Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 5, No. 2, p. 208-214, 2014
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Biology of the deepwater rose shrimp *Parapenaeus longirostris* (Lucas, 1846) from the Oranian coast of Western Mediterranean)

Ikram Benkabouche Bekadja[1*], Salim Mouffok[1], Zitouni Boutiba[1]

[1]*Laboratoire Réseau de Surveillance Environnementale, Département de Biologie Faculté SNV, Université d'Oran BP 1524 El Mnaouer, Oran, Algeria*

[2]*Université des Sciences et de la Technologie d'Oran Mohamed Boudiaf USTO Bp 1505 ElMnaouer, Oran, Algeria*

Article published on August 09, 2014

Key words: *Parapenaeus longirostris,* shrimps, Oran, Biology, Reproduction, parameters of growth.

Abstract

The Crustaceans have an important place thanks to their value bargains (market).Owing to the strong demand on the world market of the Crustacean Décapodes, the fishing of this resource doesn't stop developing, with a present production considered about a million of tons per year. Among of them, the shrimps are found very exploited by their abundance, as well as their high nutritious value and the exceptional gastronomic quality of their fleshThe objective of this work is therefore, on the one hand, to suggest a maximum of ecological and biological informations on *Parapenaeus longirostris* (Lucas, 1846), on the other hand, to determine the age according to the size and the weight; the reproduction and swaping period, as well as the parameters of growth in order to contribute to the improvement and especially to the planning of this shrimps fishing in oran area.

***Corresponding Author:** Ikram.Benkabouche Bekadja ✉ ikram-ben@hotmail.com

Introduction

The rose shrimp *Parapenaeus longirostris* (Lucas,1846) is one of the three species included in this genus, which inhabits the Atlantic Ocean (Pérez-Farfante and Kensley, 1997). It has a wide geographic distribution, from the eastern Atlantic north of Spain (Olaso, 1990) to the southern waters of Angola Crosnier, De Bondy and Lefevere, 1968), as well as in the Mediterranean and its adjacent seas (Thyrrenian, Adriatic, Aegean, and the Sea of Marmara) (Karlovac, 1949; Maurin, 1960; Massutí, 1963, Audouin, 1965).

The bathymetric range of the rose shrimp in the Mediterranean described by different authors is between 40-500 m (Audouin, 1965), 20-750 m (Tom, Gorem and Ovadia, 1988), 100-500 m (Ardizzone *et al.*, 1990).

In spite of the fact that this species has a high economic value, research on its reproductive aspects in the Mediterranean scarce. In the Mediterranean Sea, *P. longirostris* is caught by trawl and is the most important Crustacean resource along the coasts of Spain, France, Italy, Algeria, Tunisia and Turkey (Sobrino *et al.,* 2005). FAO catches and landings statistics from 1972 to 1991 indicate that the deep water rose shrimp is the fifth species in order of biomass importance among crustaceans landed in the whole Mediterranean area (Stamatopoulos, 1993). The total catch reported for this species to FAO in 2009 was 20.924 t, while the total catch ten years before (1999) was 17.778 t. (FAO, http://www.fao.org/fishery/en).

The main objective of the present paper is to describe the some aspects related to this species, reproduction and growth in oranian coast (Western Mediterranean).

Materials and methods

The information used to elaborate the present study originates from monthly sampling (stratified by commercial categories) of the commercial landings in the ports of Oran (Algéria).

The methods applied and the parameters measured were the following: Cephalothorax length (CL), taken from the ocular orbit to the posterior margin of the cephalothorax (0.1 mm); sex; weight (0.1 g); and the maturity stage, according to the following scale:

• Females: A four-stage maturity scale based on the macroscopic observation of the gonad (size and colouring) has been applied (Sobrino, 1998).

This scale was validated by visualizing through macroscopic observation the gonads of specimens from sizes ranging between 13.2 and 37.2 mm. The gonad samples were extracted from three different levels (cephalic lobe, abdominal lobe to the level of the first segment and the abdominal lobe to the level of the fifth segment).

Sex ratio

Sex ratio was examined using χ^2 (Chi-square) test with a probability level of 0.05 to test differences in relation to the expected ratio 1:1. The gonadosomatic index (GSI) was estimated as: GSI = Wg / Wt x 100. To estimate size at first sexual maturity, the data were fitted in equation: $P = 1/(1+e^{(a}bxL))$; where P is probability that individuals are sexually matured and L is their length. The length when 50% of analysed individuals were mature was calculated according to Sparre and Venema (1998): L50%=a/b.

