

GROWTH RATE OF *Penaeus semisulcatus* IN THE WATER AROUND QATAR.

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ABSTRACT

Penaeus semisulcatus is the most important shrimp species in the Gulf area. The life cycle and growth rate of this species have been dealt by various authors in the Gulf countries.

It is attempted in the present investigation to use the probability paper for the analysis of length frequency distribution of *Penaeus semisulcatus*. The aim of this analysis is to distinguish the size classes of this shrimp species population around the Qatari waters.

Two size classes have been distinguished in the length frequency measurements of random samples taken from the commercial catch landed at Doha in October 1983.

It has been proposed that these two separate size classes were recruited from two reproduction periods. This proposal may confirm the suggestions of previous authors that *Penaeus semisulcatus* has two reproduction peaks in the Gulf area.

It can also be concluded that this shrimp species grows to 8.6 cm total body length within the first six months of its life. On the other hand it attains 14.3 cm in length when it is one year old.

The above conclusion means that the largest individuals recorded in the catch would be less than two years old.

INTRODUCTION

Shrimp is considered as one of the most important marine living resources of the Gulf. Exploitation of this resource started in the sixties on an industrial scale for export purposes. In the late sixties local demand for shrimp strongly stimulated the artisanal shrimp activities. Today, the fully developed artisanal fishery is competing with the industrial fishery for shrimp resources of the Gulf.

Penaeus semisulcatus accounts for over 90% of the industrial landings of shrimp in the Gulf area. In addition sometimes small quantities of *P. latisulcatus*, *P. japonicus* and *Metapenaeus affinis* are landed, while a number of smaller species may occur that are not normally landed (Price and Jones, 1975, FAO 1970 and Van Zalinge et al. 1979).

The life cycle as well as the growth rate of *Penaeus semisulcatus* have been dealt by various authors in the Gulf countries.

Although the species has a protracted breeding season, the main spawning periods are reported by various workers in Bahrain, Saudi Arabia, Kuwait and Qatar (FAO 1978; Price and Jones 1975, Price 1979, Enomoto 1971, Al Attar and Ikenoue 1974, Mohamed et al. 1980, FAO 1981 and Siva and Ibrahim 1982).

The average growth rate of either the carapace or total length of *Penaeus semisulcatus* have been investigated by Al Attar and Ikenoue 1974, Thomas 1975, Mohamed 1978, Mohamed et al., 1980 and Siva and Ibrahim 1982.

It is attempted in the present study to use the probability paper in the analysis of size frequency distribution of *Penaeus semisulcatus* caught from the water around Qatar. The technique of this analysis has been carried out according to Cassie method (1963).

The aim of this analysis is to distinguish size classes in length frequency measurements of samples taken from the commercial catch of *Penaeus semisulcatus* landed in Doha in October 1983.

Identification of modes in the length frequency distribution led to the classification of *Penaeus semisulcatus* population into size groups. Therefore, it was possible to determine the growth rate of this shrimp species in the water around Qatar.

METHOD OF ANALYSIS

Probability paper is so designed that, if the cumulative frequencies of a homogeneous normally distributed, continuous variate are plotted, they will fall along a straight line. If (n) variates with different means are mixed, the resultant line will have ($n-1$) points of inflexion, which may be used as a basis for dissection into straight lines corresponding to the variates.

The method by which probability paper may be used in solving bimodal or polymodal distributions has been followed by Harding 1949. He described a method by which this paper may be used to dissect bimodal and in sometimes trimodal, frequency distributions of biological measurements into their component normally distributed parts.

This technique has been extended by Cassie 1950, in a manner which eliminates much of the trial and error necessary in the original method when more than two normal distributions are involved.

Cassie (1963) applied the χ^2 test of goodness of fit in the probability paper analysis of the length frequency distribution of fish.

Since the parameters (mean, standard deviation and number of fish) of the age classes are estimated from curves fitted by eye, they will not be fully efficient estimates. Nevertheless, it is possible by the conventional χ^2 test to gain some idea of how well they fit the data.

More details on the procedure of analysis and test of significance are given by Cassie (1963).

RESULTS

The length frequency distribution of *Penaeus semisulcatus* samples collected from Doha fish market during the first week of October 1983 is shown in Table (1). For probability paper analysis, the percentages of the length frequencies and the cumulative percentages are given in the same table.

The size composition of *Penaeus semisulcatus* ranged from 7.5 cm to 19.0 cm in total length.

The total length frequency distribution of the samples showed bimodal tendency as shown in Fig. (1). The first modal is 9.0 cm while the second one is 14.0 cm.

