J. Black Sea/Mediterranean Environment
Vol. 17(3): 275-281 (2011)

RESEARCH ARTICLE

Maturation, spawning and production of phyllosoma larvae of Mediterranean slipper lobster, *Scyllarides latus* (Latreille 1803) in captivity

Mevlüt Aktaş[1]*, Ercüment Genç[2], and M. Ayçe Genç[1]

[1]Departmen of Aquaculture, Faculty of Fisheries, Mustafa Kemal University, Iskenderun-Hatay, TURKEY
[2]Department of Fisheries and Aquaculture, Faculty of Agriculture, Ankara University, Dışkapı-Ankara, TURKEY

***Corresponding author**: maktas@mku.edu.tr or kapmevlut@yahoo.com

Abstract

This study reports the first successful spawning, egg hatching and production phyllosoma larvae of Mediterranean slipper lobster *Scyllarides latus* in a tank-based culture facility in hatchery conditions. The characteristics of the broodstock rearing system, the collection and handling, food and feeding, husbandry techniques, mating and spawning, hatching of eggs and survival of the phyllosoma larvae were examined.

Keywords: *Scyllarides latus*, broodstock, phyllosoma larvae, Eastern Mediterranean

Introduction

The Mediterranean slipper lobster *Scyllarides latus* Latreille, 1803 is a decapod crustacean. *S. latus* has a wide geographic distribution in the Mediterranean Sea and Eastern Atlantic from the coast of Portugal to Senegal, Madeira, the Azores, the Selvagens, and Cape Verde Islands (Maigret 1978; Martins 1985; Holthuis 1991; Spanier and Lavalli 1998; d'Udekem d'Acoz 1999; Stanley *et al.* 2009). Although it has the broad geographical distribution, it is reported that the *S. latus* is in regression almost everywhere and even locally extinct as a consequence of overfishing (d'Udekem d'Acoz 1999; Özcan 2007). *S. latus* is found mainly on hard substrates at depths of 4 to 100 m (Holthuis 1991), and nocturnally active and feeds mainly on bivalves (Spanier 1987).

Planktonic phyllosoma larvae of the Mediterranean slipper lobster, *S. latus* spends about 11 months offshore, before metamorphosing into a bentic form (Martins 1985). The high demand and delicious taste for the lobster has resulted in high commercial value (Spanier and Lavalli 2007). Adults are fished incidentally by gill net and traps in hard substrate areas along the coast of the Eastern Mediterranean of Turkey.

The complete larval development has been achieved under artificial conditions in various Scyllaridae species. Demirhindi (1960) studied the occurrence of the phyllosoma larvae in plankton from Turkish costal waters throughout the year and reported the breeding season, zonal distribution in relation to the temperature, salinity, etc. Demirhindi (1960) observed all stages phyllosoma of *Scyllarides artus*. Only a few stages are known for *Scyllarides latus* and there was no record on culture in captivity (Bianchini and Ragonese 2003). Thus, this study aimed to determine some reproductive characteristics such as moulting, mating, spawning and describe the morphology of phyllosoma stages during larval development from hatch to metamorphosis in tank conditions.

Materials and Methods

The study was undertaken at the Marine Research Station of the Faculty of Fisheries, Mustafa Kemal University in Kale, Iskenderun, Hatay. The broodstock were caught in Iskenderun Bay in the northeastern Mediterranean in June 2008 by gillnetting and trapping (36º17′29.98″N-35º47′4.40″E). The lobsters were stocked 1000 L capacity round fiberglass tanks (75 cm water depth, 1.2 m in diameter and no substrate at the bottom) from June 2008 to July 2009.

Two males (320±95 g mean live weight and 85±5 mm carapace length) and four females (625±155 g mean live weight and 110±8 mm carapace length) were selected and stocked into three tanks. Each tank was covered with thick black polyethylene to decrease natural light intensity and stress. All individuals were measured for carapace length (CL) from post-orbital margin to the posterior end of the mid-dorsal line of the carapace using vernier calipers and weighed to the nearest 1g by scales. The lobsters were fed twice daily on small frozen fish, mussel and squid flesh and shrimp pellets in the morning and in the late afternoon. Moulting and spawning were monitored regularly to determine mating, spermatophore mass, spawning season and hatching time. For this purpose, lobsters were marked by gluing plastic labels in different colors onto the carapace.