Value of the reduced distance

The value of the reduced distance (Schwartz, 1983) was also estimated; it is a homogeneity test which compares the average sizes of males and females, in case of large samples, by the following equation:

$$\varepsilon = \frac{\left|\overline{X}_1 - \overline{X}_2\right|}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

Gonadic index

Finally, to monitor morphological variations, the condition index was calculated to assess the degree of overweight consecutive to genital development and repletion state of the target species. Condition factor was studied in females in order to show differences of Kn (Le Cren, 1951) related to time, according to the formula: Kn = W/Wth with Wth = aL^b where "W" is the total weight, "Wth" is the theoretical weight, "a" and "b" are coefficients of the relative growth between weight and length and "L" is total length.

Growth

Basic principle of the growth equation of Von Bertalanffy.

There are several mathematical models to express the growth in Gadidae. A detailed review was made by Beverton and Holt (1957), Ursin (1967), Gulland (1983), and Pauly and Moreau (1997). The most popular model is Von Bertalanffy (1938) growth equation: Lt = L∞ [1-e-k (t-to)].

ELEFAN method (electronic length frenquency analysis).

In this study, we used a numerical method, the method ELEFAN (Pauly and Moreau, 1997). For mathematical modeling, the LFDA software (Kirkwood *et al.*, 2001) was used. Analyses were made for males and females, separately.

Results

In the rose shrimp catches from the commercial trawl fishery, females clearly predominated over males (61.25 and 38.75%, respectively; χ^2-test, P<0.001). Their monthly length frequency distribution by sex (Fig. 1a and 1b) showed a clear predominance of females from February to December. The length range of females specimens between 11 and 37 mm CL predominating.

Ripening gonads of females were mostly found from May to September (Fig. 2a), although some were also found in April and October. The GSI of females also showed a clear peak between May and June (Fig. 2b), while their K_n was at a minimum from May (Fig. 2c). Female L_{50} were estimated at 21 mm CL, respectively (Fig. 3).

The results of the length-weight relationship by sex showed similar values of b for females and males, both <3 (Table 2). By contrast, the Von Bertalanffy growth function gave high differences by sex (Table 1), with values of L_∞ and k for females higher than for males. The Φ for females was also higher than for males.

Table 1. Résults of growth paramèters VBGF for males and females to *P.longirostris* (Lucas, 1846).

Sex	**Females**				**Mâles**			
Parameters	K	L∞	to	Ø'	K	L∞	to	Ø'
Résults	0.54	44.48	-0.41	3.02	0.68	34.03	-0.31	2.89

Table 2. Parameters a, b et r^2 of leight weight relationship.

$W = a\,L^b$.

Sex	**Females**			**Mâles**		
Parameter	a	b	r^2	a	b	r^2
total	0,002	2,6062	0,8933	0,005	2,3076	0,8922

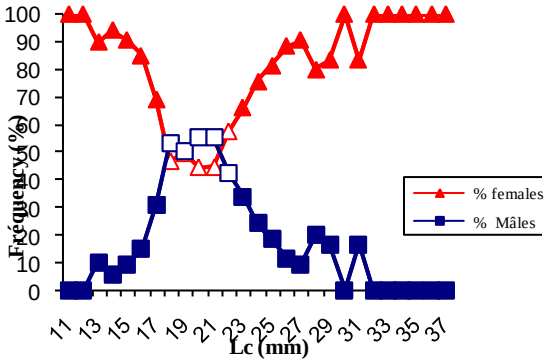

Fig. 1a. Sex-ratio of rose shrimp caught in the commercial trawl fishery by: a) length; b) month. The results of the χ^2-test are also shown (black symbols: $p<0.01$; white symbols: $p>0.05$).

