

## Some Biological Aspects of *Parapenaeus longirostris* (Lucas, 1846) (Crustacea, Decapoda) Inhabiting the Sea of Marmara

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**Abstract:** In this study, carried out between November 2000 and October 2001, the annual spawning period, first maturity length, length frequency distribution and length/weight relationship of *Parapenaeus longirostris* that inhabit most commonly the Sea of Marmara were investigated.

Analysis of the data obtained from this study revealed that although the mature individuals with fully developed eggs were found almost every month throughout the year, the highest gonadosomatic index values were obtained in September, October, December, April and May. The total length at which 50% of the population reaches maturity is calculated to be 9.7 cm. Among the individuals caught, females at 10-11 cm and males at 9-10 cm formed the dominant size groups.

**Key Words:** *Parapenaeus longirostris*, spawning period, sexual maturity, length/weight relationship.

### Marmara Denizi'nde Bulunan *Parapenaeus longirostris* (Lucas, 1846) (Crustacea, Decapoda)'in Bazı Biyolojik Özellikleri

**Özet:** Kasım 2000 – Ekim 2001 tarihleri arasında yürütülen bu çalışmada, Türkiye denizleri içerisinde en yaygın olarak Marmara Denizi'nde bulunan *Parapenaeus longirostris*'in yıl boyu üreme dönemi, ilk eşeyssel olgunluk boyu, her eşey için boy frekans dağılımı ve boy/ağırlık ilişkisi araştırılmıştır.

Yapılan çalışmalardan elde edilen bulguların değerlendirilmesi sonucunda; bu türün yılın hemen her ayında yumurtası olgun ve çok olgun dişi bireylerine rastlanılmış olmakla birlikte, gonadosomatik indeks değerlerinin en yüksek olduğu aylar sırası ile Eylül, Ekim, Aralık, Nisan ve Mayıs olarak bulunmuş, popülasyondaki bireylerin % 50'sinin eşeyssel olgunluğa ulaştığı total boy (TB) 9,7 cm olarak hesaplanmıştır. Yakalanan bireyler içerisinde en çoğunu dişilerde 10 ve 11 cm, erkeklerde ise 9 ve 10 cm'lik boy grupları oluşturmuştur.

**Anahtar Sözcükler:** *Parapenaeus longirostris*, üreme dönemi, eşeyssel olgunluk, boy/ağırlık ilişkisi.

### Introduction

Almost all of the shrimp production in Turkey is obtained through fishing. Ten of the shrimp species that are caught (*Penaeus semisulcatus*, *Melicertus kerathurus*, *Marsupenaeus japonicus*, *Parapenaeus longirostris*, *Metapenaeus monoceros*, *M. stebbingi*, *Trachypenaeus curvirostris*, *Melicertus hathor*, *Aristaeomorpha foliacea*, *Plesionika heterocarpus*) have commercial value (1).

With its total shrimp catch amounting to 2357 tons in 2001, the Sea of Marmara takes the first rank among Turkish seas with a shrimp production of 3000 tons

overall (2). It is also assumed that the present figure from the Sea of Marmara underestimates the actual catch. Compared to other Turkish seas, the shrimp species *Parapenaeus longirostris* dominates the catch in the Sea of Marmara, indicating a high potential in Turkey's total shrimp production.

Studies on shrimps in Turkish seas are scarce. Among these, only three studies (1,3,4) are concerned with their biology and the rest about their systematics and ecology.

As observed in other aquatic animals, in order to protect shrimp stocks from being depleted besides the

controlled and sustainable exploitation of the natural stocks, development of fishing methods, systematics and ecology as well as spawning behavior of the shrimps are of prime importance and should be studied in detail.

Knowing specific regional spawning periods, length and weight at spawning period, migration routes during spawning, initial maturity size and length frequency distributions of shrimps will guide much in monitoring the species, time, region and fishing methods to be employed in shrimp fishery and hence enable a rational exploitation of the stocks.

**Materials and Methods**

Female and male specimens of the shrimp species *P. longirostris* constituted the main materials in this investigation carried out over a period of one year between November 2000 and October 2001. Materials were collected on a boat (21 m long and powered with a 190 HP engine) using a beam trawl net with a beam length of 3.5 m and a mesh body (net) of 6.3 m.

