

Larvae of Decapoda Brachyura of Arasaki, Sagami Bay-V. The Swimming Crabs of Subfamily Portuninae

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The swimming crab is one of the most dominant group of crabs from low tide mark to outer littoral areas in Japan and elsewhere in the warm water regions. A variety of species live among sea weeds on rocky shores as well as on sand-mud flats in estuaries and offshores. Certain of the members support fairly important local fisheries in Japan along the Pacific, East China Sea and Japan Sea coasts.

The Japanese genera belonging to subfamily Portuninae are *Scylla* DE HAAN, *Portunus* WEBER, *Charybdis* DE HAAN, *Thalamita* LATEREILLE and *Lupocyclus* ADAMS & WHITE (SAKAI, 1939). Certain of the larval stages have already been described by AIKAWA (1929, 1937), OSHIMA (1938), YATSUZUKA (1952, 1957), RAJA ABI NAIDU (1955) and KURATA and OMI (1969). However, diagnostic characters which enable one to identify the species among Portuninae are still far from full understanding. Thus, YATSUZUKA (1957) was unable to distinguish zoea of *Portunus trituberculatus* from that of *P. pelagicus* or of *Charybdis japonica* by the basic diagnostic characters proposed by AIKAWA (1929, 1937). Indeed, zoeae of members of Portuninae are so much alike (LEBOUR, 1928) that the identification of species is almost impossible without referring to every available minor differences. The identification of larval crabs in the plankton is essential for the study of their ecology in nature.

This report presents the result of survey of all the larval crabs of subfamily Portuninae that the present author carried out at Arasaki Station of the Tokai Regional Fisheries Research Laboratory. A single report has already been published on this subject on *Charybdis acuta* (KURATA & OMI, 1969), and the remaining species belonging to *Portunus*, *Charybdis* and *Thalamita* are described here so far as they are known. A tentative key is also presented to genera and species for the known zoeae of Japanese Portuninae.

Materials and Methods

All the descriptions and drawings are taken from the specimens reared from egg in the laboratory except when otherwise stated. Coloration was observed in the first zoea. The berried crabs were obtained from commercial gill net catches and were kept in aerated aquaria of various sizes until eggs hatched out. The newly hatched larvae were transferred and reared in glass bowls of about 500 ml. capacity. About 20 larvae were held per bowl. The rearing water was

partly renewed every day. The early stage zoeae were fed on rotifers, *Brachionus* sp., cultured separately in a large tank, and the later stage zoeae on newly hatched *Artemia* nauplii. Small pieces of the mantle of the short-necked clam, *Tapes philippinarum*, were used to feed the megalopae.

Specimens of each molting stage were separated from the rearing stock, fixed and preserved in 5 % sea water formaline for the later examination. No attempt has been made to collect prezoae. Measurements were taken perpendicular under a microscope with an ocular micrometer for zoea:

1. Length from spine to spine: from tip of rostral spine to tip or, when bending in a hook, terminal outer edge of dorsal spine,
 2. Length of carapace: from the anterior edge of eyestalk to the posterior edge of carapace at the base of dorsal spine,
 3. Length of telson: from the joint with the last abdominal somite to tip of telson fork, somite 6 being included when it is fused with telson,
 4. Width of telson: distance between outer edges at the level of insertion of inner seta 1,
 5. Length of telson fork: from the insertion of inner seta 1 to tip of fork,
- and for megalopa:
1. Carapace length: from tip of rostrum to posterior margin along middorsal line,
 2. Total length: from tip of rostrum to hind end of telson.

As to the armatures of telson in zoea, outer spines and inner setae are separately numbered from anterior backward or from outside inward. One or two of the outer spines may be absent from stage 1 or disappear in later stages. Nevertheless, the spine numbers are assigned as if they were in the assumed primitive form with 3 outer spines and 3 inner setae in addition to the fork each side.

Genus *Portunus* WEBER

Among the genus *Portunus* five species are very common in Japanese waters. They are *P. trituberculatus*, *P. gladiator*, *P. pelagicus*, *P. sanguinolentus* and *P. hastatoides*. The larval stages of the last three species are described elsewhere (KURATA & MIDORIKAWA, 1975; KURATA & NISHINA, 1975), and those of the remaining two species are described here. AIKAWA (1929, 1937), OSHIMA (1938), RAJA BAI NAIDU (1955) and YATSUZUKA (1957) described certain of the larval stages of *P. trituberculatus*, *P. pelagicus* and *P. sanguinolentus*. Their descriptions are, however, too inadequate to tell them apart with any certainty.

The general characters of *Portunus* as evidenced by the above five species may be summarized as follows.

Zoea comprises 4, 5 or more stages. Number of zoeal stages may vary between different species and also even within the same species depending on the conditions of rearing such as temperatures and available foods. Zoea is rather poorly colored with diffused yellow pigment and black chromatophores. The

black chromatophores are consistent over viscera extending along intestine as far back as abdominal somite 2, and ventrally to hind end of abdominal somites 2-5.

Carapace has rostral, dorsal and a pair of lateral spines. All the spines are smooth. Rostral spine is almost straight. Dorsal spine curves posteriorly with or without terminal hook, and is longer than rostral spine. Lateral spines are short. Ventral margin of carapace is somewhat irregularly denticulated and, in later stages, fringed with sparse setae. Eyes are very large. There is an inconspicuous anterior dorsal knob above stomach.

Abdomen is of 5 somites plus telson in stages 1 and 2, and is 6 somites plus telson from stage 3. Abdominal somites 2 and 3 bear lateral hooks in all stages. These are used to fasten free edge of carapace each side when abdomen is curled in under the body. Those on somite 2 are larger and more hook-like than those of somite 3. Posterolateral margin of somite 2 is produced into a small prominence with small denticles. Somites 3-5 have postero-lateral spines which are distinct from stage 1 and become prominent in later stages.

Telson assumes typical form with slender and smooth forks and 3 or 2 outer spines. Spine 1 is on or near the outer lateral edge of fork and its insertion is level with that of inner seta 1 in early stages at least. It is always larger than spine 3. Both are distinct and spinous in all stages, while spine 2 is minute and hair-like in stage 1 disappearing in later stages, or lacking from stage 1 in some species. Spine 3 is on the inner-dorsal edge bending inward distally in early stages. Its insertion is more or less behind tip of spine 1. There are 3+3 inner setae in stage 1, and 2-3 extra setae inside in later stages. Inner seta 3 bears several long setules along the inner edge.

Antennule in all but the last stage is simple and unjointed. It is jointed and biramous in the last stage. Antenna is of moderate length. Spinous process bears two rows of spinules along the outer lateral and the inner dorsal edges. Exopod ends in a hair-like spine with a long simple spine at apical inner edge, looking as if it were ending in two spines of different lengths. Endopod appears in later stages.

Mandible is well developed with a small palp in the last stage. Maxillule bears a feathered seta on the outer edge of basis from stage 2, and a simple seta on the outer edge of coxa from stage 4. Endopod is of 2 segments with one seta on the proximal segment and 6 setae in three pairs on distal segment. Maxilla consists of two bilobed endites, foliaceous scaphognathite fringed with increasing number of feathered setae, and unjointed but bi- or tri-lobed endopod with 6 setae in three pairs, of which the terminal one tends to be more or less suppressed.

Endopod of maxilliped 1 is of 5 segments, and that of maxilliped 2 is of 3 segments. Number of swimming setae is 4, 6 and 8 in stages 1, 2 and 3 respectively, increasing somewhat irregularly in later stages. Trace of maxilliped 3 is present from stage 1, but the remaining limbs develop in later stages.

Megalopa is known in *P. trituberculatus* and *P. pelagicus*. Carapace has a square rostrum producing in the center into a long spine sticking out forward almost

horizontally. There is no other spines or prominent protuberances on carapace. Abdomen is of 6 somites plus telson. Somite 5 bears a pair of large, pointed postero-lateral spines, extending well beyond somite 6. Telson is almost as long as wide, slightly tapering behind.

Antennule is biramous with a protopod of 3 segments bending on itself, an outer flagellum of 4 segments with 3 tufts of aesthetascs, and an inner flagellum of one segment. Antenna extends well beyond the tip of rostrum and is composed of a protopod of 4 segments and a flagellum of 8 segments, of which segment 5 bears a pair of long setae at distal end.

Mandible is spoon-shaped. Cutting edge of the right is smooth, while that of the left is produced in the center into a small prominence. There is a palp of 2 segments bending inside the cutting edge. Maxillule has 2 well developed endites and an unsegmented endopod bending on itself with a few setae. Maxilla shows somewhat degenerated features compared to that in the last zoea in the setation of endites and of endopod which is now devoid of setae. Scaphognathite on the other hand, is greatly expanded and fringed with numerous setae. Endopod of maxilliped 1 is unsegmented with several short setae along terminal outer edge, and that of maxillipeds 2 and 3 is of 5 segments each with numerous spines and setae along the inner edge.

Leg 1 is chelate with a hook-like spine on ventral edge of ischium and antero-ventral edge of carpus. Fingers have 4 teeth each along cutting edge. Their tip deeply crosses each other when chela is closed. Leg 2 has a spine on ventral edge of coxa. There is a row of several prickly spines along the ventral edge of dactylii of legs 2-4 which are much longer than their propodii. Last segment of leg 5 is paddle shaped, ending in a spine, with 1 or 2 feathered setae and several feelers along ventral edge. The feelers are of two kinds. The one curves at the end with a row of very fine hairs along inner edge of curved portion, and the other curves likewise with a row of distinct teeth like a saw along inner edge of curved portion. There is a huge sternal spine each side at the base of leg 4, sticking out behind somewhat beyond hind end of abdominal somite 2.

