CHAPTER 7

7.0 Population Structure

7.1 Introduction

Mangroves are considered to be the feeding and breeding habitat for juvenile fish and many marine species (Pinto, 1987). Some species of adult fish also use mangroves as their habitat (Robertson and Duke, 1990). Weinstein (1979) found that this habitat is often productive and holds large populations of aquatic fauna than other parts of estuarine system.

Herre (1959) had suggested that a large number of marine fishes in Philippines visit the brackish water for a time, entering while quite young and staying for a longer or shorter time but returning to the sea long before sexual maturity. Studies by Pinto (1987) indicated that there are diverse spawning habits among the fish occurring in the mangroves. Few species spawn in the mangroves, while most species go offshore. Some of their larval populations may enter mangrove habitats or may spend their juvenile stages in other coastal waters. Same situation also applied to the prawns species. Robertson and Duke (1987) found the juveniles of *Penaeus merguiensis* and *Metapenaeus ensis* were significantly more abundant in mangrove habitats than other near shore habitats like sea grass ecosystems.

A population is represented by the number of individuals in each size group. It also takes into account the numbers of sexually mature individuals and their sex ratio (Mariana,1993). The differences of populations within a species may be related to genetics, environment, or usually a mixture of both (Pitcher and Hart, 1982). Fish had various modes of sexuality with the emphasis placed on the genetic and/or cytogenetic mechanisms which influence sexuality (Gold, 1979). Wootton (1992) also found that the sex of an individual in most vertebrates is determined by its genotype.

The great majority of fishes reproduce bisexually, and have separate sexes, male and female which in nature are regularly encountered in an approximate 1:1 ratio (Gold, 1979). The formation of pairs (male and female) is consistent with 1:1 sex ratio, unless there is a succession of females and this would imply a surplus of males (Pitcher and Hart, 1982).

This study was done to observe the sex of captured fish and prawns. Sex ratio between females and males were examined. The number of sexually matured were also considered. All the prawn specimens were divided into many size groups depending on their carapace lengths to study their population structure.

7.2 Results And Discussion

7.2.1 Sex Composition And Ratio Of The Sexes Of Fish Specimens.

The average percentages of females and males and the sex ratio of every species of fish captured is shown in Table 6.0. The numerically dominant species *Ambassis gymnocephalus* had more females than males during the monthly sampling in all three sites. The sex ratio of *Ambassis gymnocephalus* did not show any obvious significance because most of them were of undetermined sex in all the sites (I, II and III).

Hilsa sp. and *Ilisha megaloptera* had only male specimens which means no females were found at monthly observations in all three sites (I, II and III). Most of the captured specimens for both species had undetermined sex. No particular pattern of sex ratio were observed in the above two species.

The sex ratio of *Butis butis* were even at Site I but apparently different at Sites II and III. *Stolephorus tri* was found to have more females than males at Site I. However, a reverse trend was found at Sites II and III. No particular pattern of sex ratio was observed for *Thryssa kamalensis* and *Thryssa mystax*.

Table 6.0 : Sex ratio of fish specimens collected in three creeks (Sites I, II and III) in Sungai Sementa Kecil, Selangor during 1992 and 1993.

