Penaeoidae				
Penaeus monodon	1	0.40	0	0
Portunidae				
Portunus pelagicus	20	7.90	1	0.94
Scylla serrata	9	3.56	1	0.94
Total	29	11.46	2	1.88
Number of specimens	253	100	106	100
Total species recorded	27		25	
Total families recorded	17		18	

ping lists. The difference in results was probably due to the different in sampling gears adopted and the various intensity of sampling fishing efforts applied between the two sites.

Variation in total and dominant species often associated with the geographical location and different types of seagrass habitat (Bell and Pollard 1989, Arshad et al. 2001)). Sasekumar et al. (1989) in his study of the open subtidal seagrass fishes of the river mouth of Pulai River in Johor recorded a total of 75 fish species with the dominance of *Pervagor tomentosus* (Ariidae) and *Apogon endekataenia* (Apogonidae). On the other hand, a study by Mazlan et al. (1996) of Mengkabong Bay in Sabah resulted in the compilation of 91 fish species that was dominated by the Terapontidae (15.9%), Mugilidae (15.2%) and Leiognathidae (27.5%).

The present study site was inhabited by the seagrass species of *Halodule pinifolia* and *Halophila ovalis* and salinity ranged from 14 to 20 ppt. The two seagrass species especially *Halodule* is established as one of the species with high percentage of coverage and this characteristic has been associated with the high presence of fish species (Sudara et al. 1992). This factor perhaps is not quite influential in the case of Merchang lagoon as only 32 species were found. Denser coverage and wider variety of seagrass species has also been associated with the increase in species richness (Stoner 1983).

The use of trammel nets as the main sampling gear did manage to increase the range of fish size collected. This is quite obvious been shown by the data on fish size recorded in Appendix A. In general it is noticed that most of the catches landed belonged to the small sized fishes. For example, samples from the Apoginidae, Gobiidae, Leiognathidae, Siganidae and Tetraodontidae showed a size range of 5.2 to 17.4 cm. Studies by Mazlan et al. (1996), Rajuddin (1992), Sasekumar et al. (1989) and Arshad et al. (2001) all showed the presence of large volume of juveniles and young adult fishes in their studies. Dollar (1991) suggested that the small sized fishes often prefer seagrass habitats as they can easily seek protection and able to evade large predators. This would agree well with the prime function of seagrass bed as a nursery and feeding area for many fishes and invertebrates.

The study on day and night catches of the seagrass beds showed the presence of three groups of fishes based on their period of landing, i.e day-only, night-only and day-night categories. The basis of this classification could be attributed to the natural biological activity such as feeding activities which varies between families and species. There has been

Table 2. Summary of day and night sampling efforts.

Parameter	Day-light	Night-time
Total Number of Specimens	110	219
Total Species	25	27
Total Family	17	21

Table 3. Summary of the results of seagrass beds fish studies of the different habitats and localities in Malaysia.

Location	Results	Dominant species		
		Fish	Crab	Prawn
Seagrass beds of Pulai River in Johore (Sasekumar et al., 1989)	75 species of fish (41 families) 38 species of crustaceans (9 families)	*Pervagor tomentasus* *Apogon endekataenia*	—	*Penaeus merguiensis* *Penaeus indicus*
Seagrass beds of Setiu Lagoon in Terengganu (Rajuddin, 1992)	15 species of fish (9 families)	*Epinephalus* sp.	—	—
Seagrass beds of Mengkabong Bay in Sabah, East Malaysia (Mazlan et al., 1992)	1468 specimens 91 species of fish belonging to 40 families	Leiognathidae (27.%) Teraponidae (15.9%) Mugilidae (15.2%) Sygnathidae (9.1%) Ambassidae (8.3%) Monacanthidae (4.9%)	—	—
Mangroves of Sementa Kechil River in Selangor (Sasekumar et al., 1991)	102 species of fish 11 species of prawns	Ambassidae Engraulidae Clupeidae	—	—
Mangroves of Kelang Straits and Angsa Bank in Selangor (Chong et al., 1991)	95 species of fish 14 species of prawns	Sciaenidae Synodontidae Leiognathidae Engraulidae	—	*Penaeus monodon* *Penaeus merguiensis*
Seagrass beds of Merchang Lagoon in Terengganu (present study)	359 specimens of fish 32 fish species,19 families; 38 specimens of crust. 5 crust. species, 4 families	*Tetraodon nigroviridis* (Tetraodontidae) – 36.77% *Siganus guttatus* (Siganidae) – 11.42%	*Portunus pelagicus* (Portunidae) – 5.9% *Scylla serrata* (Portunidae) – 2.8%	—