There are well developed biramous pleopods on abdominal somites 2-5. Uropod is uniramous with or without one seta on protopod and more than 9 setae on exopod.

Portunus trituberculatus MIERS

The "GAZAMI" is one of the most common edible crabs in Japan with very high market prices. It ranges from Hokkaido to Kyushu along Japanese Islands, further extending to Korea, Formosa and China. In 1972 the Japanese domestic production was 1,466 metric tons including allied species, of which about 1/5 was landed from the Seto Inland Sea. The domestic production does not meet increasing demand in recent years and enhancing attempts have been undertaken with local successes to improve fishery production by releasing into the sea a

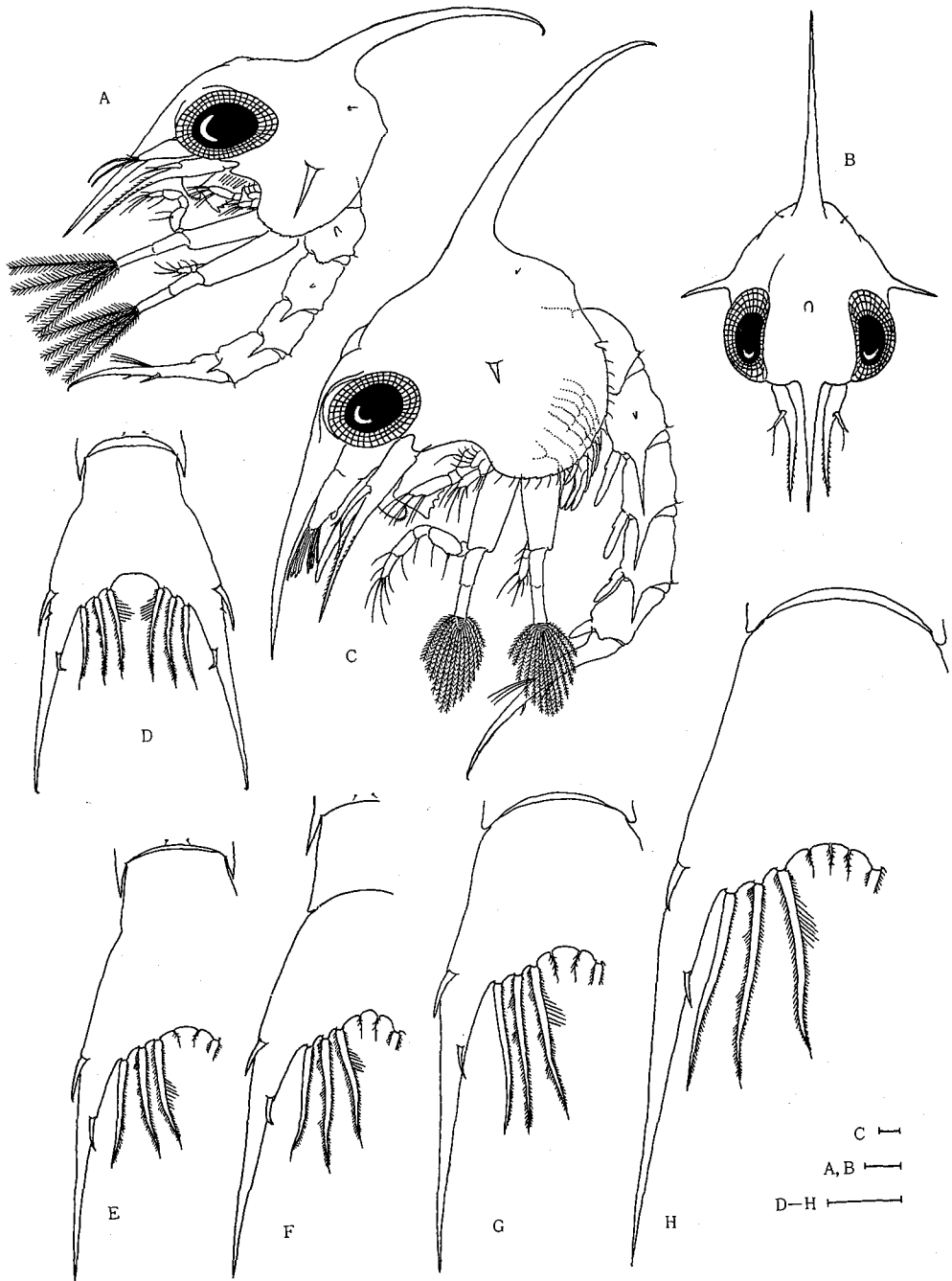


Fig. 1. *Portunus trituberculatus*, zoeal stages 1-5. A, stage 1, lateral; B, the same, carapace, dorsal; C, stage 5, lateral; D-H, telson, dorsal, stages 1-5. Scales indicate 0.1 mm.

large number of young crabs reared from eggs in the hatcheries.

Egg carrying crabs were seen from May to October. Early eggs are orange-red in color and about 0.31 mm. in diameter. Several batches of egg have been reared successfully up to crab stages.

ZOEA (Fig. 1; A-H: Fig. 2; A-K)

Zoea has following characters in addition to those of the genus. Rostral spine is shorter than carapace but dorsal spine is almost as long as or somewhat longer than the latter. Antenna is more or less shorter than rostral spine in all stages. Length of exopod less spines is somewhat more than 1/4 as long as spinous process, gradually increasing in relative length in later stages. Apical inner spine is about as long as exopod less terminal spine.

Postero-lateral spines on abdominal somites 3-5 never exceed hind end of their succeeding somites. The spines of somite 3 are longer than those of somite 4. Telson has 3 outer spines in stage 1 including minute spine 2 which disappears from stage 2. Inner setae are almost 1/2 as long as fork in all stages. Seta 1 reaches beyond tip of outer spine 3 by its distal about 1/5.

Five stages are recognized. It does not necessarily follow, however, that they always molt five times to reach megalopa. YATSUZUKA (1957) showed that fast growing zoeae normally changed into megalopa after passing 4 molts, and stage 5 zoeae may occur when rearing conditions are nonoptimal.

Stage 1. From spine to spine: 1. 26-1.41 mm. in 10 specimens.

Eyes are sessile. Abdomen is of 5 somites plus telson. Telson is twice as long as wide. Fork is 1/3 times longer than the rest of telson. Antenna has no endopod. There is a small, uniramous rudiment of maxilliped 3, but no trace of legs or pleopods. Maxillipeds bear 4 swimming setae.

Stage 2. From spine to spine: 1.62-1.77 mm. in 3 specimens.

Eyes are stalked. Telson fork is only slightly longer than the rest of telson. Outer spine 2 of telson disappears. There is a pair of extra inner setae inside. Antennal endopod is beginning. Rudiment of maxilliped 3 is biramous. Traces of leg buds are present. Maxillipeds bear 6 swimming setae.

Stage 3. From spine to spine: 2.10-2.40 mm. in 7 specimens.

Abdominal somite 6 is segmented off from telson. Telson is now 2/3 times longer than wide, and fork is somewhat less than twice as long as the rest of telson. Antennal endopod is shorter than exopod. Maxillipeds bear 8 swimming setae.

Stage 4. From spine to spine: 2.46-2.82 mm. in 7 specimens.

Postero-lateral spines on abdominal somite 3 almost reach hind end of somite 4. There are small pleopod buds. Telson is almost twice as long as wide. Fork is somewhat less than twice as long as the rest of telson. There are 3 extra inner setae. Antennal endopod is slightly longer than exopod less spines. Leg buds are large but still unjointed and covered by carapace. Maxillipeds bear 9-11