Trawlings were carried out in the south and southeastern Sea of Marmara at depths of 42-86 m (27° 53' 00" – 28° 27' 00" E; 40° 38' 00" – 40° 25' 00" N) using echo-sounders. Samples were always collected between the 10<sup>th</sup> and 20<sup>th</sup> day of each month to assure consistency in sampling intervals.

Total length of specimens caught were measured using rulers from the tip of the rostrum to the end of the telson in mm and weighed to the nearest 0.01 g; gonad weights were measured to three decimal places using a fine scale.

In order to determine spawning periods, the gonadosomatic index was calculated [ $GSI = GA/(VA-GA) \times 100$ ] and for this length, weight and gonad weight measurements were performed every month on 50 female specimens taken randomly from each catch. Stage and color of gonads were also noted. To calculate first maturity size, the size group in which the ratio of mature individuals to immature ones reaches 50% was utilized (5).

**Results**

**Length Frequency Distribution**

A total of 6585 individuals composed of 4100 females and 2485 males were analyzed throughout the

research period. The length-frequency distribution diagrams for female, male and for overall specimens are given in Figure 1.

As clearly illustrated in Figure 1A, the size of the female individuals range between 1 and 16 cm and the 10 and 11 cm size groups dominate the catch. Length-frequency distribution of males (Figure 1B) reveal that the size range between 1 and 14 cm and 9 and 10 cm size groups are caught more intensively in the catch. An overall look at the length-frequency distribution of the pooled data (Figure 1C) clearly demonstrates the presence of a normal length distribution within the community with a dominant size group of 10 cm.

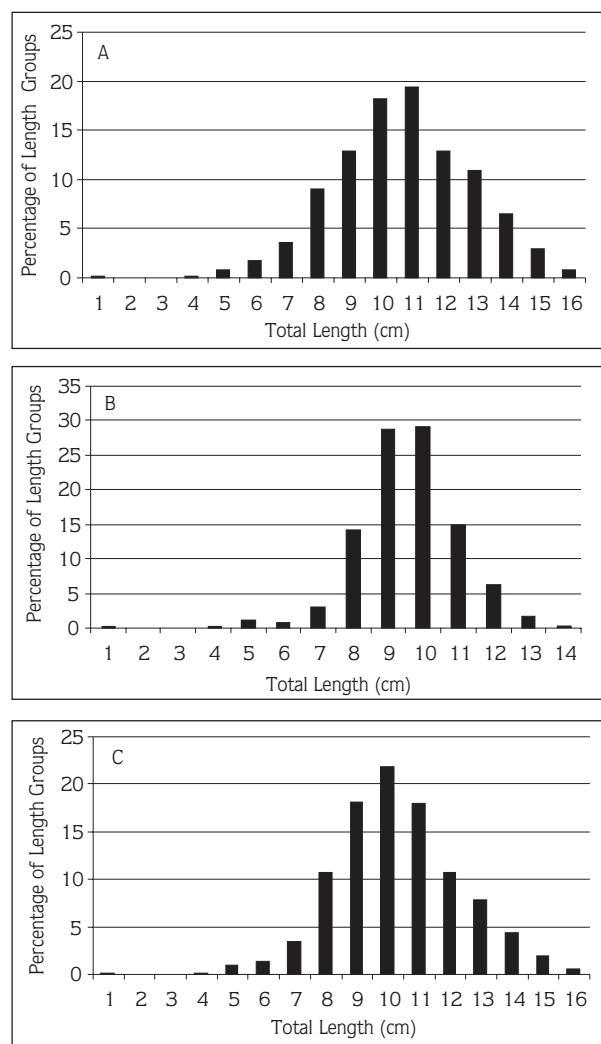


Figure 1. A: Total length distribution of females (n = 4100), B: total length distribution of males (n = 2485) and C: total length distribution of pooled data (n = 6585).

### Length-Weight Relationship

The length-weight relationship equations for male, female and all individuals of *P. longirostris* were calculated and are given in Figure 2. By looking at length-weight relationship constants one can conclude that against the negative allometry observed in males, positive allometric growth is true for females. In the case of pooled data, positive allometry as in females is observed.