Species	Site	Average							
		total specimens	female	female (%)	male	male (%)	UD	UD (%)	f/m
Ambassis gymnocephalus	I	302	99	32.78	1	0.33	202	66.89	99.33
	II	452	123	27.21	0	0.00	329	72.79	~
	III	267	95	35.58	2	0.75	170	63.67	47.44
Arius sagor	III	2	0	0.00	2	100.00	0	0.00	0.00
Tylosurus strongylurus	III	2	2	100.00	0	0.00	0	0.00	~
Lates calcarifer	III	4	0	0.00	4	100.00	0	0.00	0.00
Anadontostoma chacunda	III	5	0	0.00	0	0.00	5	100.00	0.00
Hilsa sp.	I	7	0	0.00	3	42.86	4	57.14	0.00
	II	12	0	0.00	6	50.00	6	50.00	0.00
	III	9	0	0.00	3	33.33	6	66.67	0.00
Ilisha megaloptera	I	25	0	0.00	10	40.00	15	60.00	0.00
	II	32	0	0.00	13	40.63	19	59.37	0.00
	III	73	0	0.00	7	9.59	66	90.41	0.00
Cynoglossus lingua	III	1	0	0.00	1	100.00	0	0.00	0.00
Butis butis	I	12	5	41.67	5	41.67	2	16.66	1.00
	II	5	2	40.00	3	60.00	0	0.00	0.67
	III	9	4	44.45	3	33.33	2	22.22	1.33
Ophiocara porocephala	I	4	2	50.00	2	50.00	0	0.00	1.00
Stolephorus tri	I	16	5	31.25	3	18.75	8	50.00	1.67
	II	25	7	28.00	11	44.00	7	28.00	0.64
	III	98	26	26.53	50	51.02	22	22.45	0.52
Thryssa kamalensis	I	67	0	0.00	1	1.49	66	98.51	0.00
	III	17	0	0.00	0	0.00	17	100.00	0.00
Thryssa mystax	I	21	0	0.00	1	4.76	20	95.24	0.00
	II	7	0	0.00	0	0.00	7	100.00	0.00
	III	44	0	0.00	2	4.55	42	95.45	0.00
Gerres abbreviatus	I	2	0	0.00	0	0.00	2	100.00	0.00
	III	40	0	0.00	17	42.50	23	57.50	0.00

continued from Table 6.0

Acentrogobius canirus	I	3	2	66.67	1	33.33	0	0.00	2.00
	II	4	2	50.00	2	50.00	0	0.00	1.00
	III	2	0	0.00	1	50.00	1	50.00	0.00
Boleophthalmus boddarti	I	5	3	60.00	1	20.00	1	20.00	3.00
	II	1	0	0.00	0	0.00	1	100.00	0.00
	III	6	3	50.00	2	33.33	1	16.67	1.50
Glossogobius giuris	I	9	4	44.44	2	22.22	3	33.33	2.00
	II	9	2	22.22	1	11.11	6	66.67	2.00
	III	9	3	33.33	2	22.22	4	44.44	1.50
Gobiidae sp.	I	6	5	83.33	0	0.00	1	16.67	~
	III	7	3	42.86	2	28.57	2	28.57	1.50
Periophthalmodon schosseri	I	7	3	42.86	2	28.57	2	28.57	1.50
	II	1	0	0.00	1	100.00	0	0.00	0.00
	III	3	0	0.00	1	33.33	2	66.67	0.00
Hyporhamphus unifasciatus	III	22	13	59.09	8	36.36	1	4.55	1.63
Zenarchopterus dispar	I	1	1	100.00	0	0.00	0	0.00	~
	II	1	0	0.00	0	0.00	1	0.00	
	III	36	10	27.78	23	63.89	3	8.33	0.43
Leiognathus brevirostris	I	7	0	0.00	0	0.00	7	100.00	0.00
	II	9	0	0.00	0	0.00	9	100.00	0.00
	III	11	1	9.09	0	0.00	10	90.91	~
Leiognathus equulus	I	5	0	0.00	0	0.00	5	100.00	0.00
	II	19	1	5.26	1	5.26	17	89.47	1.00
	III	17	0	0.00	2	11.76	15	88.24	0.00
Secutor insidiator	I	3	0	0.00	0	0.00	3	100.00	0.00
	II	1	0	0.00	0	0.00	1	100.00	0.00
	III	6	0	0.00	0	0.00	6	100.00	0.00
Lutjanus johni	I	2	0	0.00	0	0.00	2	100.00	0.00
	II	2	0	0.00	1	50.00	1	50.00	0.00
	III	3	1	33.33	0	0.00	2	66.67	~
Lutjanus russelli	I	2	0	0.00	0	0.00	2	100.00	0.00
	III	2	0	0.00	1	50.00	1	50.00	0.00
Liza melinoptera	I	53	8	15.09	12	22.64	33	62.26	0.67
	II	18	4	22.22	3	16.67	11	61.11	1.33
	III	47	1	2.13	3	6.38	43	91.49	0.33

continued from Table 6.0 :

