Dakin, William John, 1940. Further notes on the life history of the king prawn, *Penaeus plebejus* Hesse. *Records of the Australian Museum* 20(5): 354–359. [15 March 1940].

doi:10.3853/j.0067-1975.20.1940.585

ISSN 0067-1975

Published by the Australian Museum, Sydney

FURTHER NOTES ON THE LIFE HISTORY OF THE KING PRAWN, *PENAEUS PLEBEJUS* HESSE.

By

WILLIAM JOHN DAKIN, D.Sc.,

Professor of Zoology, University of Sydney.

(Figures 1–15.)

In a paper (Dakin, 1938) on the larval and post-larval development of this common Penaeid prawn of the coast of New South Wales, the first account was given of the habits and life history of a very well known inhabitant of certain of our estuaries and coastal lagoons. At the time this research was first undertaken there was much to be done before it could even be certain that these New South Wales prawns spawned at sea. In fact, the discovery of the breeding place and general life history was the main object of the work. Remarkably little was then known of the life history of the Penaeids. It turned out that, working at the same time, the United States Bureau of Fisheries was following the life history of the common American form, *Penaeus setiferus* (Linn.), on a relatively large scale, whilst Madame Heldt had been working for upwards of six years in the Mediterranean at Salammbo (Tunisia) on *Penaeus trisulcatus* Leach, and four other Penaeid genera. Heldt's excellent and very comprehensive paper was published in October 1938, and last year (1939) the result of the American work was indicated in a paper by J. C. Pearson.

The life history of the Penaeid prawns has thus quite suddenly been very considerably elucidated.

Both Heldt and Pearson were able to work from eggs and larvae reared in the aquarium.

Unfortunately, by reason of the marine conditions prevailing off Sydney, where we have been compelled to work under oceanic conditions with a small boat and lack of many facilities, we have only been able to obtain a relatively small number of the earlier stages and these, when isolated, were in no condition for culture experiments. The different stages had to be isolated from preserved plankton catches. This eventually led to a more concentrated effort on the high seas with nets which could be drawn (with sledge attachment) just above the sea bottom. More material was obtained, but the beautifully certain method of culture has not been possible.

The most valuable part of the earlier paper which elucidated the general life cycle of the most important commercial species of this coast, was the series of post-mysis stages, and it was pleasing to find confirmation of the change of form of the telson, described for the first time in that paper, by comparison with the discoveries of Heldt. One or two gaps were, however, left in our early series.

Now, as a result of extended cruises, we have obtained additional material which has indicated the necessity for correcting some of the sequences.

Reference to that first description will indicate that the *post-mysis* series commenced with a small larva 3·5 mm. in length, having only two rostral teeth. The next stage possessed 4 rostral teeth and it was pointed out that at least one intermediate stage was missing. The discovery of a 3-rostral teeth stage and two new forms in the mysis and post-mysis stages have now necessitated the discarding of the mysis and first post-mysis stages then figured. Further experience shows that these forms belong to one of the other Penaeid species, the possibility of whose presence was always before us.

A description of this new post-mysis stage will first be given, and then it will be indicated how this discovery influences the matter of the earlier stages. In short, we shall work back to the earlier stages from the 3-rostral teeth post-mysis stage II. The structure of the appendages and general form of this stage show a clear resemblance to the 4-rostral teeth stage which follows it (see Dakin, 1938). The size, 6·6 mm., fits in the series.

The telson bears the armature of spines indicated in the figure (Fig. 5), namely, three definitely lateral spines on each side with ten terminal spines, the two outside ones being large like the lateral spines (to which series they might be included). This form agrees with that of Heldt for a corresponding stage in *Penaeus trisulcatus*.

The antennule (Fig. 6) has the two rami, one with four and the other with three segments. In the following 4-rostral teeth stage (*loc. cit.*, fig. 40) these segments are five and four in number.

The endopodite of the antenna (Fig. 7) is practically as long as the scale.