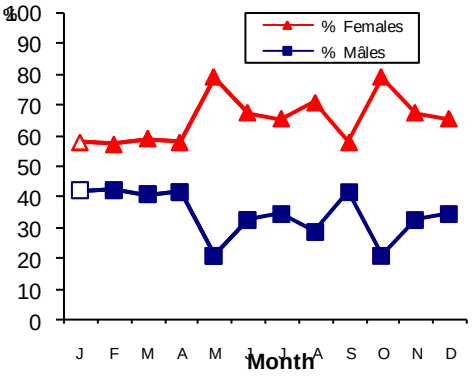

Fig. 1b. Sex-ratio of rose shrimp caught in the commercial trawl fishery by: a) length; b) month. The results of the χ^2-test are also shown (black symbols: $p<0.01$; white symbols: $p>0.05$).

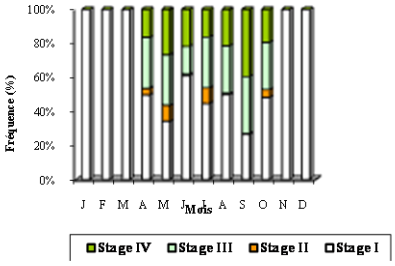

Fig. 2a.- Monthly values of red shrimp for: a) percentage of each maturity stage for females; b) mean gonadosomatic index (GSI) for females; c) mean Lecren index (K_n) for females. Error bars represent the standard error.

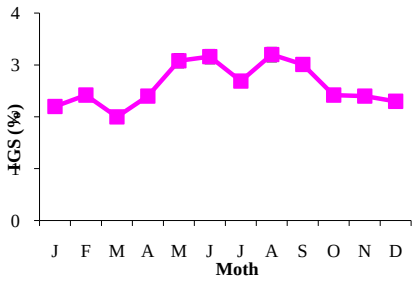

Fig. 2b. Monthly values of red shrimp for: a) percentage of each maturity stage for females; b) mean gonadosomatic index (GSI) for females; c) mean Lecren index (K_n) for females. Error bars represent the standard error.

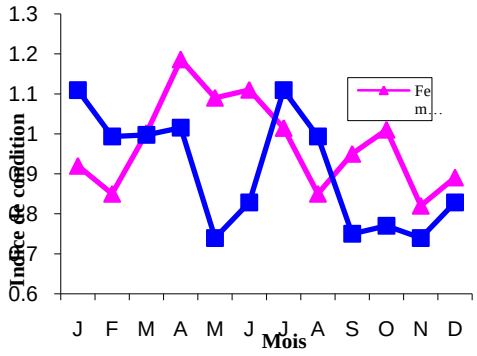

Fig. 2c. Monthly values of red shrimp for: a) percentage of each maturity stage for females; b) mean gonadosomatic index (GSI) for females; c) mean Lecren index (K_n) for females. Error bars represent the standard error.

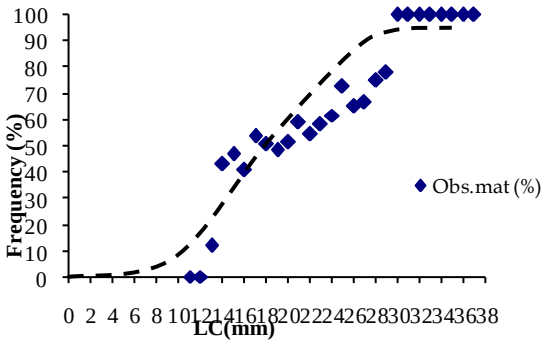

Fig. 3. Observed and theoretical values of rose shrimp percentage for mature females by size.

Discussion

The analysis of the mature condition of the ovaries, as an index of the spawning activity and a tool to estimate the size at on set of sexual maturity, is a common procedure in the stock assessment of commercial Penaeoid shrimp, which do not incubate eggs and shed their fertilized gametes directly in to the water. The maturity condition of shrimps is assigned macroscopically; looking at the fresh color and morphological appearance of the ovary, there is a general consensus in using no more than four stages, including the 'spent' condition for the blue-and-red shrimp *Aristeus antennatus*.

IGS, Kn, and the macroscopic development in the color and shape of the ovaries of the shrimp from oranian coast is in agreement with the general pattern described for other Mediterranean (Heldt,1938; Nouar, 1985; De Ranieri *et al.*,1986; TOM *et al.* 1987; De Ranieri *et al.*, 1998) and Atlantic (Crosnier *et al.*,1970; Sobrino and Garcia, 1994; Sobrino *et al.*, 2005; Garcia-Rodriguez *et al.*,2009).