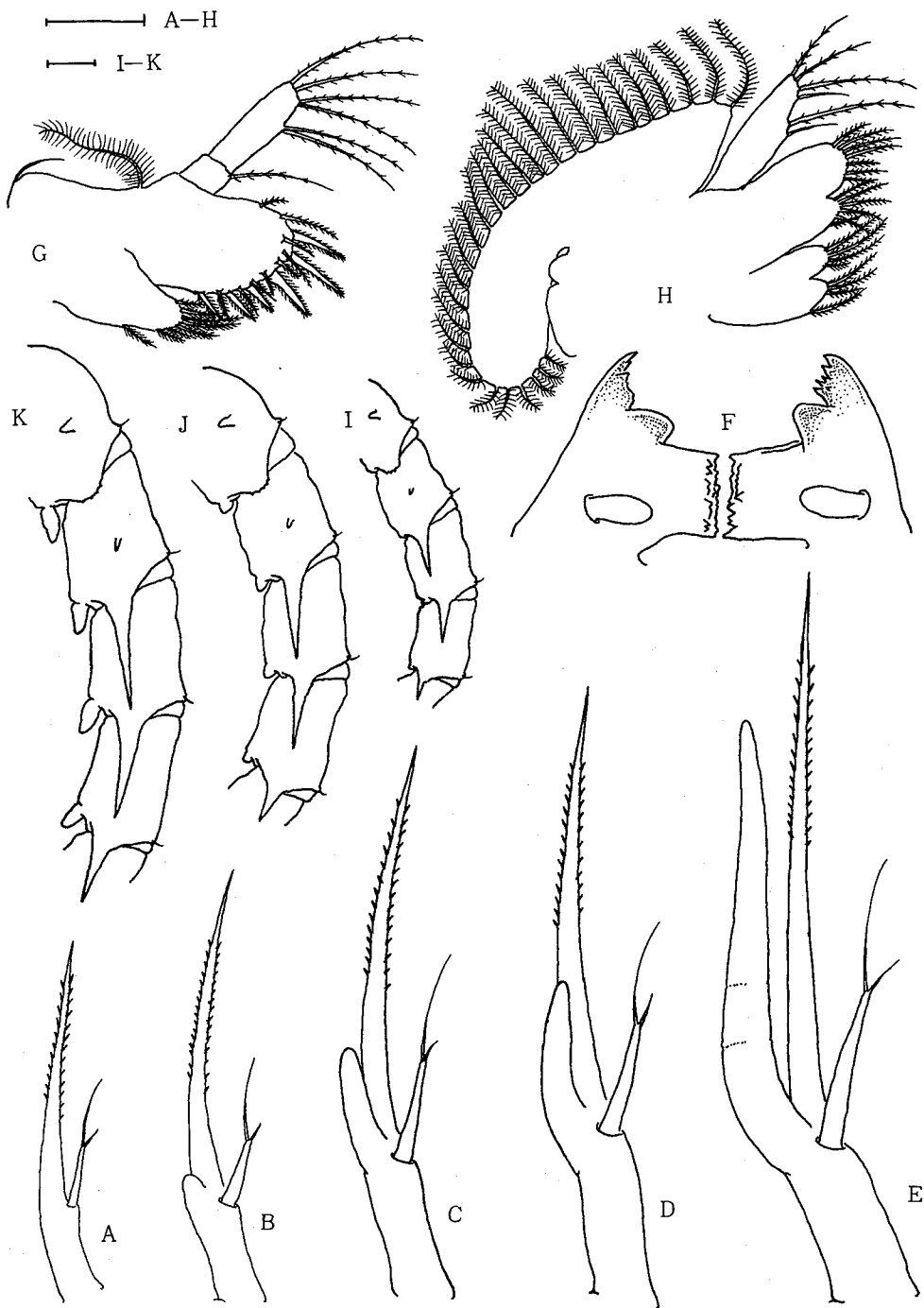


Fig. 2. *Portunus trituberculatus*: zoeal stages 1-5. A-E, antenna, stages 1-5; F-H, stage 5, mandibles, maxillule and maxilla; I-K, abdominal somites 2-5, stages 2-4. Scales indicate 0.1 mm.

swimming setae.

Stage 5. From spine to spine: 3.25-3.60 mm. in 5 specimens.

Telson is slightly more than twice as long as wide. Fork is $1/2$ times longer than the rest of telson. There are still 3 extra inner setae. Insertion of outer spine 1 is somewhat forward to that of inner seta 1. Antennal endopod is about $3/4$ as long as spinous process. Maxilliped 3 and legs are very large and more or less jointed, though not functional. Abdominal somites 2-5 bear long biramous pleopods, almost as long as respective somite. Maxillipeds bear 12-14 swimming setae.

MEGALOPA (Fig. 3; A-O)

Carapace length is 2.3-2.6 mm. (2.8-2.9 mm. in the specimens from the plankton) and total length is 4.1-4.5 mm. in 7 specimens. Rostrum is somewhat shorter than the rest of carapace and $1/2$ as wide as the latter. Central spine is almost as long as or slightly shorter than the rest of rostrum. Postero-lateral spines on abdominal somite 5 reach to proximal $1/3$ of telson.

Antennal flagellum exceeds tip of rostrum by its distal 3 or 4 segments. Palm of chela is $1/2$ or $3/4$ times longer than wide, fingers being about as long as palm. There is a sternal protuberance each side at base of leg 3 in addition to sternal spines at base of leg 4. Dactylia of legs 2-4 are $3/4$ times longer than their propodia with 4-7 prickly spines along ventral edge. Dactylus of leg 5 is slightly less than $1/4$ as wide as long with 1-2 feathered setae, 5-7 hooked feelers and 2 saw-like feelers. Uropod is about $2/3$ as long as telson with 11-13 setae on exopod. One seta may be present on protopod, though 2 setae were figured by OSHIMA (1938).

There is 1 mastigobranch bearing long filamentous setae on maxillipeds 1 and 3, 2 arthrobranchs each on maxillipeds 2, 3 and leg 1, and 1 arthrobranch on legs 2 and 3. Thus, the gill formula is completed as in the adult except 1 mastigobranch on maxilliped 2.

Remarks AIKAWA (1929) was the first to describe zoea of this crab. He obtained the first zoea from eggs but overlooked lateral spines on carapace. This was revised by himself in a later paper (AIKAWA, 1937) in which, however, he states that antennal spinous process bears only a single row of spinules, hind end of all abdominal somites are rounded and telson has two outer spines only. These are not entirely correct.

OSHIMA (1938) gives a good description and figures of zoea and megalopa reared from egg in the live boxes anchored in the shallow sea. In his description, however, rudiment of maxilliped 3 in stages 1 and 2 are overlooked, and antennal spinous process is figured as bearing many rows of spinules. These are not the case in the present materials.

Asymmetrical increase of extra inner setae of telson in later stages is also observed by OSHIMA (1938) and YATSUZUKA (1957) and seems to be common in the zoea of this crab. In other known zoeae these setae usually increase in

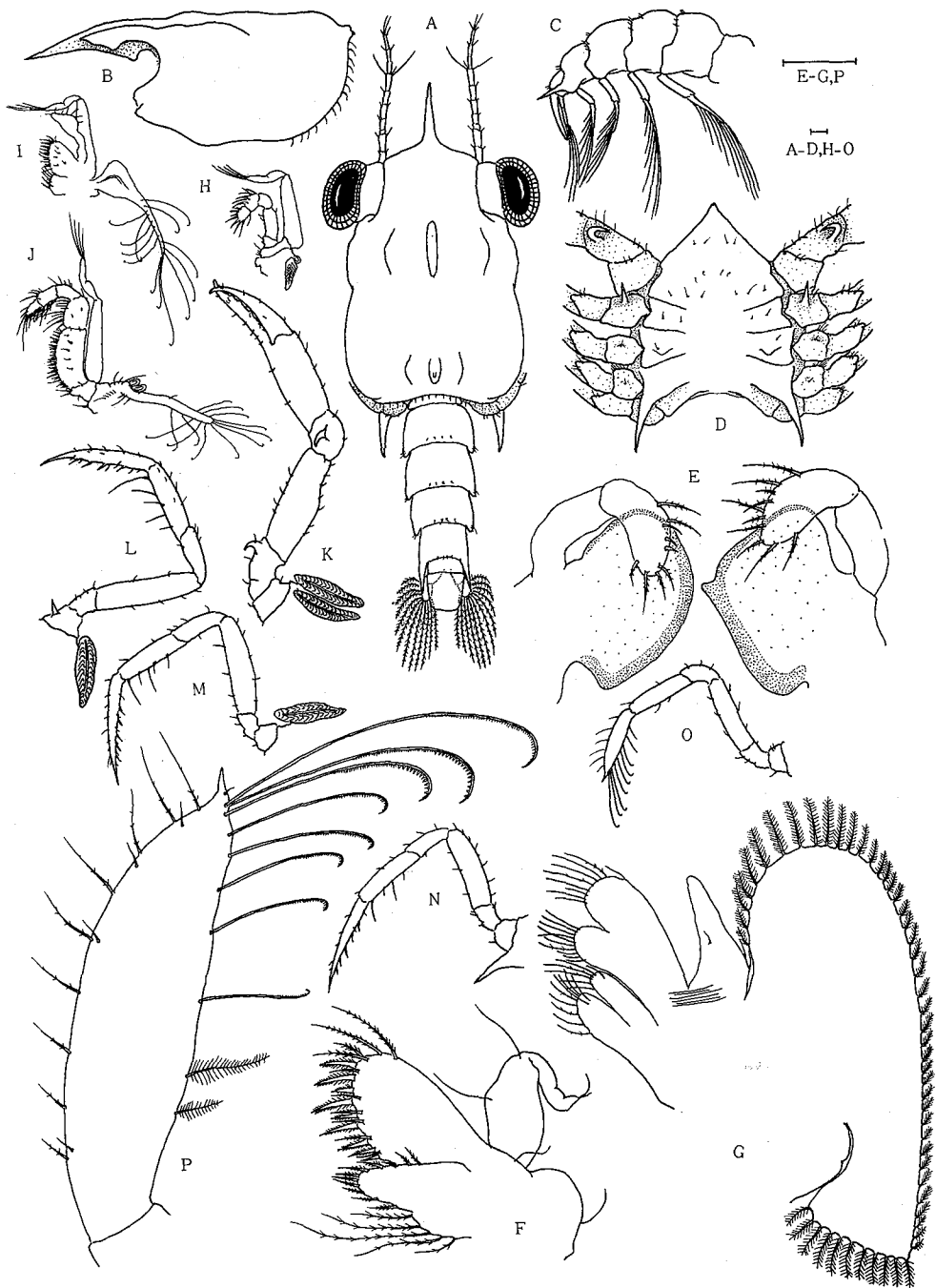


Fig. 3. *Portunus trituberculatus*: megalopa. A, dorsal; B, carapace, lateral; C, abdomen, lateral; D, thoracic sternite and basal parts of legs, ventral; E, mandibles; F, maxillule; G, maxilla; H-J, maxillipeds 1-3; K-O, legs 1-5; P, last segment of leg 5. Scales indicate 0.1 mm.

pairs.