Liza subviridis	I	11	5	45.45	2	18.18	4	36.36	2.50
	II	1	0	0.00	1	100.00	0	0.00	0.00
	III	5	0	0.00	4	80.00	1	20.00	0.00
Platycephalus indicus	III	2	0	0.00	2	100.00	0	0.00	0.00
Plotosus canius	I	2	0	0.00	1	50.00	1	50.00	0.00
	III	2	0	0.00	0	0.00	2	100.00	0.00
Pomadasys hasta	I	4	0	0.00	1	25.00	3	75.00	0.00
	II	3	0	0.00	2	66.67	1	33.33	0.00
	III	16	0	0.00	0	0.00	16	100.00	0.00
Scatophagus argus	I	6	0	0.00	0	0.00	6	100.00	0.00
	II	1	0	0.00	0	0.00	1	100.00	0.00
	III	11	0	0.00	0	0.00	11	100.00	0.00
Dendrophyssa russelli	III	2	2	100.00	0	0.00	0	0.00	~
Epinephelus hleekeri	I	1	0	0.00	0	0.00	1	100.00	0.00
Siganus canaliculatus	I	1	0	0.00	0	0.00	1	100.00	0.00
	III	4	0	0.00	0	0.00	4	100.00	0.00
Siganus javus	I	5	0	0.00	0	0.00	5	100.00	0.00
	III	3	0	0.00	1	33.33	2	66.67	0.00
Dorichtys cunculus	III	2	0	0.00	0	0.00	2	100.00	0.00
Chelonodon fluviatilis	I	6	0	0.00	0	0.00	6	100.00	0.00
	III	50	5	10.00	1	2.00	44	88.00	5.00

UD - undetermined sex.

Almost all of the *Leiognathus brevirostris, Leiognathus equulus, Secutor insidiator, Scatophagus argus* and *Chelonodon fluviatilis* speciemens were of undetermined sex. Most of the specimens of *Liza melinoptera* were of undetermined sex.

7.2.2 Sex composition and ratio of the sexes of prawns specimens.

The average percentages of females and males and the sex ratios of prawn species are shown in Table 6.1. *Penaeus merguiensis* was the dominant species captured in Sites I, II and III and showed more males than females. More specimens were found with undetermined sex compared to females of this species at Sites I, II and III. Whereas the female to male ratio did not showed any particular trend.

No male specimens of *Macrobrachium* sp. were found at Sites I, II and III. As a result, no pattern for the sex ratio between females and males could be indicate here . Both the female and male specimens of *Metapenaeus brevicornis* were observed at Sites I and III. Whereas, only males specimens were found at Site II. It was shown that the sex ratio of this species was more than 1 : 1 ratio at Site I and less than 1 : 1 ratio for Site

Table 6.1 : Sex ratio of prawn specimens collected in three creeks (Sites I, II and III) in Sungai Sementa Kecil, Selangor during 1992 and 1993.

Species	Site	Average							
		total specimens	female	female (%)	male	male (%)	UD	UD (%)	f/m
Macrobrachium sp.	I	10	3	30	0	0	7	70	~
	II	5	2	40	0	0	3	60	~
	III	9	2	22.22	0	0	7	77.78	~
Metapenaeopsis barbata	I	1	0	0	1	100	0	0	0
Metapenaeopsis lamellata	I	1	0	0	1	100	0	0	0
Metapenaeus affinis	I	2	0	0	1	50	1	50	0
	III	1	0	0	1	100	0	0	0
Metapenaeus brevicornis	I	24	10	41.67	9	37.5	5	20.83	1.11
	II	4	0	0	2	50	2	50	0
	III	29	9	31.03	11	37.93	9	31.03	0.82
Metapenaeus lysianassa	I	9	4	44.44	1	11.11	4	44.44	4
	III	5	1	20	3	60	1	20	0.33
Penaeus merguiensis	I	118	9	7.63	76	64.41	33	27.96	0.12
	II	102	20	19.61	45	44.12	37	36.27	0.44
	III	371	33	8.89	233	62.8	105	28.3	0.14
Penaeus penicillatus	I	9	0	0	9	100	0	0	0
	II	32	0	0	22	68.57	10	31.25	0
	III	11	0	0	10	90.09	1	9.09	0

UD - undetermined sex.