Though bimodal the second modal is more obvious, indicating that the fishery is mainly exploiting the recruitment from a single spawning season.

The non-asymmetry in the right side of the frequency curve which corresponds to the larger size group may indicate that a third size group is included in the samples.

The data are plotted as cumulative percentages on an arithmetical probability paper (Fig. 2). The plotted points lie on an asymmetrically placed eye fitted curve. There are two points of inflexion where the direction of the curvature changes. The positions of the points of inflexion suggest that there are more than one size class involved.

Two lines AB and CD are accordingly drawn in to represent two size classes.

The average length and standard deviation were calculated for each size class. The average length of the first size class was found to be 8.60 cm and the standard deviation was 0.516. On the other hand the average length of the second size class was found to be 14.3 cm with a standard deviation of 1.34 cm. An estimate of χ^2 for the difference between the calculated

TABLE 1
 The length frequency distribution of *Penaeus semisulcatus*
 during the first week of October 1983.

Total body length (cm)	Frequency	Percentage	Frequency	Cumulative percentage frequency
7.5	1	0.31		--
8.0	1	0.31		0.62
8.5	3	0.93		1.55
9.0	5	1.55		3.10
9.5	1	0.31		3.41
10.0	3	0.93		4.34
10.5	1	0.31		4.65
11.0	3	0.93		5.58
11.5	4	1.23		6.81
12.0	13	4.00		10.81
12.5	11	3.39		14.20
13.0	23	7.08		21.28
13.5	19	5.85		27.13
14.0	63	19.38		46.51
14.5	23	7.08		53.59
15.0	45	13.85		67.44
15.5	12	3.69		71.13
16.0	41	12.62		83.75
16.5	10	3.07		86.82
17.0	20	6.15		92.97
17.5	11	3.38		96.35
18.0	8	2.46		98.81
18.5	1	0.31		99.12
19.0	3	0.93		100.00