Salinity, temperature and dissolved oxygen (DO) levels were checked with digital salinometer and oxygen meter (YSI 30, USA) everyday regularly. Natural photoperiod and a fair aeration were maintained. Water changing rate was kept daily 100% throughout the study.

When berried females were seen in tank, eggs were sampled from the berried females to determine the hatching stages. Larvae specimens were taken from culture tank following the hatching. Microscope (CH40 Olympus, Japan) was prepared as a wet mount on a glass slide fitted with a cover slip to obtain some microphotographs for eggs and phyllosoma.

Results

The dissolved oxygen, salinity and pH levels of the water course of the study were measured as 6.0- 6.5 mg/l, 38-40 ppt and 8.02-8.20, respectively. Temperature level varied between 16- 31°C throughout the study.

There were no moulting throughout the study and it was possible to see males and newly mated females which were carrying spermatophore (Figures 1a, b). Following determination of the females, which were carrying spermathophore, eggs were spawned just after following the mating. Attached eggs were seen in the pleopods on the ventral surface of the females' abdomen (Figure 1c). Thereafter, the eggs were carried for 4-5 weeks. It was also observed that egg masses were kept for longer periods of time even if not fertilized. Water temperature was measured between 24 and 26°C when mating and spawning occurred in the spawning tank in June. While the lobsters did not molt during the study, some of them moulted in the second winter when the water temperature was as cold as 11-12°C in the tanks. Food was not consumed at day time. Frozen squid and mussel were the most consumed food items.

Four out of twelve lobsters spawned during the course of the experiment. Fertilization rate and fecundity could not be determined because of berried animals which were sensitive to handling that cause loss of almost all of their eggs when frequently manipulated. Phyllosoma larvae were taken from only one female's eggs (Figures 1d, 1e, 1f). The other females kept the eggs for longer periods, but the eggs did not hatch.

Following the spawning, eggs color in ova was seen initially light yellow. The colour turned slowly to yellow-orange and then dark orange just before hatching. Embryos passed several stages before becoming a viable naupliosoma larva. The dimensions of the eggs were measured 580 – 620 µm following the spawning. Egg diameter increased to about 840- 870 µm before hatching (Figure 1c). Eggs hatched at the end of the 1 month incubation period. Free-swimming naupliosoma larvae taken from this study died within 5 days after hatching in phyllosoma stages.

Discussion

Although still too limited for any conclusions to be drawn, the experiment nevertheless suggests ideas for controlling Mediterranean slipper lobster, *S. latus* reproduction more effectively.

For the first time, laboratory maturation, spawning, hatching and free-swimming naupliosoma/phyllosoma larval production were achieved for *S. latus* as this species hatching of eggs in captivity has not so far been known.