YATSUZUKA (1957) studied variation in the number of zoeal stages and found that the last zoea of stage 5 was much more developed and larger than the last zoea of stage 4, but was less well developed than the latter in stage 4. He concluded, therefore, that the extra stage may occur among zoeae in which growth and development were retarded.

Portunus gladiator FABRICIUS

The "IBO-GAZAMI" ranges from Inuboe-zaki to Kyushu along Pacific coast of Japan. They live on sandy flats of 30-80 m. deep attaining 68 mm. across carapace. They are fairly common among the gill net catches at Arasaki district. Berried females were found in May-June. Early eggs are oval and 0.27×0.31 mm. in size and yellowish in color.

Larvae were not described before. Eggs were hatched on June 8, 1968, but they did not live beyond stage 1.

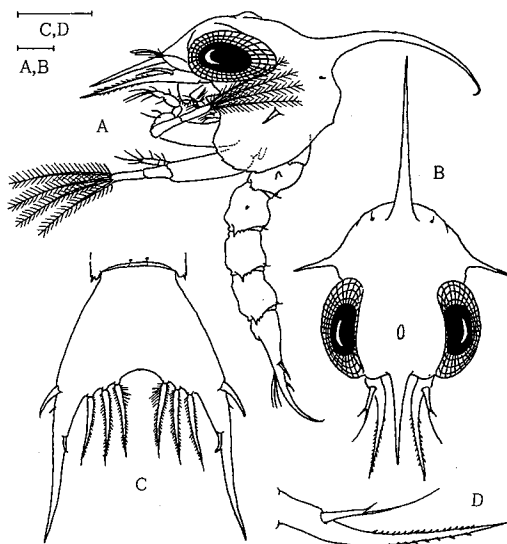


Fig. 4. *Portunus gladiator*: zoea stage 1. A, lateral; B, carapace, dorsal; C, telson, dorsal; D, antenna. Scales indicate 0.1 mm.

ZOEA (Fig. 4; A-D)

Zoea is very like *P. trituberculatus*, but differs from it in somewhat smaller size and the following minor details. Postero-lateral spines on abdominal somites 3-5 are much smaller than in the latter species, and accompanied dorsally by minute denticles in stage 1 at least. Telson is distinctly less than twice as long as wide. Insertion of outer spine 1 is level with or slightly behind that of inner seta 1. Antenna is longer than rostral spine in stage 1. Apical inner spine of

exopod is twice as long as the exopod less terminal spine.

Stage 1. From spine to spine: 1.08-1.14 mm. in 5 specimens.

Eyes are sessile. Abdomen is of 5 somites plus telson. Telson is 3/4 times longer than wide, and fork is 1/4 times longer than the rest of telson. Outer spine 1 is longer than spine 3. Inner seta 1 exceeds tip of outer spine 3 by its distal 1/8. Maxillipeds bear 4 swimming setae.

Genus *Charybdis* DE HAAN

Among the genus *Charybdis* 6 species are more or less common in the warm water areas of Japan. They are *Ch. bimaculata*, *Ch. truncata*, *Ch. miles*, *Ch. japonica*, *Ch. acuta* and *Ch. cruciata*. All but the last are more or less known of their larval stages. The larvae of the first three species are described here. Larvae of *Ch. acuta* have already been reported by KURATA & OMI (1969) and those of *Ch. japonica* by AIKAWA (1937), YATSUZUKA (1952, 1957) and KURATA & NISHINA (1975). AIKAWA described the last zoea and megalopae of *Ch. bimaculata* taken from plankton, but his identification was open to question because he recognized two stages in the megalopa. *Ch. japonica* are sold in the local market, but the other members of the genus do not have any commercial values owing to their small size.

ZOEA

All the known zoea of *Charybdis* have the following characters in common. Carapace has all the spines. Rostral spine is long and straight. Dorsal spine bends posteriorly and is much longer than rostral spine. Lateral spines are short. Ventral margin of carapace is more or less denticulated. Eyes are very large. There is an inconspicuous dorsal knob above stomach. Coloration is like *Portunus*.

There are lateral hooks on abdominal somites 2 and 3, and postero-lateral spines on somites 3-5 in all stages. The postero-lateral spines are distinct from stage 1 and become very long in later stages.

Telson is typically forked with 3 or 2 outer spines. Spines 1 and 3 are distinct and spinous in all stages, while spine 2 is minute and hair-like in stage 1, disappearing in later stages or lacking from stage 1 in some species. Spine 1 is almost as large as or smaller than spine 3 except in stage 1 in some species. Insertion of spine 1 is distinctly behind that of inner seta 1, and that of spine 3 is more or less behind the tip of spine 1. There are 3+3 inner setae in stage 1 and 1 or 2 pairs of extra ones in later stages.

Structure of antennule, antenna and mouth parts is very like *Portunus*.

Development of the remaining limbs also follows quite a similar sequence with that of *Portunus*.

MEGALOPA

Megalopa is known with certainty only in *Ch. acuta* (KURATA & OMI, 1969). As in zoea, megalopa of *Charybdis* is very like *Portunus*. The characters common

to both are the presence of one-spined rostrum, ischial spine on leg 1, coxal spine on leg 2, large sternal spine at the base of leg 4, and postero-lateral spine on abdominal somite 5. Absence of dorsal spines and conspicuous protuberances on carapace, presence of 8 jointed antennal flagellum and paddle shaped leg 5 bearing feelers are also common to both.

It is quite difficult at present to tell *Charybdis megalopa* as a whole apart from *Portunus* owing to the scarcity of knowledge. However, informations from the study of plankton specimens in addition to those from reared materials show that distinguishing characters of megalopa of *Charybdis* from *Portunus* seem to be in the absence of spine on carpus of leg 1, and smaller size of sternal spine at base of leg 4 extending hardly beyond hind end of abdominal somite 2.

Charybdis bimaculata (MIERS)

The "FUTAHOSHI ISHIGANI" is quite common from Sagami Bay to Kyushu in Japan on sandy bottoms of 20-400 meter deep. It also ranges very widely in tropical waters of Indo-West Pacific and East Africa. It is very common in the gill net catches at Arasaki district attaining 34 mm. across carapace. Berried females were found in June. Early eggs are orange-yellow in color and 0.33 mm. in diameter. Eggs hatched out on July 18, 1964 and were reared up to stage 4 which, judging from development of limb buds and pleopods, seems to be penultimate zoea. No megalopa were obtained.

ZOEA (Fig. 5; A-K)

Rostral spine is about $\frac{2}{3}$ as long as carapace. Dorsal spine curves without terminal hook and is longer than rostral spine but shorter than carapace. Postero-lateral spines on abdominal somite 3 are somewhat longer than those of somite 4, reaching behind hind end of somite 4 in later stages. Outer spine 2 of telson is hair-like in early stages and disappears from stage 3. Spine 1 is longer than spine 3 in stage 1, and is almost as long as the latter in later stages. Inner seta 1 is $\frac{1}{2}$ as long as fork and reaches slightly beyond tip of outer spine 3.

Antenna is nearly as long as or slightly shorter than rostral spine. Exopod less spines is $\frac{1}{5}$ - $\frac{1}{4}$ as long as spinous process. Apical inner spine of exopod is slightly longer than exopod including terminal spine in early stages, while in later stages it is almost as long as the latter.

Stage 1. From spine to spine: 1.08-1.14 mm. in 15 specimens.

Postero-lateral spine on abdominal somite 3 is about $\frac{1}{2}$ as long as somite 4. Telson is $\frac{2}{3}$ times longer than wide. Fork is only slightly longer than the rest of telson. Outer spine 2 is hair-like. Outer spine 1 is longer than spine 3. Antenna has no endopod. There are no leg buds or pleopods. Maxillipeds bear 4 swimming setae.

Stage 2. From spine to spine: 1.20-1.30 mm in 7 specimens.