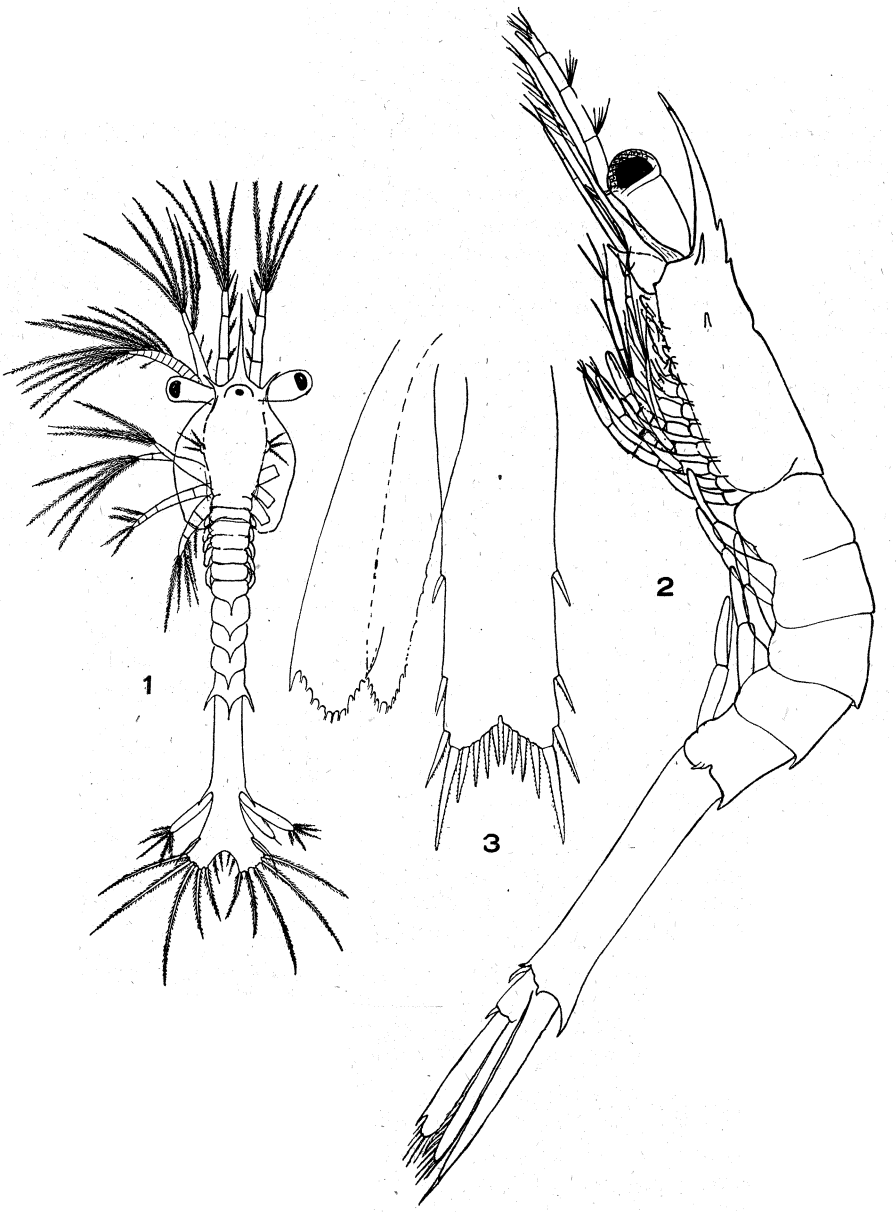
The mandible (Fig. 8) and the maxillule (Fig. 9) are practically as in the 4-teeth stage, with a few less setae. Incidentally this also agrees very closely with Heldt's figures for the Mediterranean species at this stage.

The other significant appendages are figured (Figs. 10–15). Two median ventral spines are well developed, one on each of the last 2 segments of the thorax (sternites XIII and XIV), but, as Burkenroad has indicated, these spines are present in other species and thus not necessarily of specific importance.[1]

At this stage the rostrum extends as far forward as the eye. This form appears to correspond with Heldt's stage VI after the protozoeal stages.

The discovery of this 3-rostral teeth stage made it clear that the 2-rostral teeth stage previously figured (*loc. cit.*, fig. 39) was that of another species. In

[1] It may be noted here that whilst these two ventral spines are found in the very smallest adults of *Penaeus plebejus*, they are absent in the small corresponding stages of our other common Penaeid, *Metapenaeus macleayi*. It was because of this distinct difference that special note was taken of these spines in the post-larval stages. It is, however, impossible as yet to indicate the condition in the earlier developmental stages of *M. macleayi*.



Figs. 1-3.—1. 3rd protozoeal stage. 2. Mysis, stage III. 3. Telson of mysis, stage III.

the first place the size is against the latter, and in the second place the armature of the telson altogether puts it out of court now that we have the additional information. It is easy to see this now, but it must be confessed that, with no other work for comparison, the fact that only one type of the later 4- and 5-rostral teeth stages occurred commonly in our catches at one and the same locality resulted in a mistaken identity here.

The stage preceding that just described has also 3 rostral teeth—in other words, the first *post-mysis* stage has 3 teeth (*cf.* Heldt's stage V), the last mysis (stage IV) has 2 rostral teeth.

