JUVENILE MORPHOLOGY OF THE RARE BURROWING MUD SHRIMP NAUSHONIA CRANGONOIDES KINGSLEY, WITH A REVIEW OF THE GENUS NAUSHONIA (DECAPODA: THALASSINIDEA: LAOMEDIIDAE)

Joseph W. Goy and Anthony J. Provenzano, Jr.

Abstract.—The status and history of the genus Naushonia is reviewed. Early juvenile stages of N. crangonoides reared in the laboratory from larvae captured in the plankton afforded an opportunity to evaluate changes in morphology with size. The fifth juvenile stage is described in detail and compared with adults. Some taxonomic characters used previously to discriminate species within this genus are invalid but others allow separation of the species. Comparisons of N. crangonoides with the two other American species and with description of the Red Sea species permitted the construction of a key for the identification of the known species of the genus.

Introduction

The genus Naushonia was erected by Kingsley (1897) for a small male shrimp found by Professor Hermon C. Bumpus in the sand of the channels of the Island of Naushon off the coast of Massachusetts. Kingsley named this shrimp Naushonia crangonoides because of certain morphological similarities to the Crangonidae, but noted differences which might subsequently justify the establishment of a new family. A short note was published by Gray (1901) on a second specimen of this species, an ovigerous female, collected by himself in the sand of the shore of Ram Island, near Woods Hole, Massachusetts. Thompson (1903) redescribed these two specimens and also described some unusual late larval stages taken in the plankton off Woods Hole. Some of them metamorphosed in the laboratory allowing him to attribute these planktonic larvae to N. crangonoides. Thompson remarked on the similarity of his zoeae to those of Calliaxis adriatica (=Jaxea nocturna) from the Mediterranean, and suggested placing Naushonia in the Family Laomediidae of the Thalassinidea.

Chace (1939) synonymized with Naushonia the genus Homoriscus Rathbun, containing two species, H. portoricensis (Rathbun, 1901) and H. maginetei (Glassell, 1938) and included Coralliacrangon perrieri (Nobili, 1904) in Naushonia as well. Chace devised a tentative key to separate the four
species and stated the need for a re-examination of the Massachusetts (N. crangonoides) and Red Sea (N. perrieri) species. From the descriptions and illustrations of N. crangonoides by Kingsley (1897) and Thompson (1903), it is difficult to differentiate this type-species of the genus from the other three known species.

In a previous paper (Goy and Provenzano, 1978), we redescribed the early larval development of N. crangonoides. During that study, we reared the fifth juvenile stage of N. crangonoides from captured planktonic first stage zoae. We take this opportunity to present a description and illustrations of the juvenile morphology of N. crangonoides, to compare it with adult specimens and to summarize the differences between the four known species of the genus.

Acknowledgments

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Methods and Material

In our earlier paper, we mentioned that some individuals lived beyond the postlarval stage. Of these, two individuals survived to the fourth juvenile stage and one molted to the fifth juvenile stage. These animals provided basic material for the study of the very early juvenile morphology described herein. USNM refers to catalog numbers of the National Museum of Natural History, Smithsonian Institution, and UNC-IMS to catalog numbers of the University of North Carolina Institute of Marine Science. The description of the Naushonia crangonoides postlarva has been presented earlier (Goy and Provenzano, 1978).

Juveniles and exuviae of known history were preserved in 70% ethyl alcohol. Dead animals were heated slowly in 5% KOH for approximately ten minutes to remove tissue from the exoskeleton. These specimens and all casts from molted animals were stained in either Mallory's Acid Fuchsin Red or Chlorazol Black E (1% in 70% Alcohol). Appendages were dissected in lactic acid and mounted in glycerin jelly. Drawings were made with the aid of a camera lucida; measurements were made with the aid of a stage micrometer. Carapace length (CL) was measured from tip of rostrum to the posterolateral margin of the carapace. Total length (TL) was measured from the tip of the rostrum to the most posterior margin of the telson, and excluded all telson processes and setae.

Juvenile Stages of Naushonia crangonoides

In the first few molts after the postlarval stage, Naushonia crangonoides does not change drastically. There is a gradual development of adult characters, and the major morphological changes that occur from the postlarval stage through the fifth juvenile stage.

The telson and uropods are unchanged until the fourth juvenile stage is reached.

In the first juvenile stage, the antennule is similar to that of the postlarva, but the 6 aesthetasc are now located on the external flagellum, 2 per segment. This appendage is reduced in the second juvenile stage.

The antenna of the first juvenile stage is unchanged from the postlarval stage, except that there are 20 plumose setae on the external flagellum. The antenna of the second juvenile stage has the external flagellum, 2 per segment. This appendage also remains unchanged until the fourth juvenile stage.