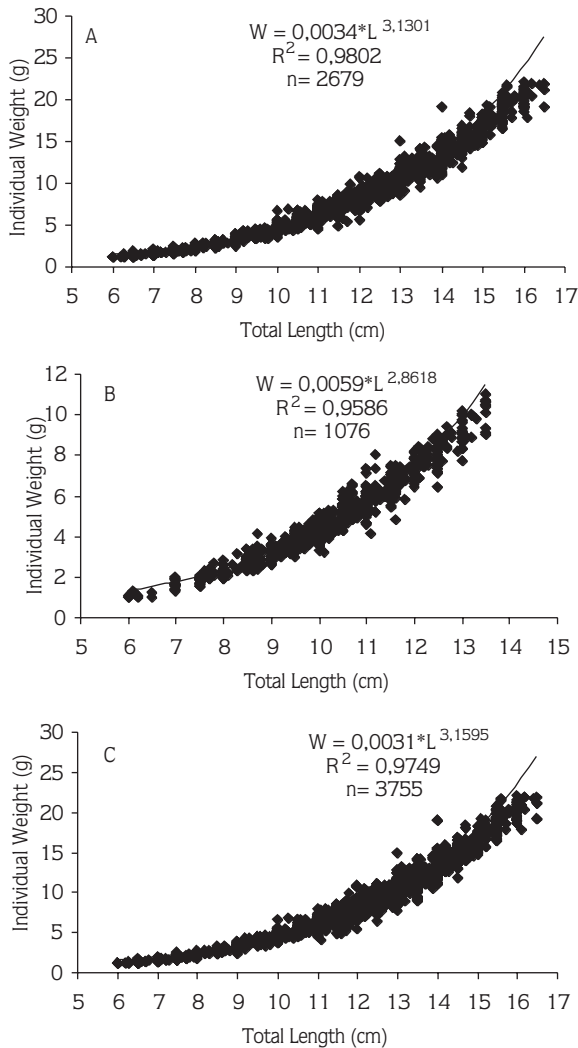


Figure 2. A: Length-weight relationship of females, B: Length-weight relationship of males and C: Length-weight relationship of pooled data.

### Spawning Period

In order to determine spawning periods, 50 female specimens were taken randomly from the catch every month. A total of 600 female specimens were measured for their gonad weights to calculate condition factor and

gonadosomatic index values. Further, utilizing the data, the monthly mean condition factor and gonadosomatic index values were calculated as shown in Figure 3.

As clearly seen in Figure 3, the highest gonadosomatic index values were obtained in December, and April-May and September-October. Apart from this, mature female individuals, all at different stages of maturity, were found almost every month throughout the year. Having caught mature female individuals throughout the year and considering the fluctuations in gonadosomatic index values we can clearly suggest that this species spawns throughout the year. Furthermore, the negative relationship between the gonadosomatic index value and the condition factor is most pronounced during the period of most intense spawning (September-October).

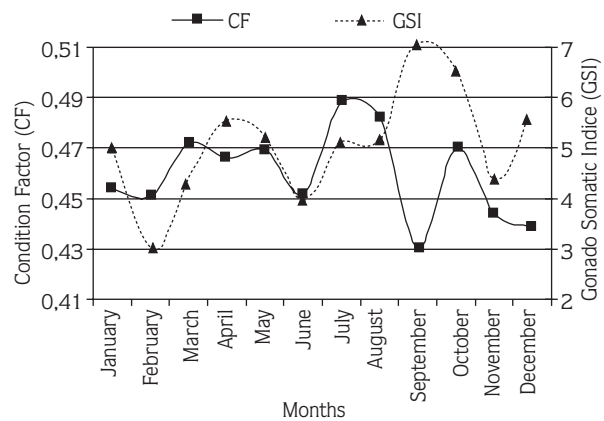


Figure 3. Monthly changes of condition factors and gonadosomatic index.

### Total Length at First Maturity

In order to determine the size at first maturity, the size group in which the ratio of mature to immature female individuals reaches 50% is taken into account as shown in Figure 4. Based on this, the initial size at first maturity for female individuals of this species was calculated to be 9.7 cm as a result of measurements performed over 2508 female individuals in total.