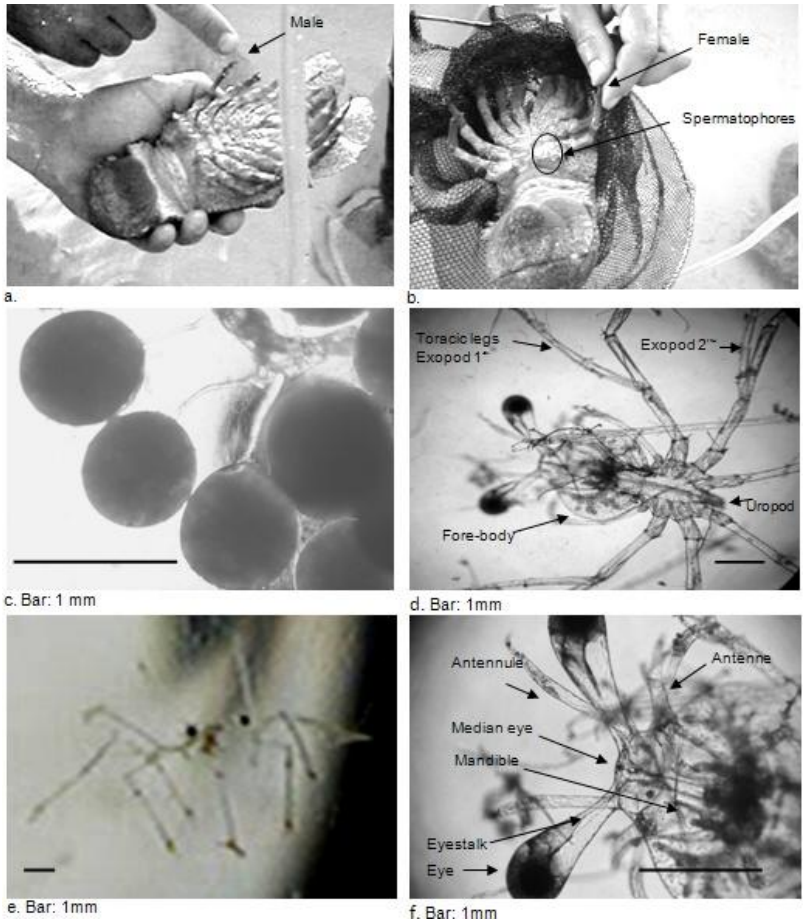

Figure 1. *Scyllarides latus* (Latreille, 1803) **a.** Male, **b.** Ovigerous Female (Reproduction Season: July-August), **c.** Fertilized eggs (620-870 µm), **d.** First phyllosoma stage of *S. latus*; the larvae fore-body is a slightly longer than the hind-body. The hind-body is much narrower than the fore-body. The first antenna is slightly longer than the second antenna. The second antenna consists of two segments. First maxilliped resembles of other scyllarid larvae and has no exopod at this stage. The first and second pereopods are consists setose exopods. Dactyls are short and in red color. The uropods are also seen. **e.** Frontal view. **f.** Dorsal view of the phyllosoma larvae.

Throughout the experiment, three of the spawning resulted in no hatching. It is reported that fertilization of the roe mass is often incomplete (Bianchini and Ragonese 2003; Spanier and Lavalli 2007). Although fertility rates were not determined in present study, many factors such as low water quality,

inappropriate photoperiod, insufficient quantity or quality of the feeds, or even genotype of the broodstock might be accounted for no hatching.

There was no moulting observed throughout the study. Some lobsters moulted in winter month. Spanier and Lavalli (2007) reported that *S. latus* moults in winter and spawns early summer in nature. Demirhindi (1960) reported that the breeding season of another Mediterranean slipper lobster species *Scyllarides artus*, which is a commercial species in the Eastern Mediterranean, is summer. The former and present investigations suggest that species of this genus spawns in early summer in the Eastern Mediterranean.

As a consequence of overfishing, this species may go extinct. This species is already in Annex 3 of the Barcelona Convention, the list of species whose exploitation is regulated under the protocol concerning specially protected areas and biological diversity in the Mediterranean Sea. Spawning, hatching and larval production of nauplisoma in current study would therefore play a very significant role in search and mass larval and post-larval production possibility of this species in the future. Besides, development of larval rearing technology and hatchery seed supply for such industry is an attractive longer term goal. In order to overcome the difficulty of rearing long-lived larvae, it may take some years.

Acknowledgement

This study was supported partly by Scientific and Technological Research Council of Turkey (TUBITAK) Number: 105 Y 259. Thanks to Cemal Turan for establishing Marine Research Station of the Faculty of Fisheries, Mustafa Kemal University in Kale, and Egemen Konaş, Nuran Çavdar for helping.