III. However no numerical ratio could be shown at Site II which had no female specimens.

No female specimens of *Penaeus penicillatus* were found at Sites I, II and III. However, almost all the specimens were males and the rest were of undetermined sex.

7.2.3 Sexual Maturity Of Fish Specimens

Almost all the fish collected in Sites I, II and III were immature fish with undetermined sex (Table 6.2). The majority of the fishes were immature or juveniles at stages I and II (Figure 6.0-6.1).

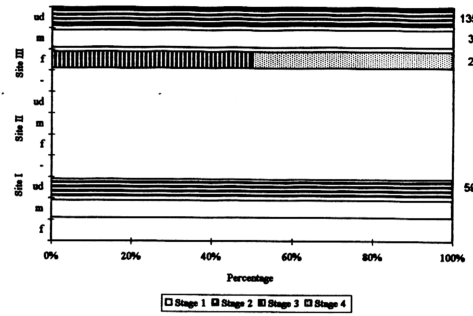
In some species, juveniles (stages I and II), subadults (stage III) and adults (stages IV - VII) were found together in the same site. This occurred for four species of fish, the glassy perchlet *Ambassis gymnocephalus* (Fig. 6.2), *Ilisha megaloptera* (Fig. 6.2), the mullet *Liza melinoptera* (Fig. 6.3) and the spinned anchovy *Stolephorus tri* (Fig. 6.3).

7.2.4 Sexual Maturity Of Prawns Specimens

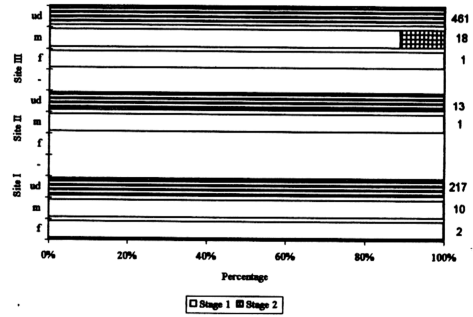
Prawns specimens collected at all sites (I, II and

Table 6.2 : Percentage composition of the maturity stages of fish and prawns sampled in three sites (I , II and III) in Sungai Sementa Kecil, Selangor.

Site		Total specimens	Undetermined sex	Immature (stages I-II)	Maturing (stage III)	Mature (stages IV-VII)
I	fish	7058	67.71	20.79	9.11	2.39
	prawns	2204	28.90	68.42	2.68	-
II	fish	1679	68.55	18.76	12.03	0.66
	prawns	365	37.53	58.63	3.84	-
III	fish	7292	64.50	20.79	10.39	4.32
	prawns	4577	29.17	70.18	0.52	0.13

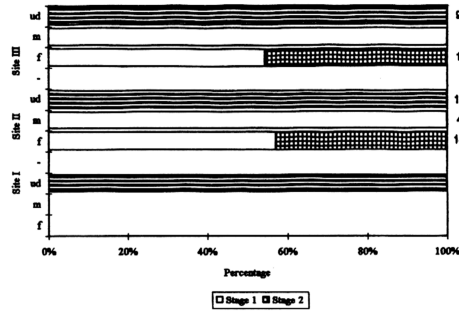


(a)

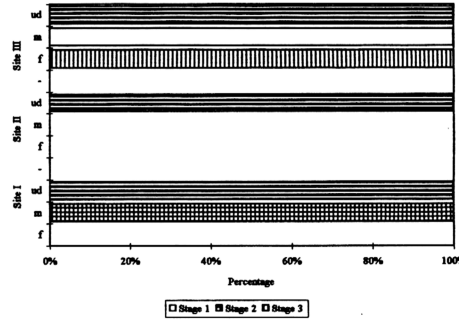


(b)

Figure 6.0 : Percentage distribution of the maturity stages of (a) *Thrysse kamalensis* and (b) *Thrysse mystax* at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.