The maxillule of the juvenile stages is unchanged from the postlarval stage. The maxilla of the juvenile stages is also similar to that of the postlarva. The maxillae of the juvenile stages show the most significant changes with each succeeding molt. The postlarval stage has symmetrical maxillae with the cutting edge provided with 4 small teeth. The palp is developed but unsegmented, bearing a minute seta terminally. In the first juvenile stage, the palp has a cutting edge with 8 terminal and 2 subterminal setae. The palp of the second juvenile stage bears 14 terminal spines. In the third juvenile stage, the cutting edge of the mandible (Fig. 1B) has a small medial tooth, and the palp is still unsegmented but now bears 2 setae terminally. In the fourth juvenile stage, the cutting edge has 10 small terminal teeth and the palp is developed but not segmented. In the fifth juvenile stage, the palp has 14 terminal spines, and the palp is now 2-segmented with the first segment bearing 2 setae terminally. The second segment of the palp bears 14 terminal spines. The mandible (Fig. 1D) has a cutting edge with 8 terminal and 2 subterminal spines. In the second juvenile stage, the cutting edge of the mandible (Fig. 1C) has a cutting edge with 8 terminal and 2 subterminal spines. The palp is developed but not segmented. In the fourth juvenile stage, the cutting edge has 10 small terminal teeth and the palp is developed but not segmented. In the fifth juvenile stage, the cutting edge has 10 small terminal teeth and the palp is developed but not segmented.

The maxillae of the juvenile stages show the most significant changes with each succeeding molt. The maxilla of the juvenile stages is similar to that of the postlarval stage, except more spines and plumose setae develop on the coxal and basal endites with each succeeding molt.

The maxillae of the juvenile stages are also similar to the postlarval stage, except that the cutting edge of the maxillary palp has 8 terminal and 2 subterminal spines. The maxilla of the juvenile stages shows the most significant changes with each succeeding molt. The maxillary palp of the postlarval stage has 8 terminal and 2 subterminal spines. The maxillary palp of the first juvenile stage has 14 terminal spines. The maxillary palp of the second juvenile stage has 14 terminal spines. The maxillary palp of the third juvenile stage has 14 terminal spines. The maxillary palp of the fourth juvenile stage has 14 terminal spines. The maxillary palp of the fifth juvenile stage has 14 terminal spines. The maxillary palp of the fifth juvenile stage is developed but unsegmented. The maxillary palp of the sixth juvenile stage is developed but unsegmented.
juvenile stage the long tapering proximal lobe of the scaphognathite has developed 5 long whip-like plumose setae.

The first maxilliped shows some significant changes with each successive molt past the postlarva. In the first juvenile stage, the basipodite and endopodite remain unchanged from the postlarva. The expodite is still 3-segmented with the proximal segment now bearing 12 plumose setae and the terminal segment having 3 long plumose setae. The epipodite is large, serrate and triangular. In the second juvenile stage, the endites of the basipodite increase their numbers of setae and the endopodite is now 2-segmented with the distal segment enlarged, rounded and bearing 5 plumose setae. The exopodite is now 5-segmented with the terminal segment bearing only 2 long plumose setae. The first maxilliped does not show further change until the fifth juvenile stage.

The second maxilliped shows a more gradual change to the adult appendage after the postlarval stage. In the first juvenile stage, the endopodite becomes 5-segmented but the rest of the appendage is unchanged from the preceding stage. By the second juvenile stage, the endopodite has the penultimate segment expanded and the exopodite bears 5 long plumose setae.

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**Fig. 1.** *Naushonia crangonoides*: Mandibles of postlarva (A); First juvenile (B); Second juvenile (C); Third juvenile (D); Fourth juvenile (E); and Fifth Juvenile (F).

**Fig. 2.** *Naushonia crangonoides*: Fifth juvenile stage: Left Antenna (C); and Antennule (D).
on the terminal segment. This maxilliped does not change considerably until the fifth juvenile stage.

The third maxilliped is unchanged from the postlarval stage in the first juvenile stage, except there are now 2 long plumose whip-like setae on the basipodite and the ischium distally bears 5 teeth. There is also an increase in setae on the segments of the endopodite. In the second juvenile stage, the teeth of the serrate ischium increase to 10 but the remainder of the appendage is the same until the fifth juvenile stage.

None of the pereiopods changes significantly after the postlarval stage, but all gradually become larger and more setose.

The pleopods remain unchanged from the postlarva until the fifth juvenile stage.

Fifth Juvenile Stage

The one animal that molted to this stage (TL 6.0 mm, CL 2.3 mm) died after 15 days.