more night-only species during sampling and similar observation is reported by Dollar (1991) in Bais Bay, Philippines. Bell and Pollard (1989) also reported higher diversity and abundance during night sampling where lots of activity such as migration and daily movements happening. According to Ogden (1980), carnivorous fish of seagrass areas would specifically become slightly more active at night.

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Appendix A. Fish species collected from Merchang Lagoon seagrass beds and their range of length and weight data

Sampling Method	Trammel Net		Cast Net	
	Total length (cm)	Weight (g)	Total length (cm)	Weight (g)
Ariidae				
Arius sagor	16.9–27.5	60.0–520.0	16.5–10.7	110.0–240.0
Apogonidae				
Apogon hyalosoma	8.5–10.8	15.0–65.0	5.6–10.7	7.2–60.0
Belonidae				
Tylosurus annulatus	28.5–42.2	50.0–42.2	—	—
Tylosurus strongylura	27.7–41.2	35.0–120.0	35.5	80.0
Carangidae				
Caranx ferdau	13.0–14.0	50.0–75.0	—	—
Dasyatidae				
Dasyatis sephan	33.0	236.0	—	—
Gerridae				
Geres abbreviatus	9.6–9.8	45.0–50.0	—	—
Geres filamentosus	—	—	5.3–9.4	4.13–55.0
Gobiidae				
Glossogobius giuris	10.8	10.0	—	—
Yongeichtys nebulosus	6.0	6.5	—	—
Leiognathidae				
Gazza minuta	8.4	55.0	—	—
Leiognathus decorus	6.0–7.5	8.8–14.0	5.7–6.3	6.79–8.2
Leiognathus equulus	5.3–12.3	6.7–90.0	4.7–15.5	4.19–11.0
Moringinidae				
Moringua javanica	72.0	260.0	—	—
Mugilidae				
Liza tade	17.4	140.0	—	—
Mugil dussumieri	—	—	17.2	60.0
Valamugil cunnesius	8.2	75.0	10.3	20.0
Moolgardal seheli	14.6	85.0	—	—
Siganidae				
Siganus guttatus	10.0–17.4	70.0–230.0	4.9–15.2	3.9–120.0
Siganus virgatus	9.5	40.0	5.2–5.7	4.9–6.5
Soleidae				
Synaptura orientalis	10.5–12.5	28.0–29.0	—	—
Sphyraenidae				
Sphyraena jello	25.0	200.0	18.0	75.0
Tetraodontidae				
Arothron sp.	7.0–8.5	22.0–25.0	7.0–8.5	60.1–70.0
Chelonodon patoca	8.4	55.0	—	—
Tetraodon nigroviridis	7.5–11.2	35.0–135.0	7.1–11.0	23.0–100.0
Tetraodon sp.	—	—	7.8	35.0

Appendix B. Species composition and abundance of fish species during day-light and night-time sampling regimes