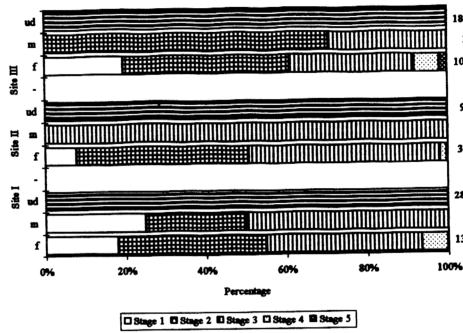


(a)

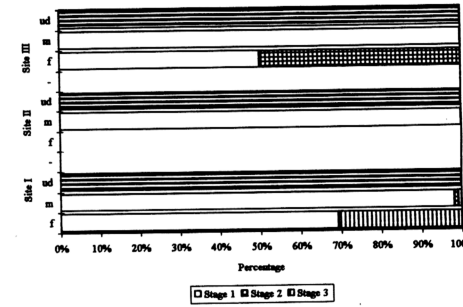


(b)

Figure 6.1 : Percentage distribution of the maturity stages of (a) *Leiognathus brevirostris* and (b) *Leiognathus equulus* at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.

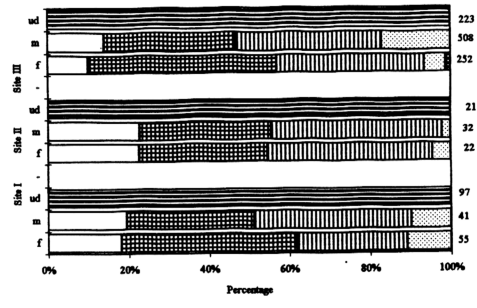


(a)



(b)

Figure 6.2 : Percentage distribution of the maturity stages of (a) *Ambassis gymnocephalus* and (b) Ilisha megaloptera at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.



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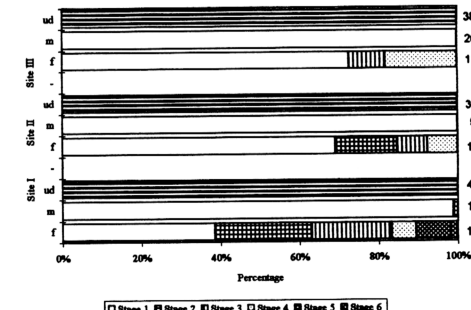


(b)

Figure 6.3 : Percentage distribution of the maturity stages of (a) *Stolephorus tri* and (b) *Liza melinoptera* at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.

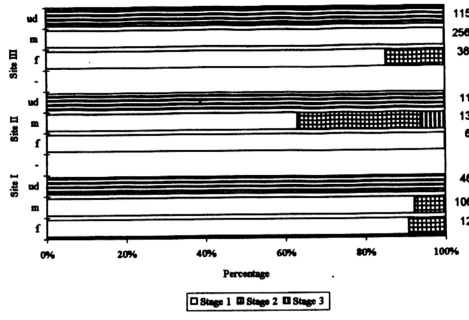
III) were of undetermined sex consisting of juveniles (stages I and II), subadults (stage III) and a small percentage of mature stages (stages IV - VI) (Table 6.2).

True migrating behaviour is exhibited by three species of prawns, *Penaeus merguiensis* (Fig. 6.4), *Penaeus penicillatus* (Fig. 6.4), *Metapenaeus brevicornis* (Fig. 6.5) and *Macrobrachium* sp. (Fig. 6.5). Only the common species of prawns are considered here. The two morphospecies, *Penaeus merguiensis* (Fig. 6.4) and *Penaeus penicillatus* (Fig. 6.4) use the waters within mangrove creeks as nursery areas. Juveniles of *Metapenaeus brevicornis* (Fig. 6.5) and *Macrobrachium* sp. (Fig. 6.5) preferred the creeks where they occurred in abundance.