Büyük ayı istakozu *Scyllarides latus* (Latreille 1803)'nun yetiştiricilik koşullarında gonad gelişimi, yumurtlaması ve phyllosoma larva üretimi

Özet

Bu çalışmayla ilk defa yetiştiricilik koşullarında Büyük ayı istakozu *Scyllarides latus*'un gonad gelişimi, çiftleşmesi, yumurtlatılması ve larva üretimi bildirilmektedir. Çalışma, anaç stoğunun elde edilmesi, yetiştiricilik sisteminin özellikleri, anaçların yemlenmesi, kabuk değişimi, çiftleşme, yumurta ve phyllosoma larvalarının özellikleri hakkında bilgi vermektedir.

References

Bianchini, M.L., Ragonese, S. (2003) In ovo embryonic development of the Mediterranean slipper lobster *Scyllarides latus*. *The Lobster Newsletter* 16: 10-12.

Demirhindi, Ü. (1960) The distribution of *Scyllarus artus* L. (*Arctus ursus* HBST.) in Turkish waters. *Istanbul University, Faculty of Sciences Hidrobiology Pub. Seri B* Tome V Fasc. 1-2: 62-69.

Díaz, D., Goñi, R., Stobart, B., Reñones, O. Kurt-Kertsing, D. (2007) Post-settlement distribution of the European spiny lobster (*Palinurus elephas*) in the Northwestern Mediterranean. 8th International Conference & Workshop on Lobster Biology and Management, Charlottetown, Prince Edward Islands, Canada.

Holthuis, L.B. (1991) FAO Species Catalogue: Marine Lobsters of the World. An annotated and illustrated catalogue of species of interest to fisheries known to date. Food and Agriculture Organization, Rome. 125 pp.

Maigret, J. (1978) Contribution a l'etude des langoustes de la côté occidentale d'Afrique (Crustaces, Decapodes, Palinuridae) 5. Les larges phyllosomes de Scyllaridae et de Palinuridae recueillies au large de côtés du Sahara. *Bulletin de l'Institut Fondamental d'Afrique Noire* 40: 36-80.

Özcan, T. (2007) Distribution of the littoral decapod (Crustacea) species on the Mediterranean Sea coast of Turkey and their bioecological aspects. Ege Üniversity, Institute of Science, PhD Thesis, 328 p. (in Turkish).

Martins, H.R. (1985) Biological studies of the exploited stock of the Mediterranean locust lobster *Scyllarides latus* (Latreille, 1803) (Decapoda: Scyllaridae) in the Azores. *Journal of Crustacean Biology* 5(2): 294-305.

Spanier, E. (1987) Mollusca as food for the slipper lobster *Scyllarides latus* in the coastal waters of Israel. *Levantina* 68: 713-716.

Spanier, E., Lavalli, K.L. (1998) Natural history of *Scyllarides latus* (Crustacea: Decapoda): a review of the contemporary biological knowledge of the Mediterranean slipper lobster. *Journal of Natural History* 32(6): 1769-1786.

Spanier, E., Lavalli, K.L. (2007) Slipper lobster fisheries—present status and future perspectives. In: The Biology and Fisheries of Slipper Lobsters. Crustacean Issues 17. (eds., Lavalli K.L, Spanier E.) CRC Press Taylor & Francis Group, New York, 377-391 pp.

Stanley, T.F.L., Spanier, E., Meyer-Rochow, V.B. (2009) Anatomy and ultra structural organization of the eye of the Mediterranean slipper lobster, *Scyllarides latus*; Preliminary results. *New Zealand Journal of Marine and Freshwater Research* 43: 233-245.

Udekem d'Acoz, C.d. (1999) Inventaireet distribution des crustacés décapodes de 1'Atlantique north-oriental, de la Méditerranée et des eaux continentales adjacentes au nord de 250 N [Inventory and distribution of Crustacea Decapoda in the Northeastern Atlantic Ocean, the Mediterranean Sea and adjacent continental waters, north of 250 N]. Collection Patrimonies Naturels, 40; i-x+1-383. Service Patrimonies Natural, Museum National d'Histoire Naturelle, Paris.

Received: 10.09.2011
Accepted: 20.10.2011