Bull. Nansei Reg. Fish. Res. Lab. (8) 21~27 (1975)

The Zoeal Stages of the Swimming Crabs, *Charybdis japonica* and *Portunus hastatoides* Reared in the Laboratory

Hiroshi KURATA and Shigemi NISHINA

The swimming crabs of the subfamily Portuninae are very abundant everywhere in estuaries and offshores of the Seto Inland Sea. A large number of zoeae and megalopae of many species usually occur together in the plankton in summer and fall when the spawning activity reaches its peak in majority of species. Identification of species of these planktonic crabs, however, is almost impossible at the present circumstances owing to their striking similarity in every essential characters as is already noticed by LEBOUR (1928).

Larval development of certain of the Japanese swimming crabs including *Charybdis japonica* has been the subject of several studies from the view point of morphology (AIKAWA, 1929, 1937), of life history (OSHIMA, 1938) and of rearing (YATSUZUKA, 1952, 1957, 1962). Our knowledges, however, are still far from satisfactory to tell species of larval swimming crabs apart.

This paper presents the descriptions and line drawings of zoeae of the two species of swimming crabs which are very common in the shallow water near the Onomichi Station. This is a part of works finally aiming at the establishment of a key to the larvae of Japanese Portuninae. Measurements were taken according to KURATA (1975).

Charybdis japonica A. MILNE EDWARD

The "ISHIGANI" is very common in shallow waters from Tokyo Bay to Kyushu in Japan, further extending to Formosa, Korea and China (SAKAI, 1939). This is one of the most abundant swimming crabs in the Seto Inland Sea and is caught commercially by gill-nets or by trawls for sale in the local markets.

Berried crabs were separated on May 28, 1974 from the regular trawl catches off Onomichi, and were kept in an aerated aquarium. Eggs hatched out on June 12, and were reared up to stage 4 feeding on rotifers, *Brachionus* sp., and newly hatched *Artemia* nauplii in succession. Unfortunately, megalopae were not obtained.

ZOEA (Fig. 1)

Black chromatophores are present over mouth parts, over stomach, along intestine as far back as abdominal somite 2, and ventrally to hind end of abdominal somites 2-5.

All the spines are present on carapace. Rostral spine is straight and smooth.

Received: August 5, 1975. Contribution No. 48 from the Nansei Regional Fisheries Research Laboratory

It is slightly shorter than carapace in early stages but becomes longer than the latter in later stages. Dorsal spine curves and is hooked at end. It is longer than carapace as well as rostral spine in all stages. Lateral spines are short. Ventral margin of carapace is denticulated and, in later stages, is fringed with sparse setae. Eyes are very large. There is an inconspicuous dorsal knob on carapace above stomach.

There are lateral hooks on abdominal somites 2 and 3, and postero-lateral spines on somites 3-5 in all stages. Postero-lateral spines of somite 3 are slightly shorter than those of somite 4. Telson is slender and typically forked with 2 outer spines, lacking the second. Outer spine 1 is inserted distinctly behind to inner seta 1, and is almost as long as or shorter than outer spine 3. Inner setae are more or less shorter than 1/2 the length of fork. Seta 1 hardly exceeds tip of outer spine 3.

Antennule is simple and unjointed until stage 4. Antenna is much shorter than rostral spine with two rows of spinules along spinous process. Exopod is of moderate length, ending in a short spine with an apical inner spine which is almost as long as the rest of exopod including terminal spine.

Maxillule has a feathered seta on outer edge of basis from stage 2, and a simple seta on outer edge of coxa from stage 3. Endopod of maxillule is of two segments with 1 and 6 setae on proximal and distal segment respectively, and that of maxilla is unsegmented but bilobed with 6 setae in three pairs of which the terminal pair tends to be suppressed. Endopod of maxilliped 1 is of 5 segments and that of maxilliped 2 is of 3 segments.

Stage 1. From spine to spine: 1.14-1.38 mm. in 15 specimens.

Eyes are sessile. Abdomen is of 5 somites plus telson. Rostral spine is slightly shorter than carapace, while dorsal spine is longer than the latter. Lateral spines are about 1/3 as long as rostral spine. Postero-lateral spines on abdominal somite 3 are somewhat less than 1/2 as long as somite 4. Telson is slightly less than twice as long as wide. Fork is 1/2 times longer than the rest of telson. Outer spine 1 is nearly as long as or somewhat shorter than outer spine 3, which bends inward distally. There are 3+3 inner setae.

Antenna has no endopod, reaching to about 3/4 the length of rostral spine. Mandible has no palp. Maxillule has no outer setae. Exopod of maxilla (scaphognathite) is produced proximally into a large feathered seta, and bears another 4 setae along outer margin. Maxillipeds bear 4 swimming setae. There are rudiments of maxilliped 3, but neither legs nor pleopods.