### Discussion

The sizes of male and female individuals of *P. longirostris* that commonly inhabit the Sea of Marmara were 1-14 and 1-16 cm respectively, based on specimens caught throughout the year. The maximum size for this species has been given as 14 cm (1), and in another study the maximum sizes for males and females were reported

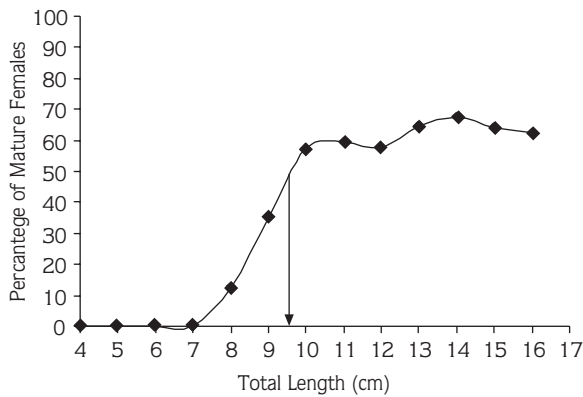


Figure 4. Relationship between percentage of mature females and total length.

as 16 and 19 cm, respectively (6). On the other hand, in a study conducted in the Sea of Marmara, the maximum size for this species was given as 16.1 cm and the average sizes for males and females were calculated to be 10-11 cm and 12-13 cm, respectively (7). A related study also reported a maximum size of 16 cm for males and 18 cm for females as well as the information regarding the increase in average size at depths beyond 200 m (8). Although we did not have the opportunity to collect samples at or below 200 m depth, these figures indicate that the females reach a much greater size and weigh more than males and the maximum sizes given for males and females more or less lie in the same order of magnitude for each sex. Among 2508 females analyzed, although 45 fully mature individuals in the 8.5-9.0 cm size group with highly developed eggs were caught, the 9.7 cm size group has been selected as the initial size at first maturity at which the ratio of mature to immature

female individuals reaches 50%. This size is in good agreement with the 9.2 cm size that has been reported earlier (1) for the same species. At this stage, determination of the appropriate mesh sizes that capture greater sizes are most important for a rational utilization of the shrimp stocks. Although the highest gonadosomatic index values were obtained in September, October, December, April and May, mature female individuals of *P. longirostris* with mature eggs were present throughout the year. Except February, relatively high gonadosomatic index values found for the rest of the months as well as the year-round presence of juveniles also support our conclusion that spawning occurs continually throughout the year. On the other hand, in a similar study, the presence of mature females with fully developed gonads throughout the year as well as the highest gonadosomatic index values for November, December and February have been reported (1). Parallel to this, the highest numerical percentage distribution of mature female specimens with fully mature eggs was obtained in September, December and January in this study. Smallest size groups for both sexes together were found in March, April and May. It could be concluded that the mature females of *P. longirostris* with developed eggs were present throughout the year and the most intensive spawning takes place during December and the period following September-October and April-May.

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#### References

1. Bayhan, K., Ünlüer, T., Özdöl M.: An Investigation on Determination of Reproduction Season of Economically Important Penaeid Shrimps of the Northeastern Mediterranean. XII National Fisheries Symposium., Elazığ, 2-5 September 2003; (in Turkish).
2. Fisheries Statistics.: State Institute of Statistics, Prime Ministry, Republic of Turkey, Publication Number: 2736, Ankara, January 2003; 9.
3. Kumlu, M., Başusta, N., Aşar, D., Eroldoğan, T.: Some biological aspects of penaeid shrimps inhabiting Yumurталık bight in İskenderun bay (North-Eastern Mediterranean). Turk. J. Zool., 1999; 23: 53-59.
4. Aktaş, M., Kumlu, M.: Gonadal maturation and spawning of *Penaeus semisulcatus* (Penaeidae: Decapoda). Tr. J. of Zoology, 1999; 23: 61-66.
5. Aşar, D.: Fisheries Biology and Population Dynamics, 5th Edition, Adana, 1998; 98-100 (in Turkish).
6. Kocataş, A., Katağan, T., Uçal, O., Benli, H.A.: Shrimps of Turkey and shrimp culture. Ministry of Agriculture and Rural Affairs. No. 4, Bodrum, 1991; 24-25 (in Turkish).
7. Balkıs, H.: Shrimps in The Sea of Marmara. University of İstanbul, Journal of Biology, 1998-99; 61: 121-145.
8. Anonymous.: Survey Report on the Demersal Fish Stocks of the Sea of Marmara, Aegean and the Mediterranean. Ministry of Agriculture and Rural Affairs and Japan International Cooperation Agency (JICA), November 1993; 365-370 (in Turkish).