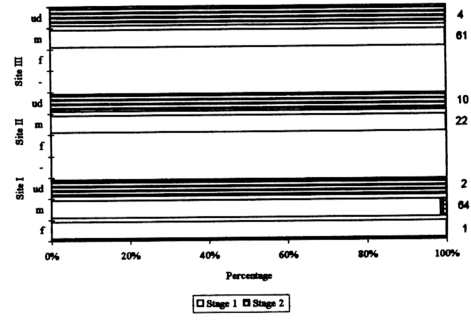
7.2.5 Length Class-Frequency Of Prawns

Analysis of carapace length classes of *Penaeus merguiensis* at Sites I (Fig. 6.6) and III (Fig. 6.8) showed the size class (1.05cm to 1.20cm) was most abundant. The size class most abundant in Site II was 1.35cm to 1.50cm (Fig. 6.7).

A different size class of *Penaeus penicillatus* was abundant in Site I compared to Sites II and III. Site I had the highest abundance of class 2.05cm to 2.20cm (Fig. 6.9).

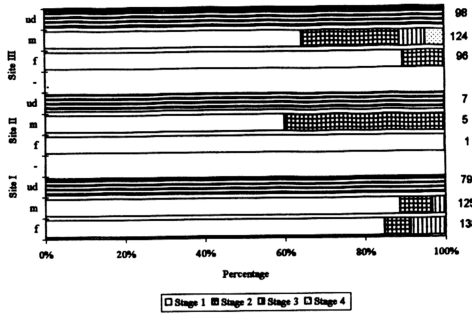


(a)

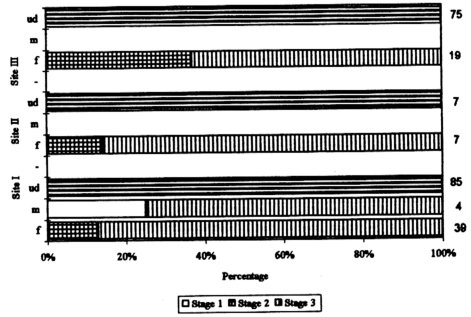


(b)

Figure 6.4 : Percentage distribution of the maturity stages of (a) *Penaeus merguiensis* and (b) *Penaeus penicillatus* at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.



(a)



(b)

Figure 6.5 : Percentage distribution of the maturity stages of (a) *Metapenaeus brevicornis* and (b) *Macrobrachium* sp. at Sites I, II and III in Sungai Sementa Kecil, Selangor.
f = female; m = male; ud = undetermined sex. Number of individuals are represented on the right of stacked bar.

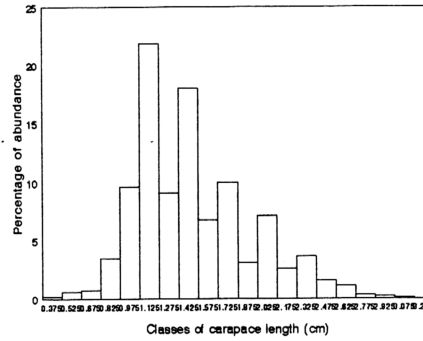


Fig. 6.6:Carapace length frequency distribution of Penaeus merguiensis at Site I in Sungai Sementa Kecil creek.

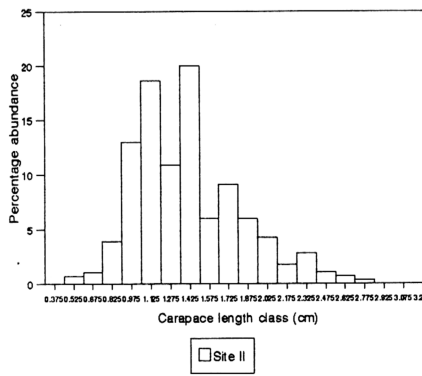


Fig. 6.7:Carapace length frequency distribution of Penaeus merguiensis at Site II during 1992 and 1993.