Stage 2. From spine to spine: 1.50-1.86 mm. in 20 specimens.

Eyes are stalked. Rostral spine is slightly longer than carapace. Postero-lateral spines of abdominal somite 3 are about 3/5 as long as somite 4. Telson is somewhat more than twice as long as wide with an extra pair of inner setae inside. Fork is 1/2 times longer than the rest of telson. Outer spine 1 is distinctly shorter than spine 3. Antenna is about 2/3 as long as rostral spine without trace of endopod. Maxillule bears a feathered outer seta on basis.

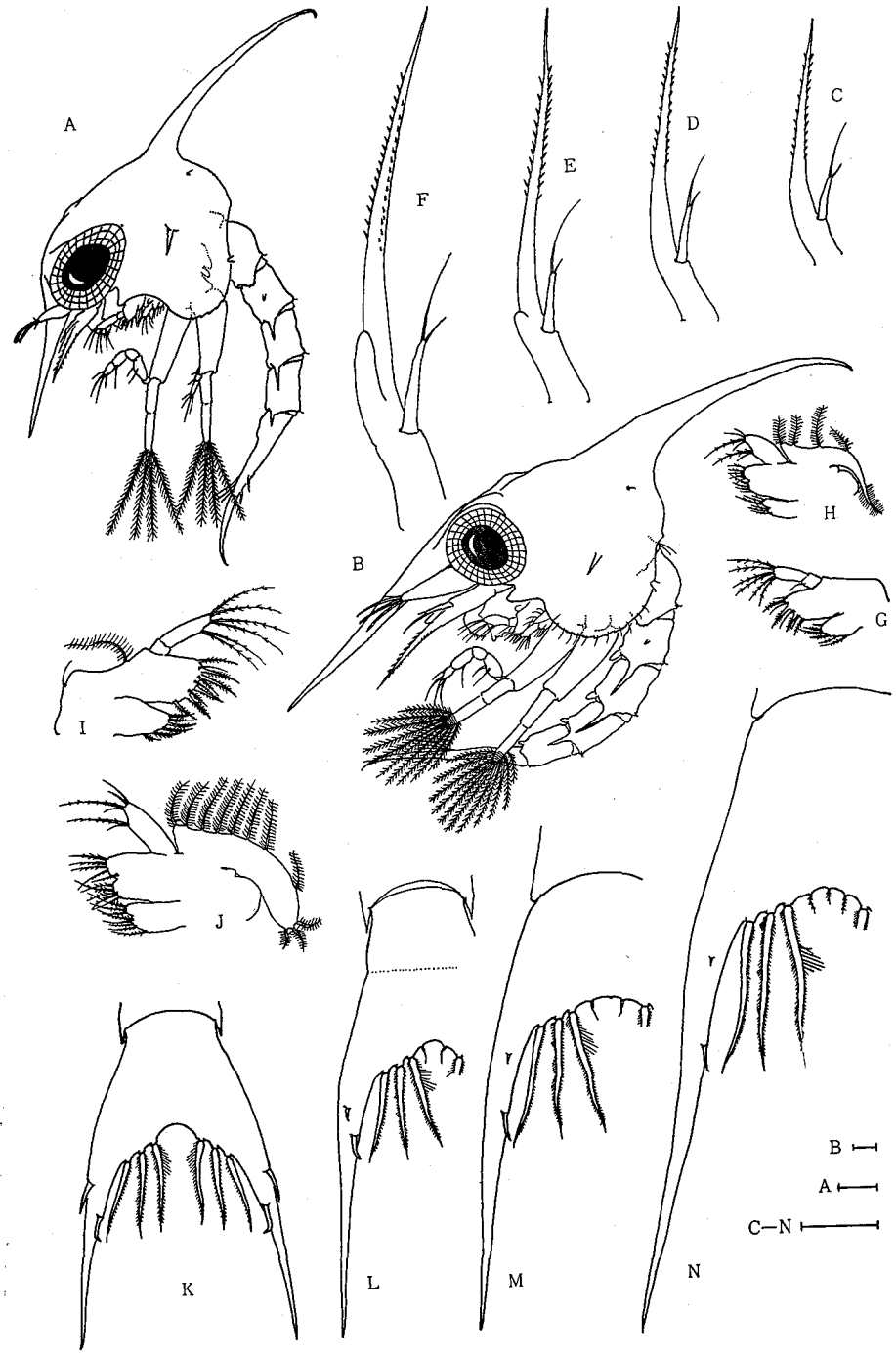

Fig. 1. *Charybdis japonica*: zoeal stages 1-4. A, stage 1, lateral; B, stages 4, lateral; C-F, antenna, stages 1-4; G,H, maxillule and maxilla, stages 1; I,J, maxillule and maxilla, stage 4; K-N, telson, dorsal, stages 1-4. Scales indicate 0.1 mm.