Carapace (Figs. 2A, 2B) cylindrical, depressed in front with rostrum slightly down curved. Rostrum triangular, flat, extending beyond eyes with finely serrate recurved borders. Anterior borders of carapace serrate with supraorbital and antennal spines. Dorsal and branchial areas distinguished by straight, prominent, longitudinal groove (linea thalassinica) and cervical groove also well marked in middle. Carapace smooth except along grooves and ridges, with posterior margin bearing 20 fine hairs. Eyes still visible from above with minute pigment spot.

Abdomen about a third longer than carapace, smooth without spines or carinae. Borders of pleura of first and sixth segments truncate, those of other segments rounded.

Peduncle of antennule (Fig. 2D) composed of 4 segments extending beyond front of eyes. Proximal segment with 14 long plumose setae on outer margin and ring of 12 setae subterminally on inner edge. Second segment ends in 2 spines and bears 5 feathered setae on outer margin, 1 medially and 1 terminally. Third segment ends in spine on inner border with medial spine and bears 5 plumose terminal setae. Fourth segment with 2 medial and 3 terminal plumose setae. External flagellum of 5 segments, with first segment lacking setae or aesthetasc. Next 3 segments each bear 2 aesthetascs on outer margin and 4, 1 and 3 setae respectively. Terminal segment with 3 plumose setae at apex. Inner flagellum 4-segmented with 2 setae on each segment, but terminal segment bearing 4 setae.

Peduncle of antenna (Fig. 2C) with 5 segments. First segment with 2 spines on outer margin, 1 spine on inner margin, and bearing antennal scale. Next 2 segments with spine on each margin while penultimate and ultimate segments lack spines or setae. Antennal scale ovate with 5 outer teeth, 7
outer setae and 17 plumose setae on inner margin tapering consisting of 51 segments, most having cirri.

Mandible (Fig. 1F) with only 2 large and 6 small setae.

Palp 3-segmented, with second segment having 1 terminal segment bearing 24 spines.

Maxillule (Fig. 3B) with 2-segmented endopodite segment and with first segment bearing plumose setae on inner margin. Basipodite bearing 4 teeth and 2 plumose setae. Coxal endite with 30 feathered setae marginally and submarginally. Endite with 30 feathered setae marginally and submarginally; terminally 19 stout teeth and 3 long plumose and 9 shorter plumose setae.

Maxilla (Fig. 3A) with following setation on 4 inner lobes of coxal endite: 8 on distal lobe; 15 on proximal lobe; 21 on distal lobe. Unsegmented endopodite bearing 4 plumose setae and 2 proximally on outer margin, and 2 plumose setae. Scaphognathite broad with 60 plumose setae on outer margin; 22 minute setae on inner margin. Long tapering proximal lobe bearing 4 plumose setae and 3 longer, whip-like plumose setae.

First maxilliped (Fig. 3C) with 2-lobed basipodite bearing 20 plumose setae and 21 shorter non-plumose setae; endopodite bearing 5 plumose setae and 8 setae. Endopodite 7-segmented with proximal segment with 30 feathered setae on outer margin. Last 5 segments each with long plumose setae on both sides near base, except terminal segment bearing long plumose setae at apex. Epipodite large, serrate and mastigobranch.

Second maxilliped (Fig. 4B) with 5-segmented endopodite segment slightly expanded. These segments bearing proximally to distally as follows: 4; 24; 2; 10; 5 plumose setae. Endopodite 7-segmented with first segment having numerous short plumose setae; terminal segment bearing long plumose setae; terminal setae at apex. Epipodite heavily serrate, with 2 arthrobranchs.

Third maxilliped (Fig. 4C) having endopodite of first maxilliped bearing 13 prominent teeth on inner border and 24 plumose setae. Second segment with 3 prominent teeth on outer margin; plumose setae; other 3 segments heavily setose. Endopodite 7-segmented with last 4 segments bearing long plumose setae, serrate-margined mastigobranch and podobranch segments on third maxilliped.

Fig. 4. *Neanthes crangonoides*: Fifth juvenile stage appendages: Telson (A); Second maxilliped (B); and Third maxilliped (C).
Telson (Fig. 4A) with rounded end, no longer possessing spine at each external angle as in postlarval and preceding juvenile stages. Outer margin bearing 40 plumose setae with numerous submarginal and medial shorter setae. Uropods with serrate transverse sutures on both rami that end with external spine. Endopodite and exopodite both with 40 plumose setae on outer borders. Exopodite also with six plumose setae submarginally and five external spines ending in a stout movable spine.