Postero-lateral spine on abdominal somite 3 is almost as long as somite 4. Telson is almost twice as long as wide. Fork is $\frac{1}{4}$ times longer than the rest

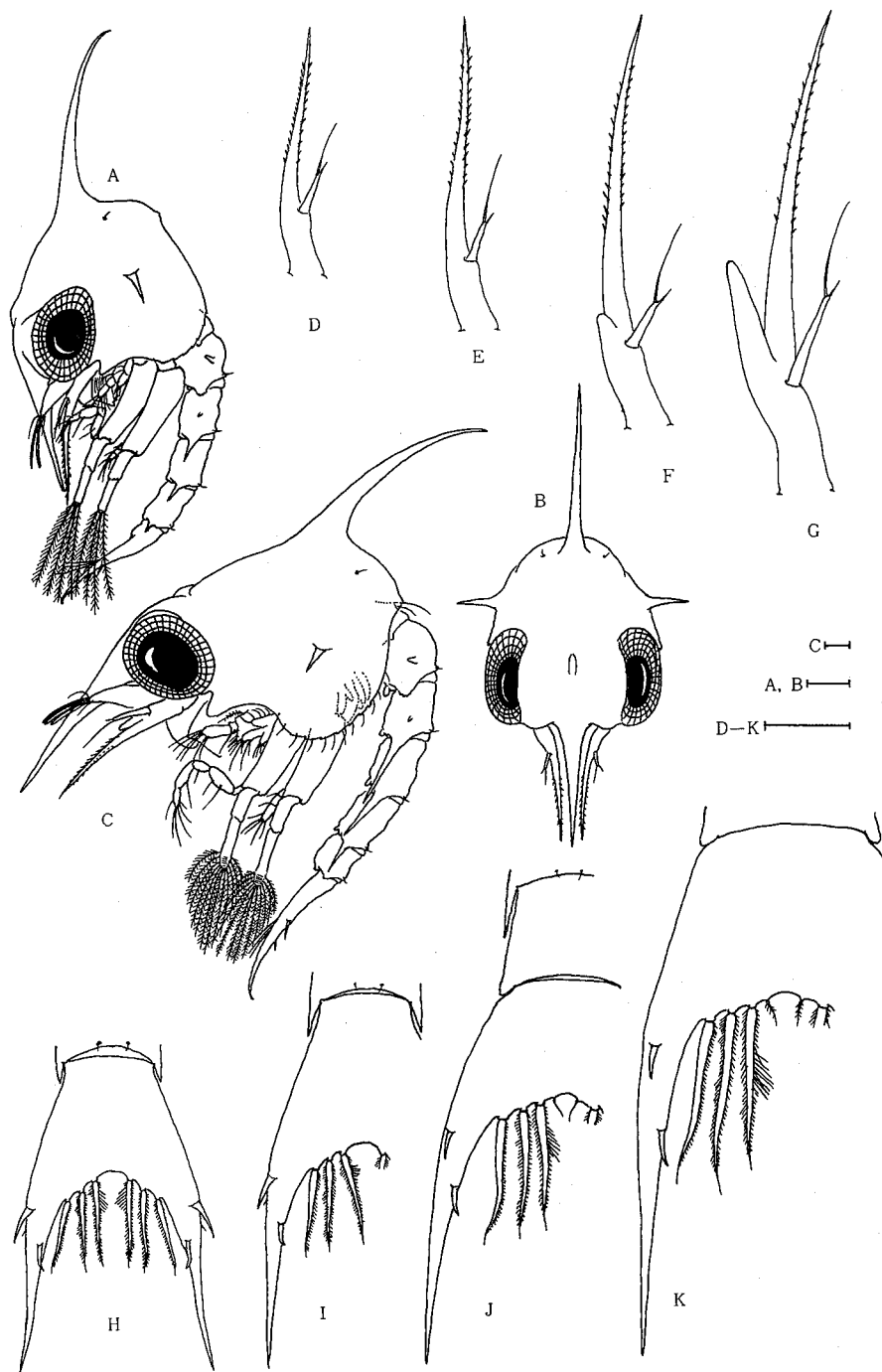


Fig. 5. *Charybdis bimaculata*: zoeal stages 1-4. A, stage 1, lateral; B, the same, carapace, dorsal; C, stage 4, lateral; D-G, antenna; H-K, telson, dorsal. Scales indicate 0.1 mm.

of telson. Outer spine 1 is as long as spine 3. There is a pair of extra inner setae inside. Maxillipeds bear 6 swimming setae.

Stage 3. From spine to spine: 1.35-1.56 mm. in 4 specimens.

Abdominal somite 6 is segmented off from telson. Telson is now about 1/2 times longer than wide. Fork is somewhat more than twice as long as the rest of telson. Postero-lateral spine on abdominal somite 3 reaches slightly beyond hind end of somite 4. Leg buds are unfolded but no pleopods. Maxillipeds bear 8 swimming setae.

Stage 4. From spine to spine: 2.1-2.2 mm. in 3 specimens.

Antennal endopod is almost as long as exopod less spines. Leg buds are large but unsegmented. Pleopod buds are present, though small. Telson still bears a pair of extra inner setae.

Remarks AIKAWA (1937) described fourth zoea and megalopa obtained from plankton from the East China Sea. His fourth zoea, however, is apparently different from present specimens described above, having antennal exopod more than 1/2 as long as spinous process, and endopod only about 1/2 as long as exopod less spines. He recognized two different size groups among his specimens of megalopa and assumed to represent different stages of the same species. Unfortunately, he did not describe the differences between the two stages in detail, except size, number of setae on uropod and of segment of antennal flagellum. These minor differences, however, seem to be enough to conclude that these two groups represent different species rather than different stages of the same species.

Charybdis truncata (FABRICIUS)

The "HIROHA ISHIGANI" ranges in Japan from Tokyo Bay to Kyushu on sand-mud bottoms of 20-50 meter deep, attaining 47 mm. across carapace. They are very common in gill net catches at Arasaki district in June, when majority of females are in berry. Any of the larval stages are not known before. Early eggs are orange-yellow in color. Eggs were hatched several times during spawning season in 1967-68 and were reared up to stage 3.

ZOEA (Fig. 6; A-H)

Zoea looks more slender than *Ch. bimaculata* owing to its slender and long dorsal spine, which is longer than carapace as well as rostral spine. Postero-lateral spines on abdominal somite 3 are slightly shorter than those on somite 4 in early stages at least. Outer spine 2 of telson is hair-like, disappearing in later stages. Outer spine 1 is almost as long as or shorter than spine 3 in all stages examined. Antennal exopod is of moderate length. Apical inner spine is almost as long as exopod including terminal spine. Inner seta 1 of telson is about 1/2 as long as fork, reaching only slightly behind tip of outer spine 3.

Stage 1. From spine to spine: 1.11-1.20 mm. in 15 specimens.

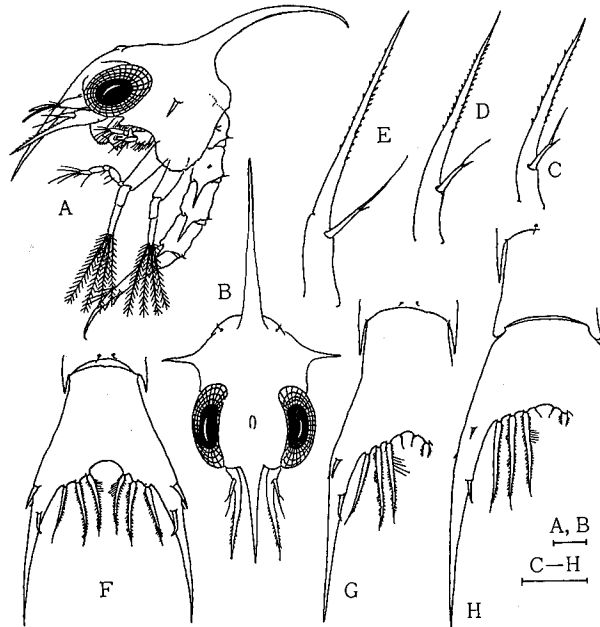


Fig. 6. *Charybdis truncata*: zoeal stages 1-3. A, stage 1, lateral; B, the same, carapace, dorsal; C-E, antenna, stages 1-3; F-H, telson, dorsal, stages 1-3. Scales indicate 0.1 mm.

Dorsal spine is slightly longer than carapace. Postero-lateral spine of abdominal somite 3 is about $1/2$ as long as somite 4. That of somite 4 is about $1/5$ longer than that of somite 3. Telson is $3/4$ times longer than wide. Fork is $1/3$ times longer than the rest of telson. Outer spine 1 is almost as long as or slightly shorter than spine 3. There are 3+3 inner setae. Antenna has no endopod and is as long as rostral spine. There are no legs or pleopods. Maxillipeds bear 4 swimming setae.

Stage 2. From spine to spine: 1.26-1.38 mm. in 8 specimens.

Telson is twice as long as wide. Fork is $1/4$ times longer than the rest of telson. Outer spine 1 is distinctly smaller than spine 3. There is a pair of extra inner setae. Postero-lateral spine on abdominal somite 3 is only slightly shorter than somite 4. Antenna is somewhat shorter than rostral spine. Maxillipeds bear 6 swimming setae.

Stage 3. From spine to spine: 1.56-1.86 mm. in 3 specimens.

Telson is now somewhat less than twice as long as wide. Fork is $1/2$ times more than twice as long as the rest of telson. Small leg buds are unfolded. Antennal endopod is beginning, but no pleopods are present. Maxillipeds bear 7-8 swimming setae.

Charybdis miles (DE HAAN)

The "AKA ISHIGANI" ranges from Tokyo Bay to Kyushu in Japan, further extending to Hongkong and Indian waters. They live on sandy bottoms of 10-100 meter deep, attaining 83 mm. across carapace. At Arasaki district berried females are found in gill net catches in June-July. Larval stages are not known before. Early eggs are orange-yellow and 0.31 mm. in diameter. Eggs hatched out on June 28, 1964 but none of the larvae survived beyond the first zoea.