Scaphognathite has a rounded proximal end provided with 3 setae, and another 5 setae on the outer margin. Maxillipeds bear 6 swimming setae.

Stage 3. From spine to spine: 2.10-2.58 mm. in 12 specimens.

Abdomen is of 6 somites plus telson. Telson is now slightly more than twice as long as wide, and length of fork is 2.5 times the rest of telson. Outer spine 1 is much smaller than spine 3. Inner seta 1 reaches 2/5 the length of fork, slightly exceeding tip of outer spine 3. Antennal endopod is beginning. Maxillule has a simple seta on outer margin of coxa in addition to the feathered seta of basis. Scaphognathite is fringed with 14 setae. Rudiments of legs are free. Maxillipeds bear 8 swimming setae.

Stage 4. From spine to spine: 3.3-3.5 mm. in 4 specimens.

Telson is 2.5 times as long as wide, and fork is slightly more than twice as long as the rest of telson. There are 3 extra inner setae. Postero-lateral spines on abdominal somite 3 are 4/5 as long as somite 4. Antennal endopod is slightly longer than exopod less spines. Rudiments of maxilliped 3 and legs are large but still unsegmented and covered by carapace. Rudiments of pleopods are free. Maxillipeds bear 10-11 swimming setae.

Remarks Judging from development of antennal endopod, legs and pleopods stage 4 is likely to be penultimate or antpenultimate zoeal stage. YATSUZUKA (1952, 1957) recognized 6 zoeal stages when he reared this crab from egg in the laboratory.

AIKAWA (1937) described the first zoea of this crab hatched from eggs as *Charybdis 6-dentata* HERBST. In his first zoea five pairs of leg buds are already present and sides of abdominal somite 5 are rounded behind. On the other hand YATSUZUKA(1952, 1957) observed leg rudiments appearing in later stages, and sides of abdominal somite 5 being produced behind into distinct spines. Our results confirmed YATSUZUKA's observations.

Portunus hastatoides FABRICIUS

The "HIME GAZAMI" is fairly common in the regular trawl catches in the Seto Inland Sea, though useless commercially owing to its small size attaining only 45 mm. across carapace. It ranges from Tokyo Bay to Kyushu in Japan, further extending widely in tropical Indo-West Pacific (SAKAI, 1939). Any of the larval stages are not known before.

Berried crabs were separated from trawl catches off Onomichi on July 15, 1974, and their eggs hatched out on July 29. Unfortunately, every attempts to rear the zoeae with similar method as in *Ch. japonica* failed, and none of them reached stage 2.

ZOEA (Fig. 2)

All the spines present on carapace. Rostral spine is almost straight and smooth, and is shorter than carapace. Dorsal spine curves without terminal hook, and is longer than rostral spine but slightly shorter than carapace. Lateral

spines are short. Eyes are very large.

There are lateral hooks on abdominal somites 2 and 3, and postero-lateral spines on somites 3-5. Postero-lateral spines on somite 3 are longer than those on somite 4. Telson is slender and forked, with 3 outer spines of which spines 1 and 3 are spinous while spine 2 is minute and hair-like. Spine 1 is longer than spine 3, and its insertion is level with that of inner seta 1. Spine 3 bends inward distally in stage 1. Inner seta 1 is somewhat less than 1/2 as long as fork, slightly exceeding tip of outer spine 3.

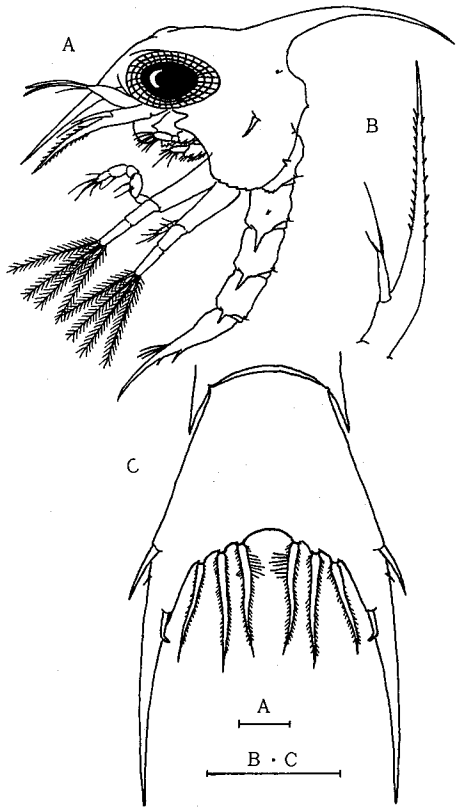

Fig. 2. *Portunus hastatoides*: zoeal stage 1. A, lateral view; B, antenna; C, telson, dorsal. Scales indicate 0.1 mm.