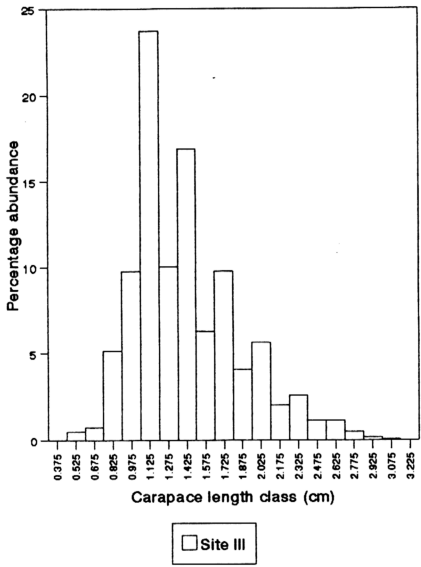


Fig. 6.8:Carapace length frequency distribution of Penaeus merguiensis at Site III during 1992 and 1993.

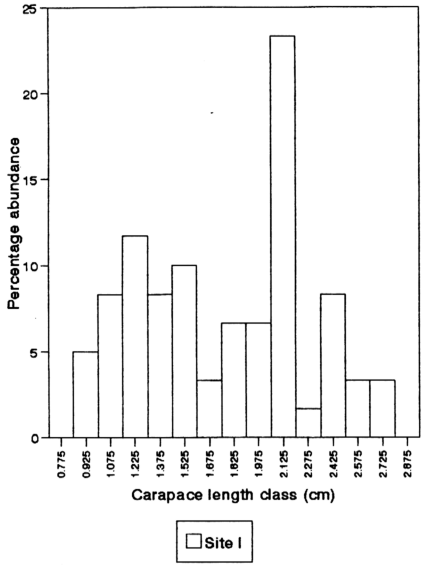


Fig. 6.9:Carapace length frequency distribution of Penaeus penicillatus at Site I during 1992 and 1993.

The abundant size class in Sites II (Fig. 7.0) and III (Fig. 7.1) was 0.85cm to 1.00cm. There were no specimens found of size class smaller than 0.85cm in all sites.

The most common size class of *Metapenaeus brevicornis* at Sites I (Fig. 7.2), II (Fig. 7.3) and III (Fig. 7.4) was 1.05cm to 1.20cm. Only a small number of larger individuals occurred at both Sites I and III.

The most common size class for *Macrobrachium* sp. at Site I was 1.65cm to 1.80cm (Fig. 7.5). A large size class was common in Sites II (Fig. 7.6) and III (Fig. 7.7). The size classes of the uncommon species captured within the sampling sites are shown in Table 6.3.

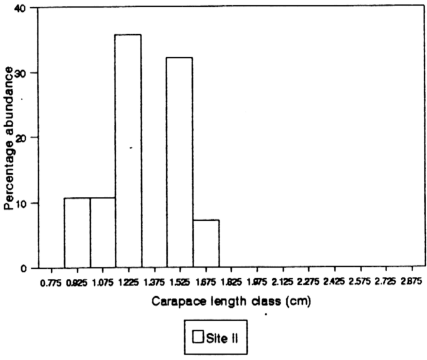


Fig. 7.0: Carapace length frequency distribution of Penaeus penicillatus at Site II during 1992 and 1993.

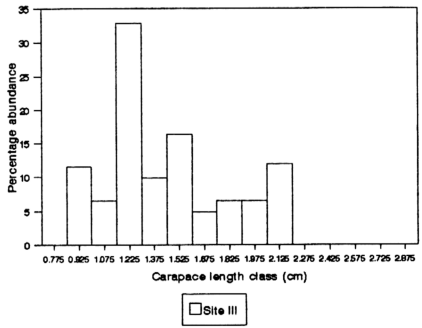


Fig. 7.1: Carapace length frequency distribution of Penaeus penicillatus at Site III during 1992 and 1993.

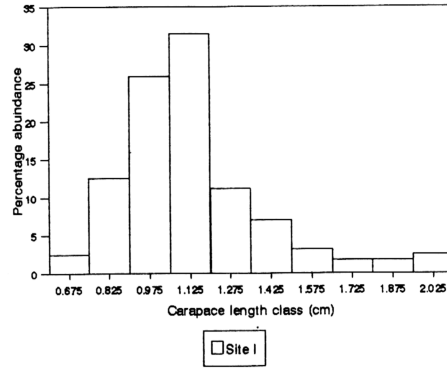


Fig. 7.2:Carapace length frequency distribution of Metapenaeus brevicornis at Site I during 1992 and 1993.