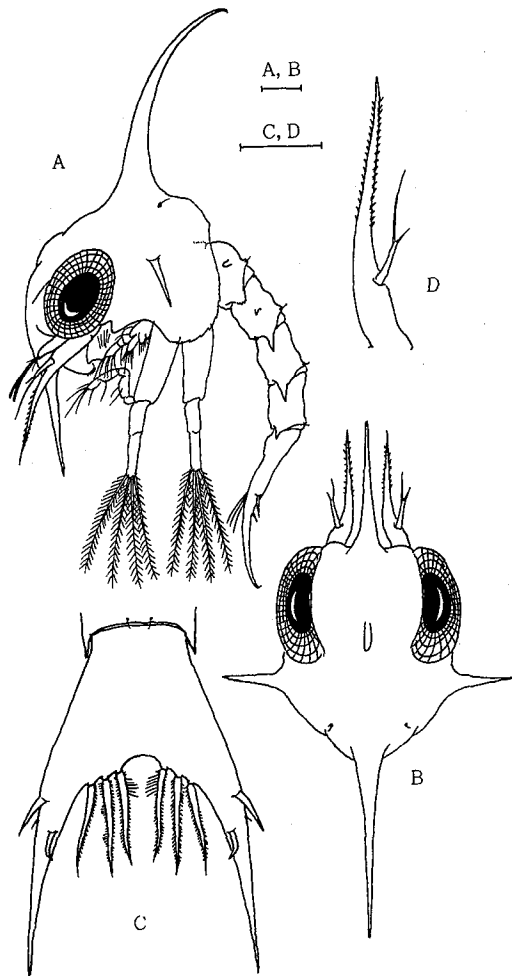


Fig. 7. *Charybdis miles*: zoeal stage 1. A, lateral; B, carapace, dorsal; C, telson, dorsal; D, antenna. Scales indicate 0.1 mm.

ZOEA (Fig. 7; A-D)

Dorsal spine is almost as long as carapace. Outer spine 2 of telson is hairlike in stage 1. Outer spine 1 is distinctly longer than spine 3 in stage 1 at least. Postero-lateral spine on somite 3 is almost as long as that on somite 4. Apical spine of antennal exopod is distinctly longer than exopod including terminal spine. Inner seta 1 of telson is somewhat less than 1/2 as long as fork, exceeding tip of outer spine 3 by its distal about 1/4. Antenna is slightly shorter than rostral spine in stage 1.

Stage 1. From spine to spine: 1.14-1.26 mm. in 10 specimens.

Telson is 3/4 times longer than wide. Fork is 1/4 times longer than the rest of telson. Postero-lateral spine on abdominal somite 3 is somewhat less than 1/2 as long as somite 4. Maxillipeds bear 4 swimming setae.

Genus *Thalamita* LATREILLE

Fourteen species of *Thalamita* are known from Japanese waters (SAKAI, 1939), of which *Th. picta*, *Th. sima* and *Th. prymna* are very common among sea weeds on rocky shores. Zoeae of the last two species are described here for the first time. Larvae of *Th. picta* are not known.

ZOEA

Zoea is very like *Portunus* and *Charybdis* in every essentials including coloration. Carapace has all the spines and an inconspicuous anterior dorsal knob. However, dorsal spine is much shorter than in the other two genera compared with carapace length. Telson has 2 or 3 outer spines, but, unlike the other two genera, spine 1 is only faintly seen or may be lacking. Spine 2 is hair-like as in the other two genera dwindling in later stages. While spine 3 is spinous in all stages. Inner seta 1 extends far beyond tip of outer spine 3. Antenna is distinctly longer than rostral spine in early stages at least, with exopod of moderate length. The armatures of abdomen, mouth parts, maxillipeds and remaining limbs are quite similar as in other two genera.

MEGALOPA

Megalopa as typified by *Th. sima* shares every essential characters in common with the other two genera, bearing one spined rostrum, coxal spine on leg 2, postero-lateral spines on abdominal somite 5, paddle shaped leg 5, sternal spines at base of leg 4, and 8 jointed antennal flagellum.

Carapace has no conspicuous protuberances. There are no ischial or carpal spines on leg 1. Sternal spine at base of leg 4 is much smaller than in the other two genera. It is hardly seen from above.

Thalamita sima H. M. EDWARD

The "FUTABA BENITSUKE" ranges from Tokyo Bay to Kyushu in Japan,

further extending widely in Indo-West Pacific, East Africa and Red Sea. They live between tide marks of rocky shores and are fairly common at Arasaki district attaining 46 mm. across carapace. Larvae are not known before. Berried females were obtained several times from gill net catches during May-June. Eggs hatched out on June 17, 1965 have been reared up to megalopa feeding on newly hatched *Artemia* nauplii.

ZOEA (Fig. 8; A-M)

Dorsal spine is not much longer than rostral spine and shorter than carapace. Postero-lateral spines on abdominal somite 3 are almost as long as or slightly longer than those of somite 4, reaching beyond hind end of somite 4 in the last stage. Antenna is longer than rostral spine in early stages, with exopod of moderate length. Apical inner spine of exopod is as long as or slightly longer than the rest of exopod including terminal spine.

Stage 1. From spine to spine: 0.96-1.07 mm. in 15 specimens.

Eyes are sessile. Abdomen is of 5 somites plus telson. Postero-lateral spine on abdominal somite 3 is almost as long as that of somite 4, and is about $\frac{2}{5}$ as long as somite 4. Telson is $\frac{3}{4}$ times longer than wide. Outer spine 1 is visible only under high magnification. Spine 2 is hair-like. Spine 3 is spinous, bending inward distally, being inserted at proximal $\frac{1}{4}$ of fork. Inner setae is 3+3. Seta 1 is $\frac{1}{2}$ as long as fork, reaching beyond tip of outer spine 3 by its distal $\frac{1}{5}$ - $\frac{1}{4}$. Antenna has no endopod, and is $\frac{1}{5}$ times longer than rostral spine. Exopod less spines is about $\frac{1}{4}$ as long as spinous process. Apical inner spine is almost as long as or slightly longer than the rest of exopod including terminal spine. Maxillipeds bear 4 swimming setae.

Stage 2. From spine to spine: 1.08-1.26 mm. in 7 specimens.

Eyes are stalked. Rostral spine is nearly as long as dorsal spine. Postero-lateral spines of abdominal somite 3 are slightly longer than those of somite 4, and are somewhat more than $\frac{1}{2}$ as long as somite 4. Telson is almost twice as long as wide. Fork is slightly longer than the rest of telson. Outer spine 1 is hardly visible. Spine 2 is hair-like but distinct. There is a pair of extra inner setae. Antenna is still longer than rostral spine. Minute leg buds are present behind rudiment of maxilliped 3. Maxillipeds bear 6 swimming setae.

Stage 3. From spine to spine: 1.64 mm. in 2 specimens.

Abdomen is of 6 somites plus telson. Telson is somewhat less than twice as long as wide. Fork is a little less than twice as long as the rest of telson. Inner seta 1 is almost $\frac{2}{3}$ as long as fork, exceeding tip of outer spine 3 by its distal $\frac{1}{3}$. Postero-lateral spines of abdominal somite 3 are about $\frac{3}{4}$ as long as somite 4. Antennal endopod is beginning. Leg buds are unjointed. There are no pleopods. Maxillipeds bear 8 swimming setae.

Stage 4. From spine to spine: 2.04-2.34 mm. in 4 specimens.

Antenna is almost as long as rostral spine. Endopod is slightly shorter than exopod less spines. Telson is $\frac{3}{4}$ times longer than wide. Outer spine 2 is very