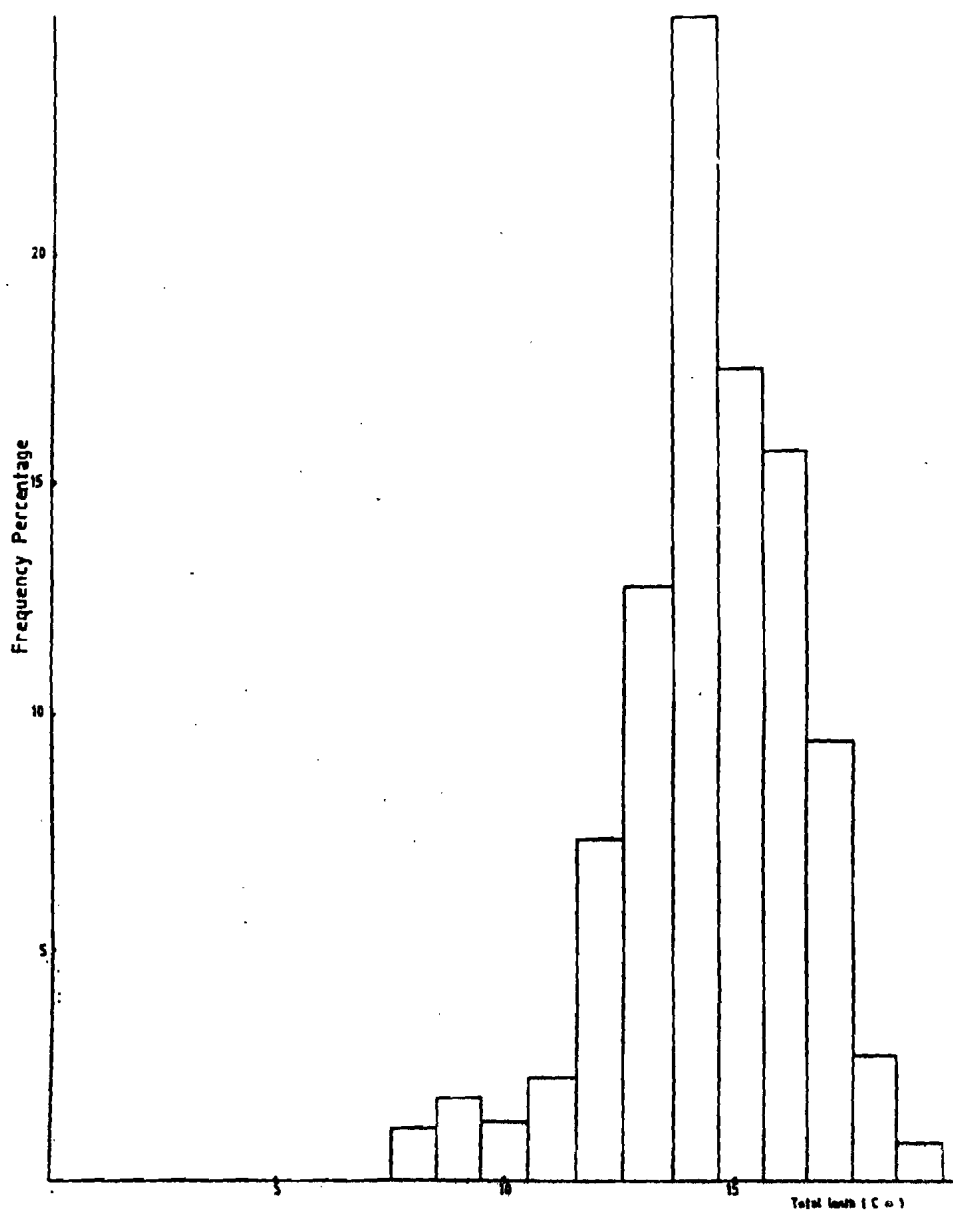


Fig. (1)
 The length frequency distribution of *Penaeus semisulcatus*
 caught from the water around Qatar.

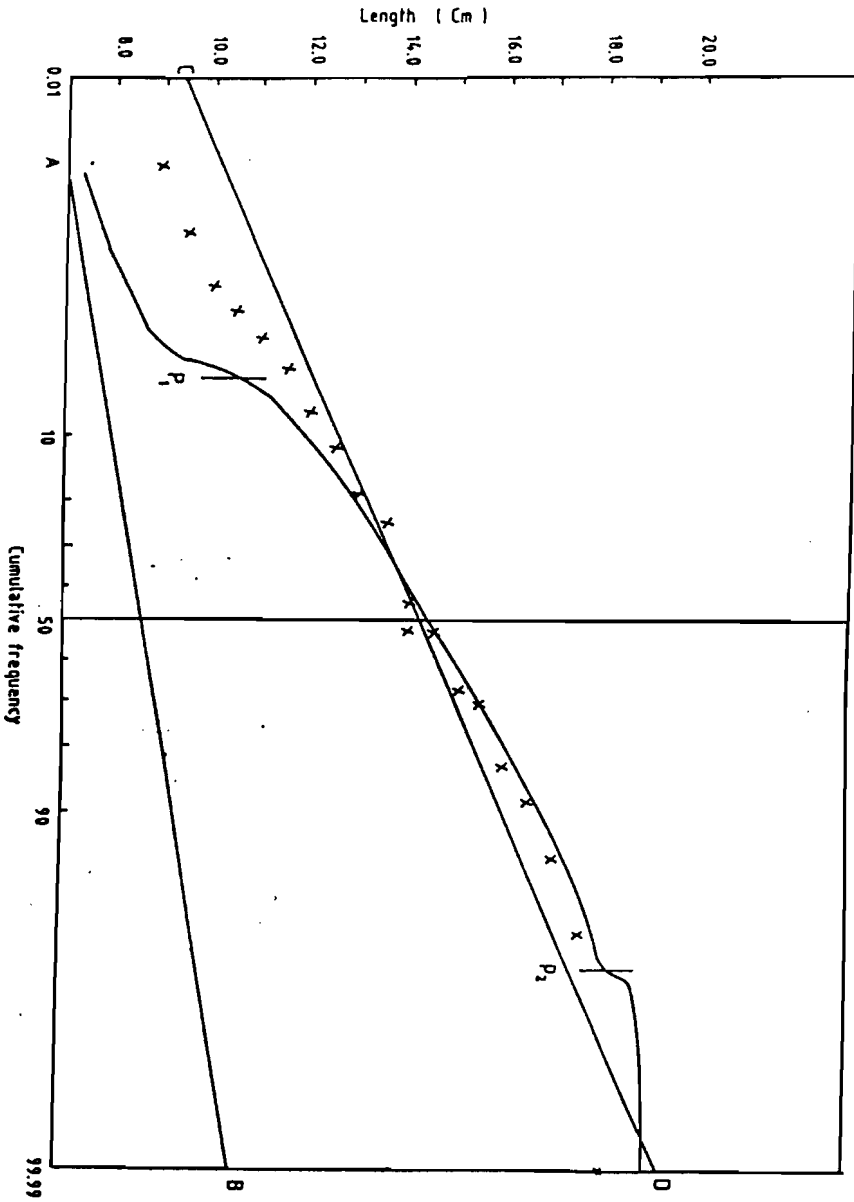


Fig. (2)
 Probability paper analysis of the length frequency distribution
 of *Panaeus semisulcatus* caught from water around Qatar.

and the observed size frequency distribution indicated a satisfactory fit. $p(x^2)$ was found to be 0.20 at 17 degrees of freedom. It is to be mentioned that the calculation of x^2 did not include the frequency distribution of individuals more than 17 cm body length.