Levi *et al.* (1995) observed mature females and juveniles throughout the year: the beginning of the peak reproductive phase in spring (whitish ovaries), with development in summer (gonads cream-orange) and autumn (gonads light-green), and full maturity (dark-green ovaries) reached between autumn and winter (but by late summer on the Tunisian side.

The parameters of the size-weight relationship estimated in the present study in both areas amplify the concept of the presence of such an allometry in the relative growth of this decapod crustacean in the whole Mediterranean Sea. Females were more robust than males in both areas and the estimated values of the coefficient b in Greek males and females *P. longirostris* were similar to those found in other Mediterranean areas, such as the Gulf of Alicante (García-Rodríguez *et al.,* 2009), higher to those found off South Portugal (Arrobas and Ribeiro-Cascalho, 1982) and lower than those in the Sea of Marmara (Bayhan *et al.,* 2005). Both b values estimated for the males and females from South Adriatic Sea were unexpectedly similar to those found in other areas, such as the south Portuguese coast (Arrobas and Ribeiro-Cascalho, 1982).

In general, the examined aspects of the population dynamics and biology of rose shrimp in Algerian waters have shown the same pattern as in other areas of the western Mediterranean (Bayhan *et al.,* 2005; García-Rondríguez *et al.,* 2009).

The Von Bertalanffy growth parameters differ greatly between sexes, with higher values of L_∞, k and Φ for females than for males. This same pattern has also been observed by the previously mentioned authors, but with lower values of k, especially for females. In any case, the estimated growth parameters in Algerian waters are in agreement with the slow growth and long life span (up to 8-9 years) considered for rose shrimp in the Mediterranean.

In conclusion, the results of the current study suggest that several characteristics describing the life cycle and certain biological aspects of red shrimp in Algerian waters do not differ significantly from other Mediterranean areas. Therefore, following the recommendations by Lleonart and Maynou (2003) for the Mediterranean fisheries, a permanent data collection system, as well as regular monitoring of the fishery and the exploited ecosystems, should be conducted in order to validate the results of the present study and to provide a continuous multi-species approach to assessment of the stock and its exploitation. Moreover, an adaptive and precautionary fishery management system is needed, which should establish close relationships between data gathering, assessment and management, and between administrators, fishermen and scientists.

References

Pérez-Farfante I, Kensley B. 1997. Penaeoid and Sergestoid shrimp and prawns of the wold. Key and diagnose for the families and genera. Memoires. Museum National d'Histoire Naturelle **175**, 1-233.

Olaso I. 1990. Distribución y abundancia del megabento invertebrado en fondos de la plataforma Cantábrica. Publicaciones Especiales. Instituto Español Oceanografía **5,** 1-128.

Crosnier A , E. de Bondy , Lefevere S. 1968. Les crevettes commercialisables de la côte ouest de l'Afrique inter-tropicale. Etat de nos connaissances sur leur biologie et leur pêche en juillet 1967. Collection Initiations Documentations Techniques. ORSTOM **7**, 60 pp.

Karlovac O. 1949. Le *Parapenaeus longirostris* (H. Lucas) de la haute Adriatique. Acta Adriatica, **3(12)**, 407-418.

Massutí M. 1963. La pêche des Crustacés aux Baleares (Méditerrannée occidentale) et dans l'Atlantique sud (Golfe de Cadix). Débats et Documents Techniques. Conseil General des Pêches pour la Meditérranee **7 (14)**, 191-202

Maurin C. 1960. Les crevettes profondes du littoral français de la Méditerranée. Répartition selon la profondeur.Notes biométriques. Commission Internationale pour l'Exploration Scientifique de la Mer Mediterranee. Rapports et Proces-Verbaux des Reunions **15,** 147-154.

Audouin J. 1965. Répartition bathymétrique des crevettes sur les côtes algériennes entre les îles Zaffarines et les îles Habibats. Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée, **18**, 171-174.

Ardizzone G D, Gravina MF, Belluscio A, Schintu P. 1990. Depth-size distribution pattern of *Parapenaeus longirostris* (Lucas, 1846) (Decapoda) in the Central Mediterranean Sea. Journal of Crustacean Biology **10 (1),** 139-147.

Sobrino I. 1998. Biología y pesca de la gamba blanca (*Parapenaeus longirostris*, Lucas 1846) en el Atlántico nororiental. Ph.D. thesis. University of Sevilla. Sevilla, Spain: 218 pp.