The telson of the first *post-mysis* stage is figured (Fig. 4). It will be noticed that it shows a slight cleft indicating the original furca, and the number of setae is significant.

The Mysis Stages.

In the original paper we described one mysis stage. It was always found in company with the succeeding post-mysis stage. Unfortunately, as noted above, this stage has now had to be eliminated from the *P. plebejus* series. The result is that the mysis stage must also go. The two stages were obviously linked.

At the same time, the discovery of other larvae, coupled with information from the two life histories recently made known, has thrown an altogether new light on certain features of this stage.

In the first post-mysis stage of Penaeus the total number of spines on the telson is 16. In the earliest protozoeal stage known in the life history of *any* Penaeid the number of setae is 7 on each furca. This number is even found on the last nauplius stage. Somewhere in the following stages of Penaeus this number must be increased by two. There was nothing to indicate at the beginning that features which may be characteristic of different genera in this respect might be established already in the protozoeal stages. Now, however, we may possibly assume that in the genus Penaeus (as restricted by Burkenroad) a characteristic 16-spined telson is always found not only in the *mysis* stages, but in the late *protozoea* also.

Heldt found by culture experiments that there were four mysis stages in her Mediterranean species. Pearson, with the American *Penaeus setiferus*, refers only to two mysis stages.

We have only taken one of these stages which we are inclined by reason of the telson armature and a comparison of other details to regard as *Penaeus plebejus*. The whole animal, together with a dorsal view of the telson, is figured (Figs. 2 and 3). The size is 5·7 mm. There are 2 rostral teeth. A well developed supraorbital spine is present. The armature of the 5th and 6th abdominal segments should also be noted. This mysis stage figured comes near to the last two mysis stages of Heldt. In Heldt's experiments each stage is a little more advanced than the other, and the fourth stage differs from the third in the presence of setae on the pleopods. Pearson also seems to get setae on a mysis stage, but it is difficult to make comparison here for possibly some stages may be still missing in this American life history. On the whole, then, it will be suggested, failing culture experiments, that the mysis now figured is a late mysis comparable to Heldt's stage III, and that there is probably a fourth mysis stage.

The Protozoeal Stages.

It has been indicated that in most text books the known protozoea of Penaeids are figured with only seven feathered setae on each furcal branch of the telson. A protozoeal stage with 8 setae had, however, turned up in our catches which was a much more likely stage in the life of *Penaeus plebejus*, especially in the light of our latest discoveries, and then Heldt's work showed that the 8-setae stage occurred also in her Penaeus species. We now have three protozoeal stages with 2 × 7 setae on the telson and two types with 2 × 8 setae. It is one of these latter types which must be linked with *Penaeus plebejus*. We hope to follow out the series of the 2 × 7 setae type in the near future. The new protozoea (3rd stage) is figured (Fig. 1). We have a first protozoeal stage (not figured as yet), but owing to the absence of the second we are not inclined to affirm that it is one species or another.

In conclusion, it must be stated that in the absence of definite cultures there is always the possibility of confusion in these earlier stages where a complete series is not available. In this respect, too, I should like to refer to a communication already made to Dr. Burkenroad in regard to the occurrence of eggs containing nauplii off this coast. They were at first attributed to *Penaeus plebejus*. We now consider from the difficulty of finding the earliest larvae of this form that it is most likely those eggs did not belong to it. There seems no doubt whatever that the eggs of this species are normally demersal, falling to the sea bottom if not actually deposited there. It is, of course, not beyond the bounds of possibility (where there are strong upwards currents or other suitably disturbed conditions) for some to be carried to higher levels. Incidentally, it may be interesting to add that Heldt records a single female of the Mediterranean species as depositing 800,000 eggs. Furthermore, in view of the theories which have been suggested regarding the later life of these egg-laying females, the individual seemed in no way indisposed afterwards.

Bibliography.

