Notes on the Early Development of a Scyllarid Lobster, *Parribacus antarcticus* (Lund)

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Abstract

Early three stages of *Parribacus antarcticus*, a scyllarid lobster, are described. The newly hatched out larvae were reared in the laboratory. The larvae passed through several distinctly defined phyllosoma stages at first. Some notes on the first stage phyllosoma of other forms of the Scyllaridae and their developments are described.

Introduction

A scyllarid lobster, *Parribacus antarcticus* (Lund) is usually found in shore reef along the coast of southern Japan. Several species of lobsters belonging to the family Scyllaridae, *Parribacus antarcticus*, *Ibacus ciliatus*, *Ibacus incisus*, *Scyllarus cultrifer*, *Scyllarides sieboldi*, and *Scyllarides haani*, have been known to live in southern Japan coast, but to our regret, we lack information of those larval development. Only concerned with the phyllosomas of *Ibacus ciliatus*, the first stage, the last stage, and the early several stages of development are described by Tokioka (1954), Harada (1957), and Saisho & Nakahara (1960), respectively.

Its spawning season extends from late May to early August with its maximum activity in July. About ten berried females of *Parribacus antarcticus* were obtained in July 1962 at Ei-cho, Kagoshima Prefecture, and kept in the Sakurajima Aquarium. With some difficulty, the larvae of one of them were hatched out. The attempt to breed them by using brine shrimps as their food was interrupted by an incident at the third stage.

The present paper is a record of observations on the development of phyllosoma. The writer would like to take this opportunity of extending his sincerest thanks to Professor Saburo Murayama and Dr. Sadahiko Imai of Kagoshima University for many suggestions and valuable pieces of advice during the course of this study. Thanks are also due to Mr. Kantaro Nakahara of the Sakurajima Aquarium for the help given in obtaining the materials.

Table 1. The measurement of phyllosomas of *Parribacus antarcticus*.

	1st stage	2nd stage	3rd stage
Body length	1.59 mm (av.)	2.04 mm (av.)	2.65 mm (av.)
Length of fore-body	0.89 〃	1.25 〃	1.74 〃
Width of fore-body	0.76 〃	0.96 〃	1.30 〃
Abdomen length	0.31 〃	0.32 〃	0.38 〃
The number of individuals measured	8	4	4

Description of phyllosoma

The first stage (Fig.1 1a—1b)

The eggs were dull, yellowish-brown in colour and finally have attained to

a whitish appearance when they are ready to hatch. The eggs hatched directly into the phyllosoma. The larvae measure 1.54 mm–1.60 mm in body length (from the front margin of the carapace to the tip of the abdomen), and 0.76 mm, across the widest part of the fore-body. The eyes are not stalked and are about as long as the first antenna or a little shorter. The first antenna is long and is about 1.2–1.3 times as long as the second antenna. There are two long terminal setae, two short ones, and also another short seta almost at the middle of its length. The second antenna is a biramous appendage like in other scyllarid larvae. Its endopod that bears three small setae at the tip is marked off into a segment and is shorter than the exopodite which does not show any indication of segmentation; the exopodite terminates in two spines. The second maxilla has a somewhat elongated basal segment with four plumose setae. The first maxillipede is a mere stumplike projection immediately behind the base of the second maxilla, while the second maxillipede has five segments without any exopodite. The third maxillipede with a trace of exopodite is long and uniramous as in the larvae of most other scyllarids. There are three pairs of legs, of which the first and the second have well developed exopodites with the natatorial setae while the third has only a rudimental exopodite. The dactyls of the third maxillipede and three pairs of the legs are short and claw-like. A small coxal spine is present in the third maxillipede and a rather large spine with an accesory seta at its base is present in each of three pairs of legs. The abdomen is narrow and the sides run parallel. The details regarding the spines and setae at the end of the abdomen are shown in Fig. 1. (1d)

The second stage (Fig. 1. (2a–2b))

The first ecdysis took place in nine to ten days after hatching. The larvae measure 2.02 mm–2.05 mm in length, 0.96 mm in width, and the growth rate in body length is about 1.29. Short stalks have appeared on the eyes. The first and the second antennae are segmented at the base. The second maxilla with its plumose setae slightly changed its shape. The three pairs of maxillipedes, which appeared in the first stage, remain essentially the same as before. The rudimentary exopodite of the third leg has grown bigger. At the same time, the fourth leg that existed as a rudiment has enlarged. The tip of the abdomen shows very little change from that of the earlier stage.

The third stage. (Fig. 1. (3))

The second exdysis took place in seventeen to nineteen days after hatching. The larvae measure 2.6 mm–2.8 mm in length, 1.30 mm in width and the growth rate is 1.31. The fore-body is rather long than broad. The eyes becomes to possess a difinite slender stalk which markedly increased in length. The antennae remain essentially the same as in the second stage. The exopodite of the third leg is well-formed with three pairs of natatory setae. The fourth leg has grown longer and the exopodite comes into sight as a small protuberance. The rudiments of the fifth leg are also seen as small rounded protuberances.