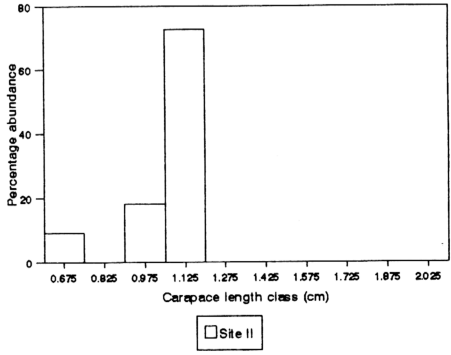


Fig. 7.3:Carapace length frequency distribution of Metapenaeus brevicornis at Site II during 1992 and 1993.

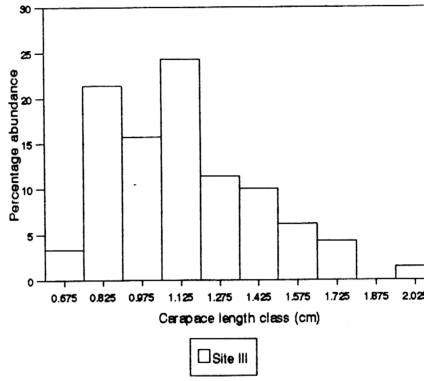


Fig. 7.4:Carapace length frequency distribution of Metapenaeus brevicornis at Site III during 1992 and 1993.

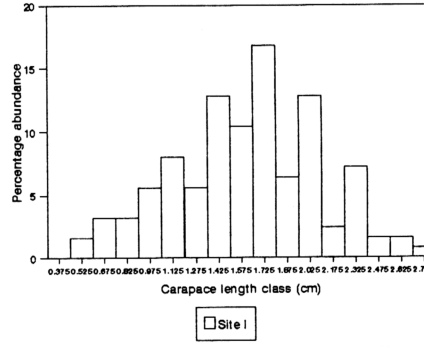


Fig. 7.5:Carapace length frequency distribution of Macrobrachium sp. at Site I during 1992 and 1993.

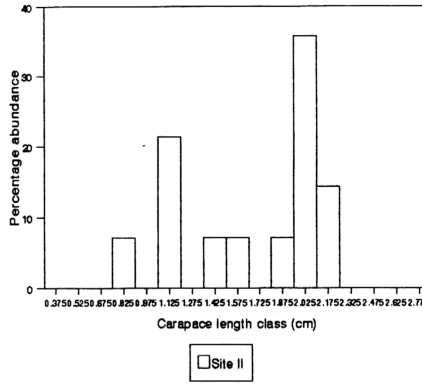


Fig. 7.6:Carapace length frequency distribution of Macrobrachium sp. at Site II during 1992 and 1993.

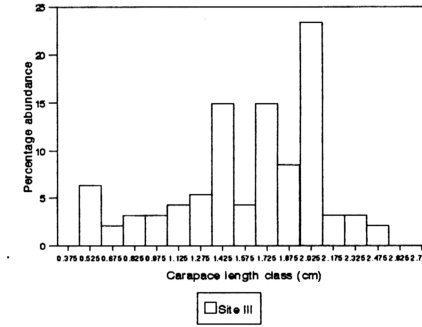


Fig. 7.7:Carapace length frequency distribution of Macrobrachium sp. at Site III during 1992 and 1993.

Table 6.3 : Carapace length frequency distribution of prawns species found at Sites I and III in Sungai Sementa Kecil.

	Site I		Site III	
	Length-class (cm)	Frequency	Length-class (cm)	Frequency
Metapenaeus affinis	1.3 - 2.5	6	1.0 - 1.3	3
Metapenaeopsis barbata	1.8	1	-	-
Metapenaeopsis lysianassa	-	-	0.8 - 1.1	6
Metapeneopsis lamellata	1.8 - 2.5	2	-	-