

NOTES ON THE OCCURRENCE OF PRENAUPLIOSOMA LARVAE OF SPINY LOBSTERS IN THE PLANKTON

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ABSTRACT

Seventeen specimens of the controversial prenaupliosoma stage in the early larval development of the spiny lobster were captured in a plankton net 100 miles offshore in the Yucatan Straits. To the knowledge of the author, this is the first report of such a stage being found in a plankton.

INTRODUCTION

For a number of years, the role of the prenaupliosoma and naupliosoma stages in the early development of the spiny lobsters has caused a controversy among carcinologists working with the group. Gilchrist (1913) was the first to record one of these stages. During attempts to hatch and raise the larvae of the South African spiny lobster, *Jasus lalandii* (H. Milne Edwards), Gilchrist observed nauplius-like stages swimming among the first stage phyllosomas. They swam by means of setose biramous antennae and rose to the surface in a series of rapid dancing movements. On closer examination, he found that the larvae were not true nauplii, but the earliest free stage, which he named "naupliosoma." The duration of the stage was reported to be 4 to 6 hours, after which it molted into a first stage phyllosoma. In the summary, Gilchrist stated that the naupliosoma stage probably enables the young to ascend more rapidly and with more certainty to the surface than can the first phyllosoma stage which is more adapted to a horizontal mode of progress. Gilchrist (1916) again discussed the naupliosoma larvae in a paper on the larvae and post-larvae of *Jasus lalandii*, in which he confirms his earlier findings. Von Bonde (1936), also working with *Jasus lalandii*, showed that there is an earlier stage which he called a "prenaupliosoma." This stage lasted about 8 hours before molting into a naupliosoma. Sheard (1949) recorded a naupliosoma stage in *Panulirus longipes* (H. Milne Edwards) which was later found to be *P. cygnus* George. Feliciano (1956) and Baisre (1964) record the prenaupliosoma and naupliosoma stages in the scyllarid, *Ibacus ciliatus* (Von Siebold).

Crawford & DeSmidt (1922), Lebour (1950), Lewis (1951) and Sims (unpublished data), all working with *Panulirus argus*, found that the larvae hatch as first stage phyllosomas. Other authors generally say nothing about the prephyllosoma stages.

To my knowledge, this is the first report of prephyllosoma stages being found in the plankton.

¹Contribution No. 86.

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METHODS AND MATERIALS

Seventeen larvae of the prenaupliosoma stage were taken during a routine plankton sample on October 6, 1962. The sample, an oblique tow from 150 feet to the surface over a period of one-half hour, was taken at 9 p.m. at about 22°10' North latitude, 86°09' West longitude, where the water depth is over 3000 feet. A conical California type net with a diameter of one meter at the mouth and 5 meters in length was used. The main body of the net was constructed of No. 30 grit gauze nylon with a finer section of No. 56 grit gauze nylon at the cod end. The sample was taken as a part of the department's study on the possible Caribbean origin of Florida's spiny lobster population (*cf. Ingle et al.*, 1963). In the same sample, 18 phyllosomas of *Panulirus argus* all under 5.0 mm in length, and one unknown phyllosoma 2.2 mm long, were taken.

DESCRIPTION

The larva, which appears to be in the prenaupliosoma stage, is shown in Figure 1. A description of the larvae is as follows: eyes well developed, with definite eye spots, not stalked; with a prominent naupliar eye; antenna and antennule uniramous, with few terminal setae; mandibles well developed; maxilla a bud without setae; first maxilliped not present; second maxilliped well formed but unsegmented, ending in a small spine; third maxilliped segmented, with small exopod not bearing setae; pereopods 1 and 2 segmented, with exopods not bearing setae, but ending in a tuft of small spines, without coxal spines, ending in one or more short stout setae or bristles; pereopod 3 without exopod or coxal spine, ending in small bristles; pereopods 4 and 5 not formed; abdomen well developed, almost identical with stage one of *Panulirus argus*; average total length, measured from the frontal projection between the eyes to the tip of the abdomen, 1.3 mm.

DISCUSSION

The presence of an exopod on the third maxilliped and the lack of a biramous antenna indicate that the larvae belong to the genus *Panulirus*. The setose exopod on the third maxilliped and the uniramous antenna are prominent features in laboratory-hatched larvae of *Panulirus argus*. I