Discussion

Literature which dealt with the larval developments of scyllarid lobster in the neighbouring waters of Japan is scarce except on *Ibacus ciliatus*. On the scyllarid phyllosomas in the Indian Ocean, Prasad and Tampi(1957, 1959, 1960a, 1960b) offered

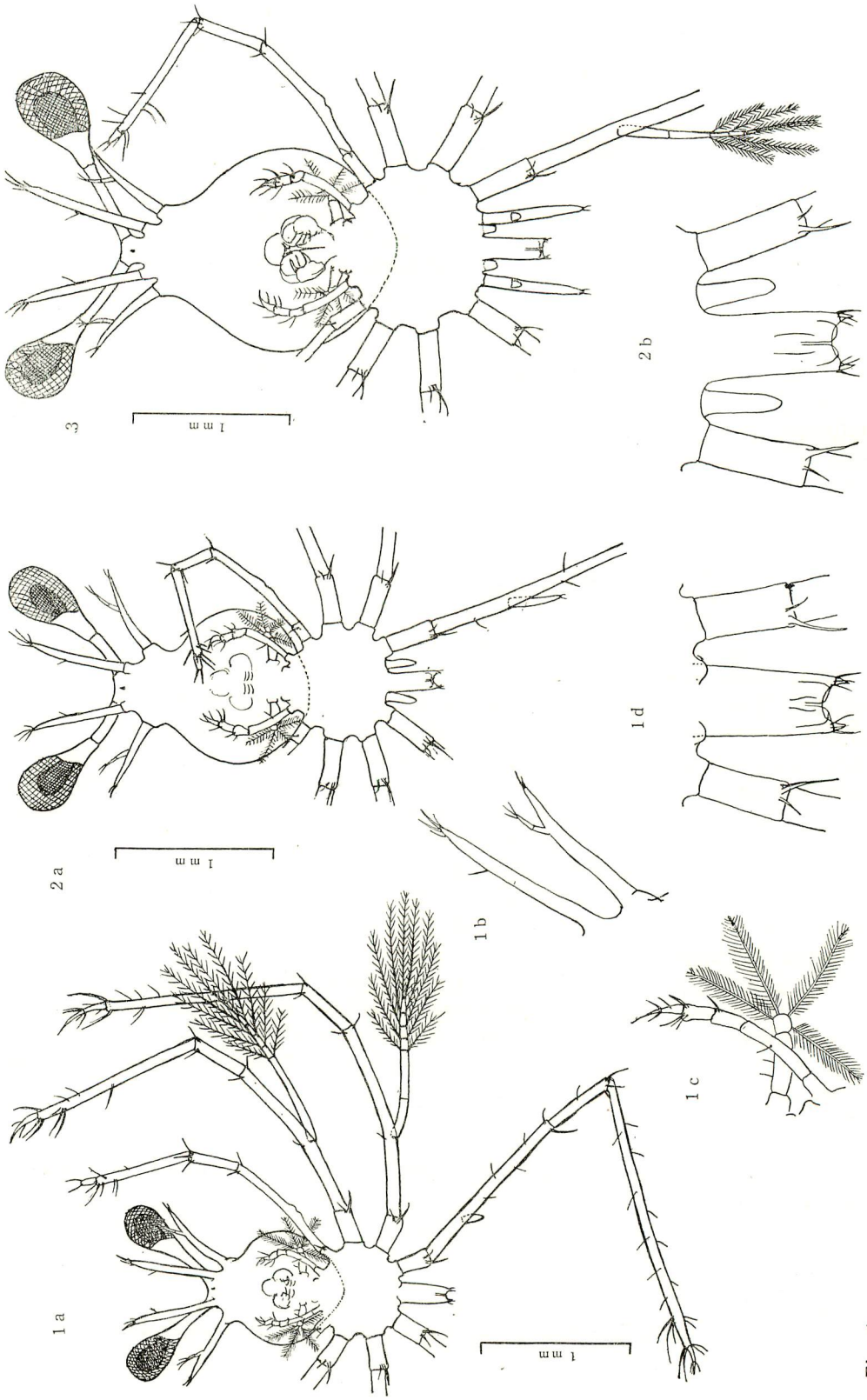

Fig. 1

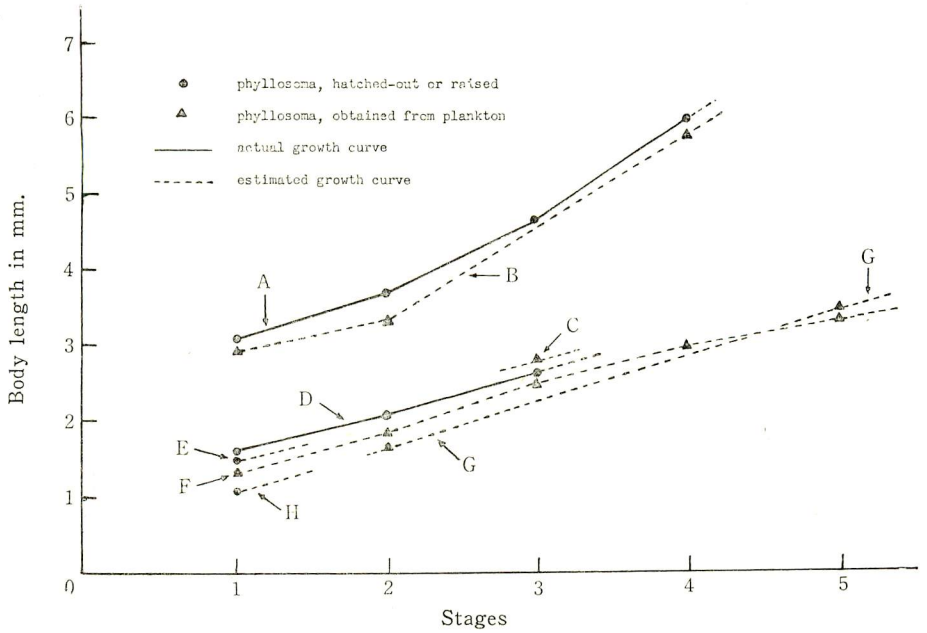

Fig. 2. The growth of early stages of *Parribacus*-type phyllosomas compared to that of *Ibacus*-type phyllosomas.

A. *Ibacus ciliatus* (Saisho & Nakahara, 1960), B. *Thenus orientalis* (Prasad & Tampi, 1957), C. *Scyllarus* sp. II (Prasad & Tampi. 1960), D. *Parribacus antarcticus* E. *Scyllarus arctus* (Stephenson, 1923), F. *Scyllarus* sp. (Prasad & Tampi, 1957), G. *Scyllarus* sp. I (Prasad & Tampi, 1960), H. *Scyllarus sordidus* (Prasad & Tampi).

valuable papers in which their full treatments of distribution, transformation and development of *Thenus orientalis*, *Scyllarus sordidus*, and unknown species of *Scyllarus* and *Scyllarides* are given.

From these observations described above it can be suggested that there exist two types of the first stage phyllosoma in Scyllaridae. One is *Ibacus*-type, to which *Ibacus ciliatus* and *Thenus orientalis* belong, and another is *Parribacus*-type, to which *Parribacus antarcticus*, *Scyllarus sordidus*, *Scyllarus arctus*, and Prasad & Tampi's *Scyllarus* sp., *Scyllarus* sp. I. *Scyllarus* sp. II belong.

The first stage of *Ibacus*-type is one of the largest among phyllosoma larvae, approximately 3.0 mm in length, and the fore-body is more broad than long and looks slightly concave in its posterior end. The body of phyllosoma has developed to some extent, and its three pairs of legs have well-developed exopodites with 10–15 pairs of natatorial setae. The fourth leg, with several segments,

Fig. 1. The phyllosma of *Parribacus antarcticus* in early stages.

1a. The ventral view of the newly hatched phyllosoma.
1b. Left first antenna and second antenna, ventral view.
1c. Left second maxilla, first and second maxillipede, ventral view.
1d. Abdomen, ventral view.
2a. The ventral view of the second stage.
2b. Abdomen, ventral view.
3. The ventral view of the third stage.

bears a rudimental exopodite in case of *Ibacus ciliatus*, and not in *Thenus orientalis*. The fifth leg, segmented or unsegmented, is present without exception.