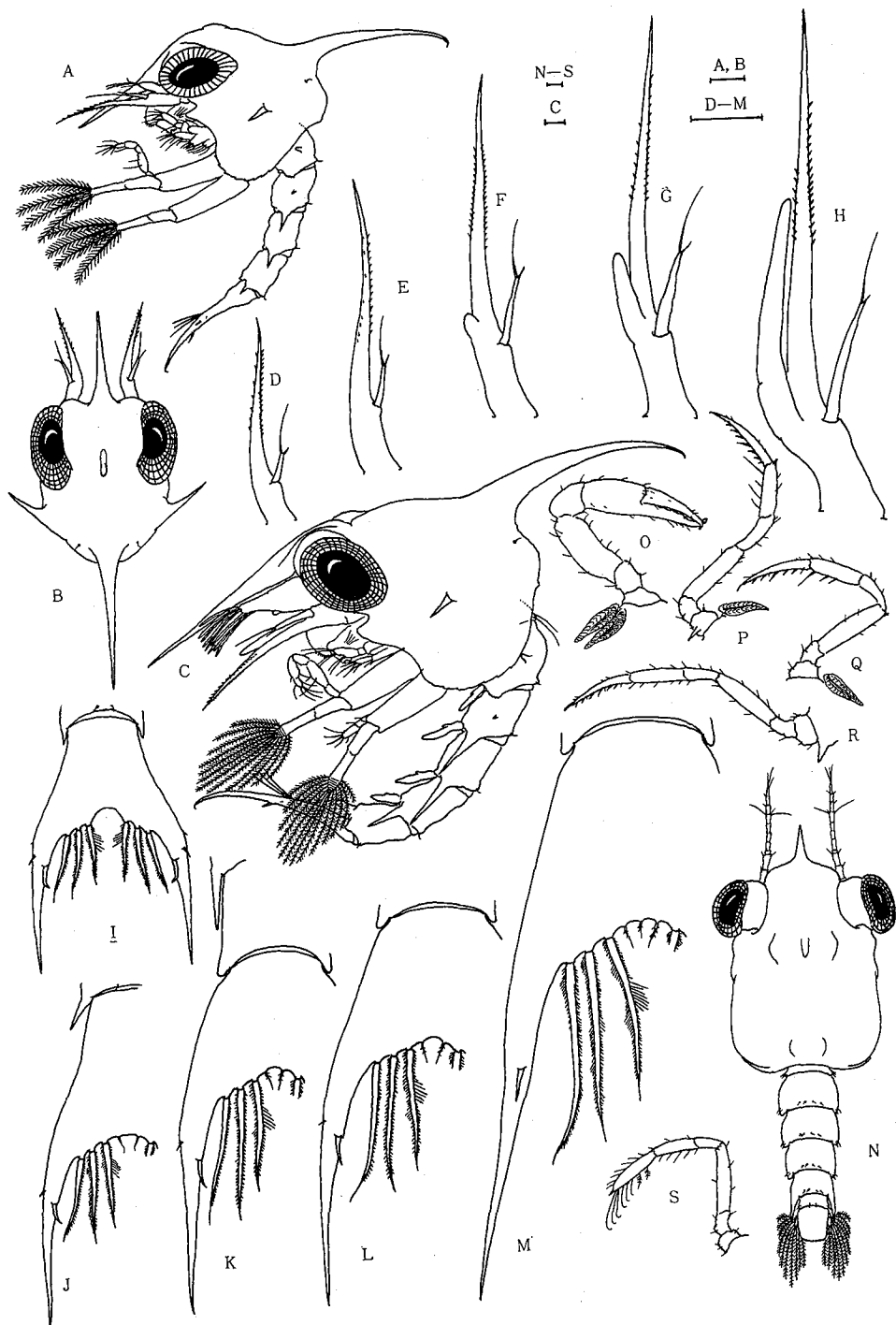


Fig. 8. *Thalamita sima*: zoeal stages 1-5 and megalopa. A, stage 1, lateral; B, the same, carapace, dorsal; C, stage 5, lateral; D-H, antenna, stages 1-5; I-M, telson, dorsal, stages 1-5; N, megalopa, dorsal; O-S, the same, legs 1-5. Scales indicate 0.1 mm.

minute but still visible. Postero-lateral spines of abdominal somite 3 are about $7/8$ as long as somite 4. Leg buds are large but unjointed. There are pleopod buds. Maxillipeds bear 9-10 swimming setae.

Stage 5. From spine to spine: 2.6-2.9 mm. in 2 specimens.

Antenna is somewhat shorter than rostral spine, with endopod which is longer than exopod. Exopod less spines is slightly less than $1/3$ as long as spinous process. Apical inner spine is $3/4$ - $3/5$ as long as the rest of exopod less terminal spine. Postero-lateral spine on abdominal somite 3 reaches beyond hind end of somite 4. Telson is a little more than twice as long as wide with 3 extra inner setae. Fork is $3/4$ times longer than the rest of telson. Outer spine 2 disappears. Maxilliped 3 and legs are large and jointed, though not yet functional. Pleopods are as long as respective somite. Maxillipeds bear 11-12 swimming setae.

MEGALOPA (Fig. 8; N-S)

Carapace length: 1.71 mm., Total length: 2.85 mm. Central spine of rostrum is about $1/2$ as long as the rest rostrum. Carapace has no conspicuous protuberances or dorsal spines. Postero-lateral spine on abdominal somite 5 reaches to about middle of telson. Uropod bears 1 seta on protopod and 10 setae on exopod. Antennal flagellum exceeds tip of rostrum by its distal 4 segments. Leg 1 has no spines. Leg 2 has a spine on coxa. Sternal spine at base of leg 4 is much smaller than in *Portunus* and *Charybdis*. Dactylia of legs 2-4 bear 6 spinules along their ventral edges. Last segment of leg 5 is paddle shaped with feelers.

Thalamita prymna (HERBST)

The "BENITSUKE GANI" lives on rocky shores of 20-30 meters deep, and also between tide marks. They range widely in Indo-West Pacific, East Africa and Red Sea attaining 75 mm. across carapace. A berried female was separated from gill net catches at Arasaki district, and the egg hatched out on August 10, 1967. But none of the larvae survived beyond the first zoea.

ZOEA (Fig. 9; A-D)

Zoea is so much like *Th. sima* in every details that it is almost impossible to tell them apart except size. The first stage zoea of this species is somewhat larger than corresponding stage of *Th. sima*.

Dorsal spine is much shorter than carapace. Postero-lateral spines on abdominal somites 3-5 are of moderate length from stage 1, those of somite 3 are as long as those of somite 4. Outer spine 1 of telson may be seen under high magnification at least in stage 1, spine 2 is hair-like, while spine 3 is spinous bending inward distally. Inner seta 1 exceeds well beyond tip of outer spine 3. Antenna is longer than rostral spine in stage 1 at least. Apical inner spine is distinctly longer than the rest of exopod including terminal spine.

Stage 1. From spine to spine: 1.08-1.20 mm. in 5 specimens.

Rostral spine is about $3/5$ as long as carapace and dorsal spine is $3/4$ as long

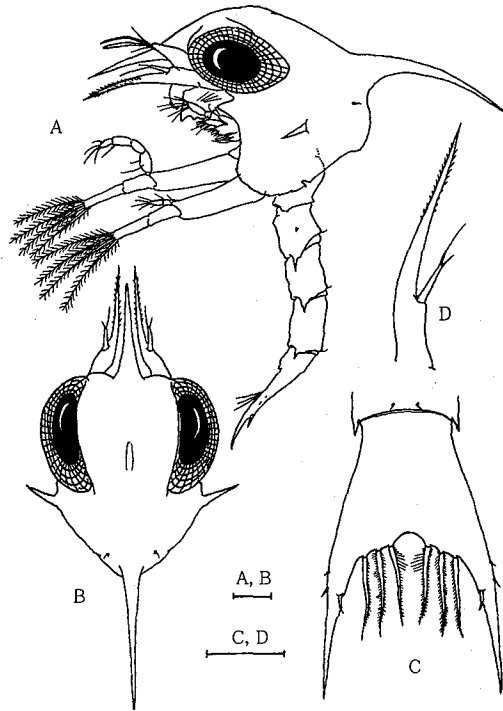


Fig. 9. *Thalamita prymna*: zoeal stage 1. A, lateral; B, carapace, dorsal; C, telson, dorsal; D, antenna. Scales indicate 0.1 mm.

as the latter. Postero-lateral spine on abdominal somite 3 is $\frac{2}{5}$ as long as somite 4. Telson is slightly less than twice as long as wide. Fork is about $\frac{1}{5}$ times longer than the rest of telson. Inner seta 1 reaches beyond tip of outer spine 3 by its distal about $\frac{1}{3}$. Antenna has no endopod. There are no legs or pleopods.

DISCUSSION

RAJA BAI NAIDU (1955) described and figured first zoea of *Scylla serrata* hatched from egg in the the laboratory, which is very like *Portunus* in every essentials including the armature of telson, bearing spinous outer spines 1 and 3, lacking spine 2. It differs, however, from the other known zoea of Portuninae in the armatures of abdominal somites. Postero-lateral spines on abdominal somites 3 and 4 are very small without accessory denticles and sides of somite 5 are rounded behind in stage 1 at least. In *Portunus gladiator* these armatures are also very small but accompanied by accessory denticles and sides of somite 5 are pointed behind as in the preceeding somites. In addition, zoea of *Scylla* has maxillular endopod bearing 4 setae, instead of 6 setae as in other Portuninae.

The zoeae of Portuninae including *Scylla* may be distinguished from all the

known zoeae of Brachyura by the following criteria.

1. Carapace has all the spines 2
 Carapace lacks certain of the spines non Portuninae
 (including Portunidae: Carcininae, *Carcinus* and Portuninae, *Portunus*)
2. Telson is typically forked 3
 Telson is not typically forked non Portuninae
3. Antenna is of moderate length with spinous process bearing two rows
 of spinules and endopod ending in a short spine and one long apical
 inner spine 4
 Antenna is rudimentary, or of moderate length with spinous process
 bearing more than two rows of spinules, and exopod being spinous as
 a whole with two or more lateral spines or ending in a short terminal
 spine and two apical inner spines non Portuninae
 (including Portunidae, Macropipinae: *Macropipus*)
4. One pair of lateral hooks only on abdominal somite 2
 Cancridae: *Cancer* (LEBOUR, 1928; AIKAWA, 1937)
 Corystidae: *Corystes* (LEBOUR, 1928, INGLE & RICE, 1971)
 More than one pair of lateral hooks on abdominal somites 5
5. Four pairs of lateral hooks on abdominal somites 2-5
 Grapsidae, Plagusiinae: *Plagusia* (KURATA, unpublished)
 Portunidae, Macropipinae: *Ovalipes*
 Two pairs of lateral hooks on abdominal somites 2 and 3 6
6. Rostral spine of carapace distinctly bends upward. Postero-lateral spines
 of abdominal somites 3-5 are robust, ending in a blunt tip and not much
 different in length one another
 Parthenopidae, Parthenopinae:
 *Lambrus* (KURATA, unpublished) and *Parthenope* (YANG, 1971)
 Rostral spine of carapace is almost straight. Postero-lateral spines of
 abdominal somites 3-5 are slender, ending in a pointed tip. Spines of
 somite 5 are much shorter than those of somites 3 and 4 7
7. Telson outer spines 1 and 3 are inserted close each other near the base
 of fork, spine 1 well exceeding insertion of spine 3. Apical inner
 spine of antennal exopod is very long, being more than 1/2 as long as
 spinous process Calappidae, Calappinae:
 *Calappa* (AIKAWA, 1937; RAJA BAI, 1959; KURATA, unpublished)
 and *Hepatus* (COSTLOW & BOOKHOUT, 1962; KURATA, 1970)
 Telson outer spines 1 and 3 are set apart each other, spine 1 hardly
 exceeding insertion of spine 3. Apical inner spine of antennal exopod
 is relatively short, being less than 1/2 as long as spinous process
 Portunidae, Portuninae:
 *Scylla*, *Portunus*, *Charybdis*, *Thalamita*, and *Callinectes*

Among the family Portunidae certain other genera are more or less known of their larval stages. They may be distinguished from the three genera described here by the following characters.