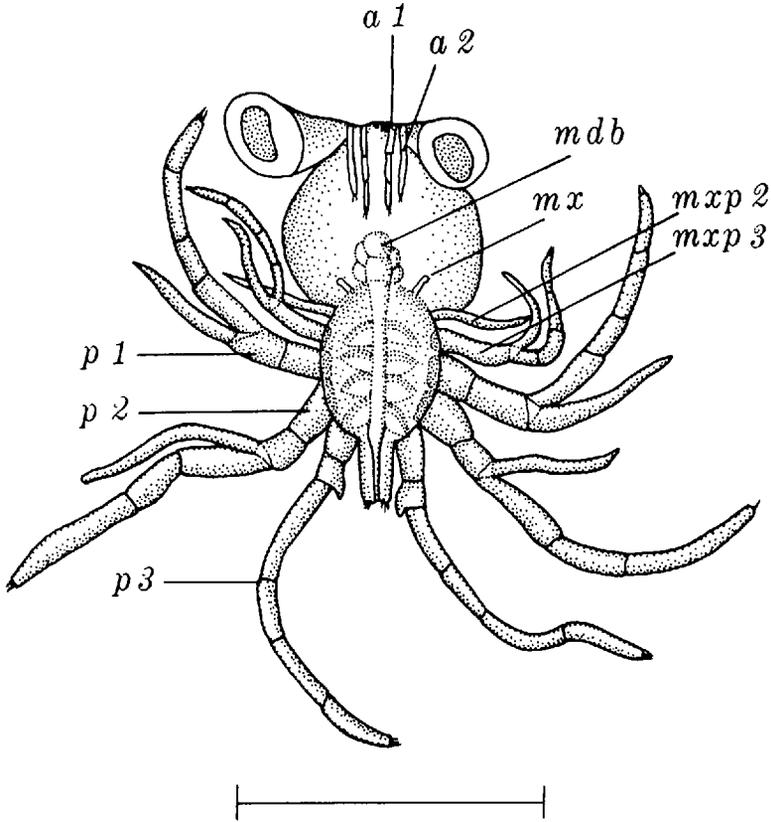


FIGURE 1. *Prenaupliosoma* from plankton sample. Scale represents 1.0 mm. (Lettering: *a 1*, antennule; *a 2*, antenna; *mdb*, mandible; *mx*, maxilla; *mxp 2*, second maxilliped; *mxp 3*, third maxilliped; *p 1*, *p 2*, *p 3*, first, second and third pereopods. Drawn by Barbara Stolen.)

assume that the larvae described here belong to the species *Panulirus argus* and are in the prenaupliosoma stage. However, a definite statement cannot be attempted until further observations are made on the newly hatched larvae of the many species of the Scyllaridae and Palinuridae.

This report of the finding of a prenaupliosoma stage in the plankton, 100 miles offshore, will no doubt add to the controversy over the role of this stage. The controversy is whether the naupliosomal stages are a normal part of the free life development of the spiny lobster or whether they are the result of premature rupture of the egg.

In my observation of the development of the eggs of *Panulirus argus* and *Scyllarus americanus* (Smith), I found that in *P. argus*, the eggs

normally hatched directly into the first phyllosoma stage. To date, I have been unable to hatch the eggs of *S. americanus* but have observed the following, which is also true of *P. argus*. A stage almost identical to the prenaupliosoma stage can be produced from eggs of late development by placing the eggs in sea water of a lower salinity. The osmotic transfer of water into the egg sometimes causes it to break open, and the embryo escapes. This larva is able to move around and in some cases is able to swim, but in no case have I been able to keep it alive until a molt. The point at which a lysed egg could produce an embryo capable of survival is no doubt critical.

I have observed that the female lobster tends her eggs with the dactyl of the fifth leg. With this modified appendage, she cleans the eggs and occasionally removes some of them. The eggs removed in this manner sink to the bottom and in no case have they hatched into normal first stage phyllosomas. I have, however, found what appear to be prenaupliosoma stages, dead or almost so, among eggs removed by the female.

In view of Gilchrist's observations that in one instance several naupliosomas molted and became phyllosomas, it seems reasonable to believe that naupliosomas released from the egg at a relatively advanced stage of development, could grow and become phyllosomas.

Feliciano (1956) reported finding prenaupliosoma stages in *Panulirus argus* but indicated that there was some doubt in his mind if it were a normal stage or one caused by the rupture of eggs. He said there is a need for further investigation to establish how it does occur. Lewis (1951) reported that *Panulirus argus* hatched as first stage phyllosomas, but that he could produce a condition more or less similar to the naupliosoma if he broke open the egg. Crawford & DeSmidt (1922) and Lebour (1950) reported that *Panulirus argus* hatched directly into first stage phyllosomas. Gilchrist (1916), Von Bonde (1936), Sheard (1949) and Harada (1958) reported the eggs of *Jasus lalandii*, *Panulirus cygnus* and *Ibacus ciliatus*, hatched as prenaupliosoma or naupliosoma stages. Perhaps this is the norm for certain species. Further investigation is needed to establish the role of the naupliosomal stages in the life history of the spiny lobsters.

SUMARIO

NOTAS SOBRE LA PRESENCIA EN EL PLANCTON DE LARVAS PRENAUPLIOSOMA DE LANGOSTAS

Diecisiete ejemplares de larvas prenaupliosoma fueron cogidas en una red de plancton en el Estrecho de Yucatán. La presencia en estas larvas de un exopodito en el tercer maxilípodo y antenas con una sola rama indican que pertenecen al género *Panulirus*. Larvas casi idénticas pueden ser inducidas a madurar prematuramente, colocando huevos de *P. argus*, en un estado avanzado de desarrollo, en agua de salinidad baja. Tales larvas son activas y capaces de nadar pero nunca han vivido lo suficiente

para mudar en el laboratorio. Es imposible establecer si las prenaupliosomas cogidas en el plancton eran larvas normales o resultado de una ruptura prematura de los huevos.

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