The first phyllosoma of *Parridacus*-type is, on the contrary, small in size and from 1.05 mm (*Scyllarus sordidus*) to 1.6 mm (*Parribacus*) in body length. They are underdeveloped compared with the *Ibacus*-type, and the third leg has only a rudimental exopodite. The rudiment of the fourth leg is observed as a small protuberance and the fifth leg is not seen. The width of the forebody is nearly equal with its length and it is broadest about the middle of the body. The differences between *Ibacus*-type and *Parribacus*-type become distinct according as animals develop. Fig. 2 shows their growth in the early stages of *Parribacus*-type phyllosoma compared to that of *Ibacus*-type. As an example, *Parribacus antarcticus*, at the third stage, have rudimental exopodites on the fourth leg, and present the round protuberances of the fifth leg between the abdomen and the fourth leg. In *Ibacus ciliatus*, on the other hand, the fourth leg has, at the same stage, well-developed natatory exopodite with 10–12 pairs of setae and the larvae have the rather long fifth leg with its exopodite. The growth curve of *Parribacus antarcticus* is almost similar to that of *Scyllarus* sp., *Scyllarus* sp. I etc, observed by Prasad & Tampi.

At any rate, in comparison with the palinulid the scyllarid phyllosoma shows a rapid development; the free-swimming life is somewhat shorter and larval ecdyses are fewer in frequences than the palinulid phyllosoma. In early several ecdyses after hatching, the phyllosomas show no differences in size increase or degree of development; the increase in length from moult to moult is almost constant. The Brooks's law can, with some restrictions, be applied on these cases. We may safely say that is possible to classify the phyllosomas, obtained from the plankton, into several kinds of stages when they are in early stages, though difficult in the later stages of development. The reason is that their growth rate gradually becomes inconstant and decreases as they develop.

In order to have an exact treatment of the problem unsettled, further careful observations and experiments on the breeding of phyllosoma are needed.

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