Antenna is nearly as long as rostral spine in stage 1. Exopod is of moderate length ending in a short spine with an apical inner spine which is as long as the rest of exopod including terminal spine. Structure of mouth parts and maxillipeds are very like *Charybdis japonica.*

Stage 1. From spine to spine: 0.90-1.02 mm. in 15 specimens.

Eyes are sessile. Abdomen is of 5 somites plus telson. Rostral spine is about 2/3 as long as carapace, while dorsal spine is slightly shorter than the latter.

Telson is somewhat less than twice as long as wide. Fork is 1/2 times longer than the rest of telson. There are 3+3 inner setae. Antenna has no endopod. Exopod less spines is about 1/5 as long as spinous process. Maxillule has no outer setae. Scaphognathite bears 4 setae on outer margin, ending proximally in a large feathered seta. Maxillipeds bear 4 swimming setae. There are rudiments of maxilliped 3, but no legs or pleopods.

DISCUSSION

Zoeae of the two species described here are much more like than different each other. Every essential characters are common to both. They differ, however, in certain minor details as are summarized in the following table.

Distinguishing characters between zoeae of Charybdis japonica and Portunus hastatoides

Characters	*Charybdis japonica*	*Portunus hastatoides*
Rostral spine	Not much shorter than carapace	Much shorter than carapace
Antenna	Much shorter than rostral spine	As long as rostral spine
Postero-lateral spines of abdominal somite 3	Shorter than those of somite 4	Longer than those of somite 4
Outer spines on telson	Spine 1 is as long as or shorter than spine 3. Its insertion is behind to that of inner seta 1.	Spine 1 is longer than spine 3. Its insertion is level with that of inner seta 1.

Among these differences, those in outer spines of telson may be taken as generic between *Charybdis* and *Portunus* since the similar differences are consistently observed between several members of the both genera (KURATA, 1975).

SUMMARY

Zoeal stages 1-4 of *Charybdis japonica* and stage 1 of *Portunus hastatoides* reared from egg in the labortaory are described in detail. Generic difference between the two genera may be seen in the armature of telson, while specific differences are found in relative length of antenna, of spines on carapace, and of postero-leteral spines on abdominal somites 3 and 4.

References

AIKAWA, H. (1929) : On larval forms of some Brachyura. *Rec. Oceanogr. Works Jap.* 2, 17—55.

AIKAWA, H. (1937) : Further notes on Brachyuran larvae. *Rec. Oceanogr. Works Jap.* 9, 87—162.

KURATA, H. (1975) : Larvae of Decapoda Brachyura of Arasaki, Sagami Bay-V. The swimming crabs of the subfamily Portuninae. *Bull. Nansei Reg. Fish. Res. Lab.* 8, 39—65.

LEBOUR, M. V. (1928) : The larval stages of the Plymouth Brachyura. *Proc. Zool. Soc. London* 1928, 473—560, 16 pls.

OSHIMA, S. (1938) : Biological and fishery researches in Japanese blue crab (*Portunus trituberculatus* MIERS). *Jour. Imp. Fish. Exp. Station* 9, 208-212, Pls. 2-5. (in Japanese with English summary)

SAKAI, T. (1939) : Studies on the crabs of Japan IV. Brachygnatha, Brachyrhncha. Yokendo, Tokyo, pp. 365-741, Pls. 42-111.

YATSUZUKA, K.(1952) : The metamorphosis and growth of the larvae of *Charybdis japonica* A. MILNE EEDWARD. *Bull. Jap. Soc. Sci. Fish.* 17 (11), 353-358 (in Japanese with English summary).

YATSUZUKA, K. (1957) : Study of Brachyuran zoea, artificial rearing and development. *Suisangaku Shusei*, 571-590, Uuiversity of Tokyo press. (in Japanese)

YATSUZUKA, K. (1962) : Studies on the artificial rearing of the larval Brachyura, especially of the larval blue-crab, *Neptunus pelagicus* LINNAEUS. *Rep. Usa Mar. Biol. Station, Kochi Univ.* 9 (1), 1-88. (in Japanese with English summary)

イシガニとヒメガザミの飼育幼生について

倉田　博・仁科重巳

瀬戸内海において圧倒的に優勢なガザミ類であるイシガニとヒメガザミとについて、抱卵親ガニからふ化した幼生を飼育して、ゾエア期の形態的特徴を明らかにした。両種のゾエアは、すべての基本的な特徴に関して、違いよりも類似の方がはるかに顕著である。主な相違点は頭胸甲の棘、第2触角、腹節後側棘などの相対的な長さのほか、尾節第1側棘の縮少傾向に認められる。最後に掲げた相違点は、ほかの種に関する知見と合せて判断すると、恐らく *Charybdis* 属と *Portunus* 属との違いを示すものと考えられる。