Since the growth in weight is one of the important biological characters of shrimp, a relationship between the body weight and total length of *Penaeus semisulcatus* was derived. The derivation of this relationship based on data regardless of sex and state of maturity. Siva & Ibrahim (1983) concluded that the relationship between body weight and total length showed no significant difference due to sex and location of fishing center of *Penaeus semisulcatus* shrimp in the Qatari water.

The derived relationship is explained by the following equation:

$$\text{Log}(w) = -5.0790 + 2.9369 \text{ Log}(L_t)$$

or

$$w = 8.3368 \times 10^{-6} L_t^{2.9369}$$

The general length weight data of Table (2) are graphically represented in Fig. (3). The smooth curve represents the calculated weights, while the dots represent the emperical weight. From the table and the graph, it is clear that the agreement of the calculated and emperical weights is satisfactory.

DISCUSSION AND CONCLUSIONS

The growth rate of *Penaeus semisulcatus* in the Gulf region has been discussed by several authors. Al-Attar & Ikenoue (1974) found that the males grow with a range between 90 mm to 120 mm in body length within nine months while the female body length increases with a range between 80 mm to 150 mm within 10 months in Kuwait waters. Thomas (1975) concluded that the monthly growth rate in carapace length of males and females of this species in the south east coast of India for the two sexes is 2.0 mm and 3.5 mm respectively. Mohamed (1978) estimated a monthly growth rate of 1.69 mm and 2.42 mm in the carapace length for respectively males and females *Penaeus semisulcatus* in Bahrain waters. Siva & Ibrahim (1982) indicated that, on an average the females gain 2.0 mm and the males gain 1.8 mm in carapace length per month in Qatar waters.

On the other hand it appears from the present analysis of length frequency distribution using the probability paper that the length distribution of *Penaeus semisulcatus* contains mainly two size groups. It is also obvious that the smaller size group has an average total body length of 8.6 cm, while the average length of the larger one is 14.3 cm.

Kepping in mind the above reported growth rates of this shrimp species in the Gulf region, it can be concluded from the present investigation that the larger size group in the length frequency distribution is about one year old while the smaller size group is certainly less than one year in age.

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TABLE 2
 Total lengths, average emperical weights and calculated
 weights of *P. semisulcatus* caught from water around Qatar.

Total length (mm)	Average emperical weight (gm)	Calculated weight (gm)
80	3.10	3.46
85	3.70	3.85
90	4.07	4.57
95	5.05	5.36
100	5.95	6.23
105	6.90	7.20
110	7.90	8.25
115	8.83	9.40
120	10.52	10.65
125	11.16	12.00
130	14.19	13.47
135	15.85	15.05
140	17.44	16.75
145	18.51	18.57
150	20.62	20.51
155	14.15	22.58
160	26.18	24.79
165	28.38	27.14
170	31.93	29.61
175	34.39	32.25
180	36.20	35.04
185	39.35	37.98
190	41.83	41.08