Sampling Method	Trammel net				Cast net			
Family/Species	Day-light		Night-time		Day-light		Night-time	
	Inds	(%)	Inds	(%)	Inds	(%)	Inds	(%)
Teleostei								
Ariidae								
Arius sagor	3	5.26	9	4.59	4	7.27	0	0
Apogonidae								
Apogon hyalosoma	0	0	7	3.57	2	3.64	8	15.67
Belonidae								
Tylosurus annulatus	1	1.75	4	2.04	0	0	0	0
Tylosurus strongylura	1	1.75	2	1.02	1	1.82	0	0
Total	2	3.50	6	3.06	1	1.82	0	0
Carangidae								
Caranx ferdau	0	0	0	0	1	1.82	0	0
Caranx sexfasciatus	0	0	2	1.02	0	0	0	0
Total	0	0	2	1.02	1	1.82	0	0
Chandidae								
Ambassis miops	0	0	0	0	0	0	1	1.96
Ambassis urotaenia	0	0	0	0	0	0	1	1.96
Total	0	0	0	0	0	0	2	3.92
Dasyatidae								
Dasyatis sephan	1	1.75	0	0	0	0	0	0
Gerreidae								
Gerres abbreviatus	1	1.75	1	0.51	0	0	0	0
Gerres filamentosus	0	0	0	0	3	5.45	7	13.73
Total	1	1.75	1	0.51	3	5.45	7	13.73
Gobiidae								
Glossogobius giuris	0	0	1	0.51	1	1.82	1	1.96
Yongeichthys nebulosos	1	1.75	0	0	0	0	0	0
Total	1	1.75	1	0.51	1	1.82	1	1.96
Leiognathidae								
Gazza minuta	0	0	1	0.51	0	0	0	0
Leiognathus decorus	3	5.26	5	2.55	2	3.64	1	1.96
Leiognathus equulus	6	10.53	14	7.14	12	21.82	5	9.80
Total	9	15.74	20	10.20	14	25.46	6	11.76
Lethrinidae								
Lethrinus lentjan	0	0	0	0	1	1.82	1	1.96
Lutjanidae								
Lutjanus argentimaculatus	0	0	0	0	1	1.82	0	0
Lutjanus monostigma	0	0	0	0	2	3.64	3.64	1.96
Total	0	0	0	0	3	5.46	3.64	1.96
Monacanthidae								
Stephanolepis auratus	0	0	0	0	1	1.82	0	0
Moringnidae								
Moringua javanica	0	0	1	0.51	0	0	0	0
Mugilidae								
Liza tade	0	0	1	0.51	0	0	0	0
Mugil dussumierri	0	0	0	0	1	1.82	0	0
Valamugil cunnesius	0	0	2	1.02	1	1.82	0	0
Total	0	0	3	1.53	2	3.64	0	0
Siganidae								
Siganus guttatus	2	3.51	29	14.80	7	12.27	3	5.88
Siganus virgatus	0	0	1	0.51	0	0	7	13.73
Total	2	3.51	30	15.31	7	12.27	10	19.61
Soleidae								
Synaptura orientalis	1	1.75	2	1.02	0	0	0	0

Appendix B. (Continued)

Sampling Method	Trammel net				Cast net			
Family/Species	Day-light		Night-time		Day-light		Night-time	
	Inds	(%)	Inds	(%)	Inds	(%)	Inds	(%)
Teleostei								
Sphyraenidae								
Sphyraena jello	0	0	1	0.51	1	1.82	0	0
Tetraodontidae								
Arothron sp.	4	7.02	0	0	1	1.82	1	1.96
Chelonodon patoca	0	0	1	0.51	0	0	0	0
Chelonodon nigroviridis	23	40.35	86	43.88	12	21.82	11	21.57
Tetraodon sp.	0	0	0	0	0	0	1	1.96
Total	27	47.37	87	44.39	13	23.64	13	25.43
Teraponidae								
Pelates quadrilineatus	0	0	0	0	0	0	1	1.96
CRUSTACEA								
Grapsidae								
Episesarma sp.	0	0	1	0.51	0	0	0	0
Menippidae								
Myomenippe hardwicki	0	0	5	2.55	0	0	0	0
Penaeoidae								
Penaeus monodon	0	0	1	0.51	0	0	0	0
Portunidae								
Portunus pelagicus	7	12.28	11	5.61	0	0	1	1.96
Scylla serrata	3	5.26	8	4.08	1	1.82	0	0
Total	10	17.54	19	9.69	1	1.82	1	1.96
Total No.of Specimens	57	100	196	100	55	100	51	100
Total Species	14		24		19		16	
Total Families	10		17		15		11	