Le Cren ED. 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perh (Perca fluviatilis). Journal of Animal Ecology **20 (2),** 201-219.

Schwartz D. 1983. Méthodes statistiques à l'usage des médecins et des biologistes. Flammarion Ed, 3éme Ed, 7éme tirage : 318 p.

Beverton RJH, Holt SJ. 1957. On the dynamics of exploited fish populations. Fisheries. Investigator. Series. II, 19. 533 p.

Ursin E. 1967. A mathematical model of some aspects of fish growth, respiration and mortality. Journal of Fisheries. Board of Canadian, **13,** 2355-2454

Gulland. 1983.Fish stock assessment. A manual of basic methods. Ed. John Wiley and Sons/FAO Series on Food and Agriculture, Vol.1. 223 p.

Pauly D, Moreau J. 1997. Méthodes pour l'évaluation des ressources halieutiques. Collection POLYTECH de l'I.N.P. de Toulouse, Cépaduès-Editions, France. 288p

Kirkwood GP, Aukland R, Zara SJ. 2001. Length Frequency Distribution Analysis (LFDA), Version 5.0. MRAG Ltd., London, UK.

Heldt JH. 1938. La reproduction chez les crustacés décapodes de la famille des pénéides. Annales de l'Institut Oceanographique. Fundation Albert I. Musée Oceanographique Monaco **18,** 31-206.

Nouar A. 1985. Contribution à l'étude de la crevette peneidé *parapenaeus longirostris* (LUCAS, 1846) dans la région d'Alger : Ecologie, biologie et exploitation. Thèse de magistère en océanographie. Université.des

Sciences.Technologiques.Houari.Boumedienne Algérie : 136 p.

Tom M, Goren M, Ovadia M. 1988. The benthic phase of the life cycle of *Parapenaeus longirostris* (Crustacea, Decapoda, Penaeidae) along the Mediterranean coast of Israel. Hydrobiologia, **169**, 339-352.

De Ranieri S, Biagi F. Mori M. 1986. Note sulla biologia reprodutiva di *Parapenaeus longirostris* (Lucas) nel Tirreno settentrionale. Nova Thalassia **8**, 627-628.

De Ranieri S, Mori M, Sbrana M. 1998. Preliminary study on the reproductive biology of *Parapenaeus longirostris* (Lucas) off the northern Tyrrhenian Sea. Biol.Mar.Mediterranea **5 (1)**, 710-712.

Crosnier A, Fontana A, Le Guen JC, Wise JP. 1970. Ponte et croissance de la crevette Peneide *Parapenaeus longirostris* (Lucas) dans la region de Pointe-Noire (Republique du Congo). Cahiers ORSTOM. Serie Oceanographie **8**, 89-102.

Sobrino I. García T. 1994. Biology and fishery of the deepwater Rose shrimp, *Parapenaeus longirostris* (Lucas,1846) from the Atlantic Moroccan coast. Scientia Marina **58 (4),** 299-305.

Sobrino I, Silva C , Sbrana M , Kapiris K. 2005. Biology and fisheries of deep water rose shrimp (*Parapenaeus longirostris*) in European Atlantic and Mediterranean waters. Crustaceana, **78,** 10: 1153-1184.

García-Rodríguez M, Pérez Gil JL, Barcala E. 2009. Some biological aspects of *Parapenaeus longirostris* (Lucas, 1846) (Decapoda, Dendrobranchiata) in the gulf of Alicante (S.E. Spain). Crustaceana, **82(3)**, 293-310.

Levi D, Andreoli MG , Giusto RM. 1995. First assessment of the rose shrimp, *Parapenaeus longirostris*(Lucas, 1846) in the central Mediterranean. Fisheries Research **21,** 375-393.

Arrobas I, Ribeiro Cascalho A. 1982. Some aspects of the fishery and biology of & ^{2} off Portuguese coaStage ICES C.M. 1982/K: 5.

BayhanYK, Çiçek E, Ünlüer T, Akkaya M. 2006. Güney Doğu Marmara'da Algarna ile Karides Avcılığında Av Kompozisyonu ve Hedef Dışı Av. E.Ü.Su Ürünleri Dergisi **23**, 277-283.