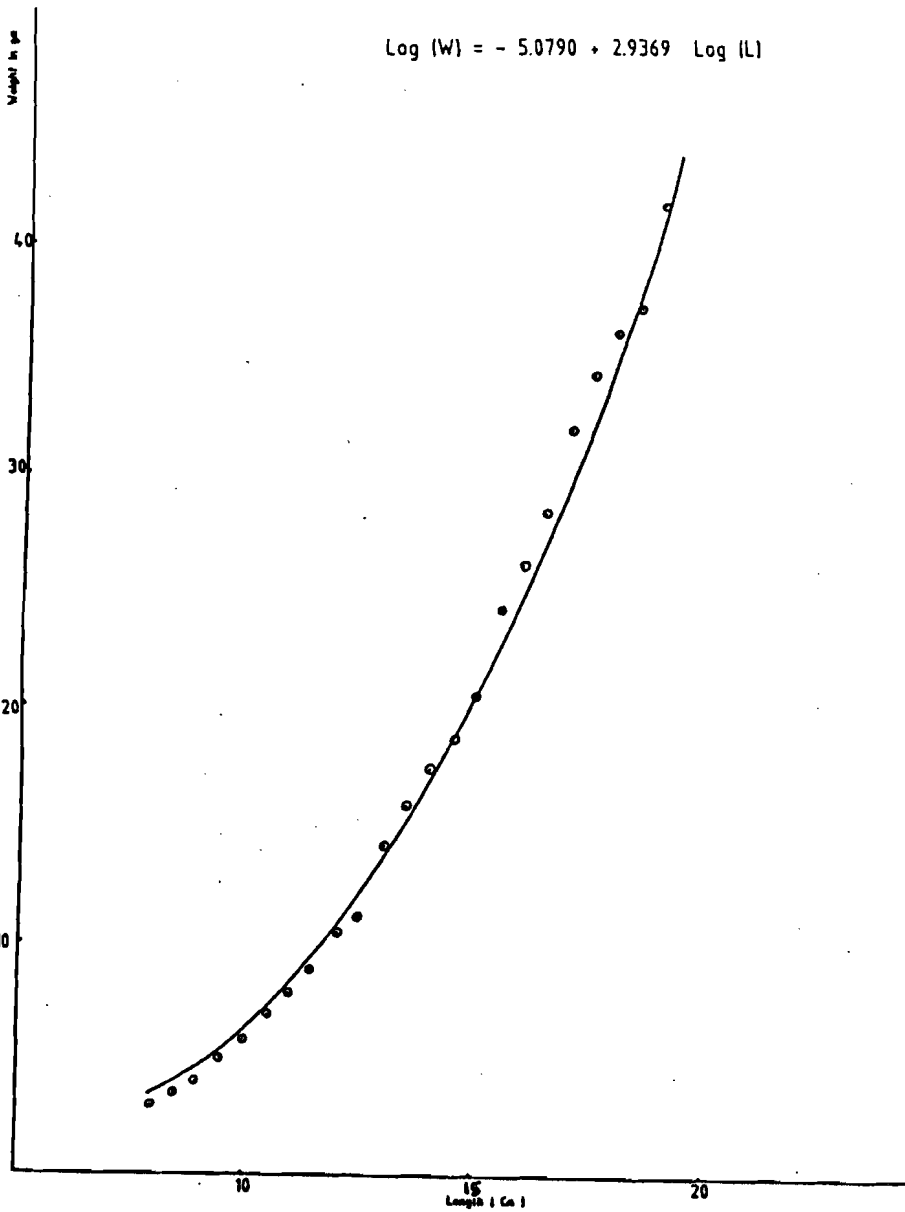


Fig. (3)
Relationship between total length and total weight of *P. semisulcatus*
caught from water around Qatar.

This approach may indicate that the maximum size of *Penaeus semisulcatus* recorded in the catch sampled during the present investigation which had 19.0 cm total body length is less than two years old.

Van zalinge (1980) reported that *penaeus semisulcatus* in the Gulf area in common with the other shrimp species, has a short life cycle. Due to the high rate of fishing mortality, relatively few shrimp survive to participate in the spawning around the time of their birthday.

The spawning season of *Panaeus semisulcatus* in the Gulf region has been reported in Bahrain from December to March (FAO 1978), in Saudi Arabia from October to April (Price & Jones 1975), from December to May (Price 1979), in Kuwait, from January to May (Enomoto 1971), from March to Aprile (Al-Attar & Ikenoue 1974) and from January to April (Mohamed et al., 1980).

On the other hand, it has been noted by other authors that *Penaeus semisulcatus* is a multi spawner. Badawi (1975) reported that this shrimp species spawn five times during its life times. A report by FAO (1982) reviewing the available date regarding the spawning of *Penaeus semisulcatus*, indicates that the reproduction seasonal patterns were in broad agreement along the west coast of the Gulf and there are also two reproduction peaks one in Spring and the second in Autumn, with varibale relative importance from one year to another.

Since it have been shown in the present study that the length frequency distribution of *Penaeus semisulcatus* contains two separate size groups, it can be concluded that the members of these two groups were recruited from two reproduction periods. It can therefore be suggested that the larger size group has been spawned in October / November 1982, and the smaller size group has been spawned in March / April 1983.

This suggestion may lead to the confirmation of the proposal that *Penaeus semisulcatus* has two repoduction peaks in Spring and Autumn.

It can also be concluded that *Penaeus semisulcatus* grow to 8.6 cm total body length within the first six months of its life, namely from March/April to October. Those spawned in the previous Autumn grows to 14.3 cm total body length after one year of it life.

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