Zoeae of *Carcinus* (WILLIAMSON, 1903) and *Portumnus* (LEBOUR, 1944) differ from all the other known Portunidae in lacking lateral spines on carapace. Among Macropipinae, *Ovalipes* (COSTLOW & BOOKHOUT, 1969) differs from the other known members of the subfamily in bearing 4 pairs of lateral hooks on abdominal somites 2-5. *Macropipus* (LEBOUR, 1928 as *Portunus*; GOLDSTEIN, 1971) has antennal exopod ending in two or three spines of varied length. Telson has three pairs of outer spines which are all spinous and not very much different in length one another, excepting *M. puber* in which spine 2 disappears in later stages. Postero-lateral spines on abdominal somites 3-5 are accompanied with accessory denticles in all stages. Lateral hooks on abdominal somite 3 disappear in later stages. According to LEBOUR (1928, 1944) *Polybius* resembles *Macropipus* very closely and no characters could be found to tell them apart. In *Bathynectes* (ROBERT, 1969), outer spine 1 of telson is very much longer than the other two and all the spines are distinctly spinous in all stages.

Zoea of *Callinectes* (COSTLOW & BOOKHOUT, 1959; KURATA, 1970) is very like *Portunus* in every details. The other American species of *Portunus* so far known have a general characters of the genus (KURATA, 1970). Thus, the zoeae of the known Portuninae as a whole seem to differ from the other members of Portunidae in the condition of the outer spine 2 of telson. It is minute or absent in all the known Portuninae, while is large and spinous in all stages in other members of Portunidae except *Macropipus puber*.

The outer spine 1 of telson is minute or absent in *Thalamita*, is spinous but tends to be smaller than spine 3 in *Charybdis* and is always larger than spine 3 in *Scylla*, *Callinectes* and *Portunus*.

Key to the known zoeae of Japanese genera of Portuninae

1. Outer spine 1 of telson is distinct and spinous. Dorsal spine is not much shorter or even longer than carapace 2
 Outer spine 1 of telson is hair-like or absent. Dorsal spine is much shorter than carapace *Thalamita*
2. Outer spine 1 of telson is level at insertion with that of inner seta 1, except in later stages of *P. pelagicus*. Spine 1 is much longer than spine 3 *Portunus*
 Outer spine 1 of telson is distinctly behind at insertion to that of inner seta 1. Outer spine 1 is about as long as or much shorter than spine 3, except in stage 1 *Charybdis*

Key to the known zoeae of Japanese species of *Portunus*

1. Antennal exopod less spines is of moderate length being at least 1/5 as

- long as spinous process. 2
- Antennal exopod less spines is very short, being less than 1/10 as long as spinous process *P. sanguinolentus*
2. Antenna is longer than rostral spine. Apical inner spine of antennal exopod is about twice as long as the rest of exopod less terminal spine. Postero-lateral spines on abdominal somites 3-5 bear accessory denticles *P. gladiator* (stage 1 only)
- Antenna is more or less shorter than rostral spine. Apical inner spine of antennal exopod is much less than twice as long as the rest of exopod less terminal spine. Postero-lateral spine on abdominal somites 3-5 is simple without accessory denticles 3
3. Outer spine 1 of telson almost reaches insertion of spine 3. Apical inner spine of antennal exopod is longer than the rest of exopod including terminal spine *P. hastatoides* (stage 1 only)
- Outer spine 1 of telson ends before the insertion of spine 3. Apical inner spine of antennal exopod is nearly as long as or shorter than the rest of exopod including terminal spine. 4
4. Inner seta 1 of telson reaches well behind tip of outer spine 3. Insertion of outer spine 1 is level with that of inner seta 1. Rostral spine is shorter than carapace. Antenna is slightly shorter than rostral spine *P. trituberculatus*
- Inner seta 1 of telson only slightly exceeds tip of outer spine 3. In later stages insertion of outer spine 1 is behind that of inner seta 1 and rostral spine is longer than carapace. Antenna is much shorter than rostral spine *P. pelagicus*

Key to the known zoeae of Japanese species of Charybdis

A. Stage 1.

1. Antenna is almost as long as rostral spine. Inner seta 1 of telson reaches behind tip of outer spine 3 2
- Antenna is about 2/3 as long as rostral spine. Inner seta 1 of telson does not exceed tip of outer spine 3. Dorsal spine is much longer than carapace *Ch. japonica*
2. Dorsal spine is almost as long as or shorter than carapace. Outer spine 1 of telson is longer than spine 3 3
- Dorsal spine is somewhat longer than carapace. Outer spine 1 of telson is shorter than spine 3 *Ch. truncata*
3. Dorsal spine is almost as long as carapace 4
- Dorsal spine is distinctly shorter than carapace *Ch. bimaculata*
4. Inner seta 1 of telson exceeds tip of outer spine 3 by its distal 1/4. Apical inner spine of antennal exopod is longer than the rest of exopod including terminal spine. Postero-lateral spines on abdominal somite

3 are nearly as long as those of somite 4 *Ch. miles*
 Inner seta 1 of telson only slightly exceeds tip of outer spine 3.
 Apical inner spine of antennal exopod is almost as long as the rest of
 exopod including terminal spine. Postero-lateral spines on abdominal
 somite 3 are shorter than those of somite 4 *Ch. acuta*

B. Stage 2 and later.

(*Ch. miles* is not known)

1. Rostral spine is longer than carapace. Outer spine 1 of telson is much shorter than spine 3. Inner seta 1 only slightly exceeds tip of outer spine 3. Postero-lateral spines of abdominal somite 3 are somewhat shorter than those of somite 4. Antenna is very much shorter than rostral spine *Ch. japonica*
 Rostral spine is not longer, usually much shorter, than carapace.
 Postero-lateral spines of abdominal somite 3 are almost as long as or longer than those of somite 4 2
2. Outer spine 1 of telson is much shorter than spine 3. Inner seta 1 of telson only slightly exceeds tip of outer spine 3 *Ch. truncata*
 Outer spine 1 of telson is almost as long as spine 3. Inner seta 1 well exceeds tip of outer spine 3 3
3. Telson fork is less than 1/3 longer than the rest of telson in stage 2, and is not longer than twice the latter in later stages. Dorsal spine is almost as long as or longer than carapace. *Ch. bimaculata*
 Telson fork is more than 1/3 longer than the rest of telson in stage 2, and much longer than twice the latter in later stages. Dorsal spine is much shorter than carapace. *Ch. acuta*

Megalopa of Portuninae may be distinguished easily from the other groups of crabs by the following characters.

1. Paddle shaped leg 5 bearing feelers.
2. One spined rostrum sticking out almost horizontally.
3. Absence of dorsal spines and conspicuous protuberances on carapace.
4. Presence of postero-lateral spines on abdominal somite 5.
5. Antennal flagellum of 8 segments with a pair of long setae at distal end of segment 5.
6. Presence of coxal spine on leg 2.
7. Presence of a pair of large sternal spines (cornua) sticking out behind at the bases of leg 4.

The last mentioned character is quite unique and outstanding since in no other known megalopae these armatures have been observed. The cornua are also present in *Callinectes* (COSTLOW & BOOKHOUT, 1959; KURATA, 1970) but absent in *Macropipus* and *Portumnus* (LEBOUR, 1028; GOLDSTEIN, 1971).

Megalopae of the three genera described here may be distinguished from one another by the armatures of leg 1. *Portunus* has a hook-like spine on ischium

and carpus, *Charybdis* on ischium only, while in *Thalamita* both spines are absent. The cornua are very long in *Portunus*, of moderate length in *Charybdis* and small in *Thalamita*.

SUMMARY

Larval stages are described in detail of two species of *Portunus*, three species of *Charybdis* and two species of *Thalamita*. All the larvae were hatched from eggs and reared in the laboratory. A tentative key to the known zoeae of Japanese genera and species of Portuninae has been presented and diagnostic characters of megalopa of Portuninae are summarized.

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相模湾荒崎産カニ類の幼生 -V. Portuninae 亜科のわたりがに類

倉 田 博

わたりがに類幼生はガサミ、タイワンガザミ、イシガニなどが一応知られている。しかし、主として飼育技術開発に関心のまどがしぼられていたため、自然での生態調査に不可欠なプランクトン標本の同定のための知見は極めて不十分である。

本報告では、日本産 Portuninae 亜科のうち主要な部分を占める *Portunus*, *Charybdis* および *Thalamita* 3 属の幼生について、飼育材料に基づく形態観察結果の詳細を記載し図解した。さらに、既往の文献を参考にして、知られている限りの Portuninae ゾエアについて、ほかのカニ類との識別法、属の検索表、*Portunus* と *Charybdis* の種の検索表を示し、メガロパの形態的識別点を整理した。

Portuninae 亜科の幼生は、いわゆる基本的な特徴に関しては類似性が非常に顕著である。従って、全体としてほかのカニ類との識別は比較的容易である反面、亜科内種間の識別は相当細かい特徴にまで立入らないと難しい。