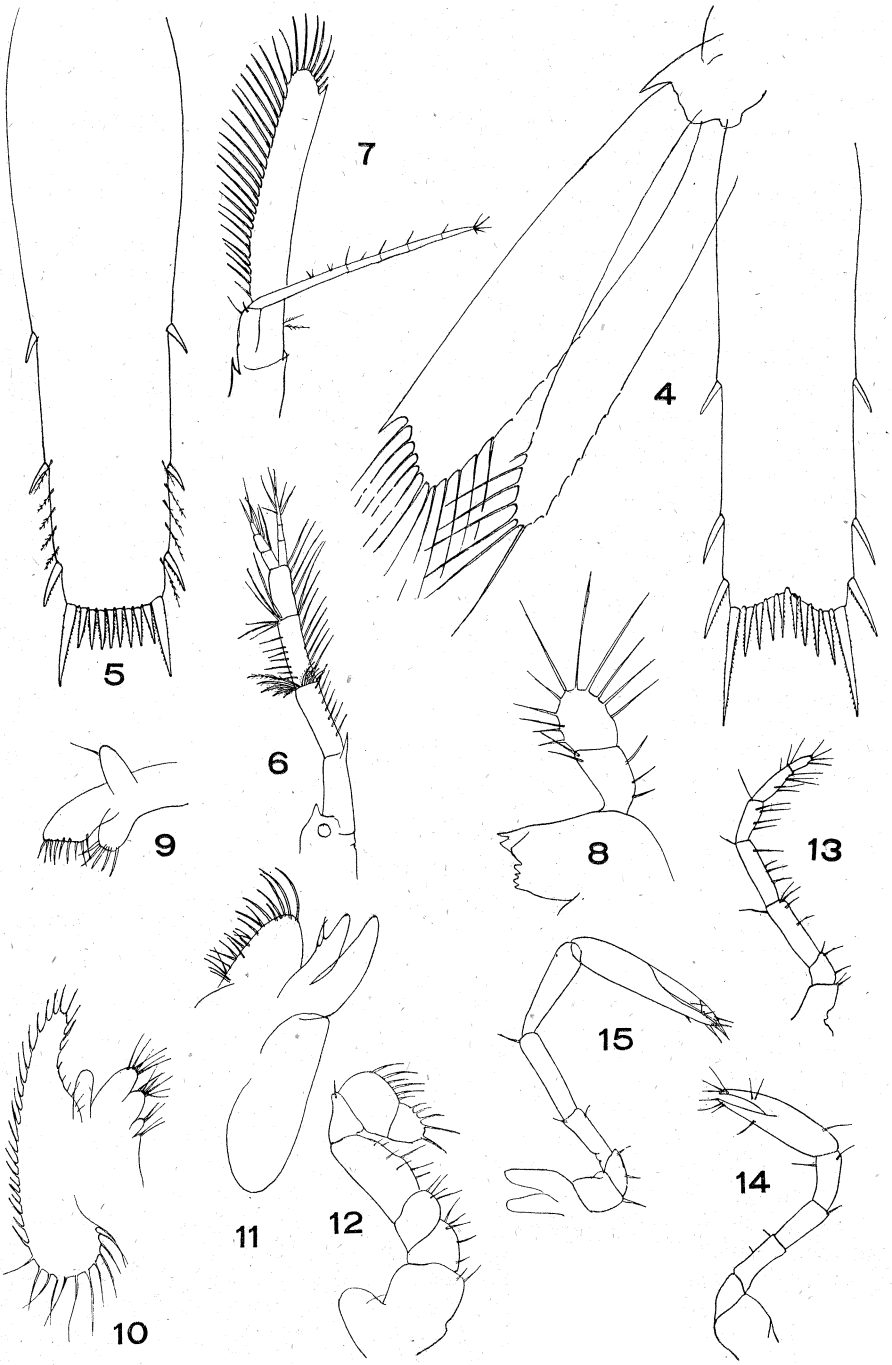
Burkenroad, M. D. (1939) : Further Observations on Penaeidae of the Northern Gulf of Mexico. *Bull. Bingham Oceanog. Coll.*, Yale, vi (6).

Dakin, W. J. (1938) : The Habits and Life History of a Penaeid Prawn (*Penaeus plebejus* Hesse). *Proc. Zool. Soc. Lond.*, Ser. A, 108, pt. 2, July, pp. 163-183.

Heldt, J. H. (1938) : La reproduction chez les Crustacés Décapodes de la Famille des Pénéides. *Ann. l'Inst. Oceanog. Monaco,* N.S., Tome xviii, Fasc. 2, October, pp. 31-206.

Pearson, J. C. (1939) : The Early Life Histories of some American Penaeidae, chiefly the Commercial Shrimp, *Penaeus setiferus* (Linn.). *U.S. Dept. Commerce, Bureau of Fisheries, Bulletin No. 30.*

Fig. 4-15.—4. Telson of first post-mysis (stage V), 3 rostral teeth. 5. Telson of second post-mysis (stage VI), 3 rostral teeth. 6. Antennule of second post-mysis. 7. Antenna of second post-mysis. 8. Mandible of second post-mysis. 9. Maxillule of second post-mysis. 10. Maxilla of second post-mysis. 11. 1st maxillipede of second post-mysis. 12. 2nd maxillipede of second post-mysis. 13. 3rd maxillipede of second post-mysis. 14. 1st peraeopod of second post-mysis. 15. 2nd peraeopod of second post-mysis.


7
4
5
6
9
8
13
15
14
11
12
10