Chelipeds (Fig. 5A) large, slender, subchelate. Ischium slightly smaller than merus with 5 small teeth on inner border. Merus with 2 small outer teeth and 4 small inner teeth plus large spine near apex. Carpus triangular in outline, articulating with propodus by 2 tubercles. Propodus setose, elongate, bearing 3 prominent teeth and 6 smaller teeth on distal inner margin, 2 small teeth terminally, and 13 small teeth along entire length of outer border. Dactylus bent at base almost at right angle, very slender and falcate, and with sharp margins, outer of which fringed with long setae. Two arthrobranchs, small podobranch, and slender mastigobranch present.

Second pereiopods (Fig. 5B) short, flattened and setose on ventral margin. Dactylus robust, bearing 10 small teeth on inner margin and numerous long setae on outer margin.

Third pereiopods (Fig. 5C) longer than fourth and fifth legs (Figs. 5D, 5E) but all 3 pairs slender with long propodi and arcuate dactyli; those of third pair bearing 18 small teeth on inner margins. Two arthrobranchs on second, third and fourth pairs of pereiopods, small podobranch on second and third pairs, and slender mastigobranch on all 3 pairs. No gills on fifth pereiopods.

Pleopods (Figs. 5F, 5G, 5H, 5I) absent on first abdominal somite but present on second to fifth somites. Pleopods biramous, lanceolate and without stylambs. Endopodites and exopodites with 12 and 14 long plumose setae respectively.

Museum Specimens

*Naushonia crangonoides*

1.—CL 7.5 mm; TL 21.0 mm. (USNM 34143). Male. Eyes barely visible from above. No spines on telson. Uropods with complete transverse sutures, exopod with 5 spines on lateral margin ending in a strong movable spine. Antennal scale margin with 11 teeth. Mandibular palp 2-segmented. Third pereiopod has 12 and fourth pereiopod has 7–10 movable spines on outer margins of dactyli.

2.—CL 6.5 mm; TL 17.5 mm. (USNM 102277). Female. Eyes visible from above. Telson, uropods, antennal scale and mandibular palp same as above. Third pereiopod has 20 and fourth pereiopod has 12 movable spines on dactyli.

3.—CL 10.0 mm; TL 25.0 mm. (USNM 102279). Female. Eyes not visible
from above. Telson, uropods, antennal scale and mandibular palp same as above. Third pereiopod has 24 and fourth pereiopod has 15 movable spines on dactyli.

4.—CL 11.0 mm; TL 27.0 mm. (USNM 102280). Female. Eyes not visible from above. Telson, uropods, antennal scale and mandibular palp same as above. Third pereiopod has 20 and fourth pereiopod has 14 movable spines on dactyli.

5.—CL 4.5 mm; TL 11.0 mm. (UNC-IMS 254). Female. Eyes visible from above. Telson and uropods same as above. Antennal scale margin with 7 teeth. Mandibular palp 3-segmented. All pereiopods missing.

Naiishonia portoricensis

1.—CL 6.3 mm; TL 14.5 mm. (USNM 23782). Female. Type of Homoriscus (=Naiishonia) portoricensis. Eyes visible from above. Telson with spine on lateral margin. Uropods with complete sutures, exopod with 2 spines on lateral margin ending in a strong movable spine. Antennal scale margin with 6 teeth, distal tooth largest and curved inward. Mandibular palp 3-segmented. All pereiopods missing.

2.—CL 4.2 mm; TL 12.0 mm. (USNM 155101). Male. Eyes visible from above. Telson, uropods, antennal scale and mandibular palp same as above. Third pereiopod has none and fourth pereiopod has 20 movable spines on dactyli.

3.—CL 2.0 mm; TL 5.6 mm. (USNM 155101). Male. Eyes visible from above. No spines on telson. Uropods and mandibular palp same as above. Antennal scale margin with only 4 teeth. All pereiopods missing.

Naiishonia macginitei

1.—CL 7.6 mm; TL 19.0 mm. (USNM 171605). Ovigerous female. Paratype of Homoriscus (=Naiishonia) macginitei. Eyes visible from above. Telson with 3 spines on lateral margin. Uropods with incomplete transverse sutures, exopod with 2 spines on lateral margin, ending with 2 small spines and a large movable spine. Antennal scale margin with 7 teeth. Mandibular palp 3-segmented. Third pereiopod has 20–22 and fourth pereiopod has 18 movable spines on dactyli.

2.—CL 7.5 mm; TL 18.2 mm. (USNM 171604). Female. Eyes visible from above. Telson, uropods and mandibular palp same as above. Antennal scale margin with 8 teeth. Third pereiopod has 20–24 and fourth pereiopod has 16 movable spines on dactyli.

3.—CL 7.5 mm; TL 19.1 mm. (USNM 144492). Female. Eyes visible from above. Telson, uropods and antennal scale same as paratype. Third pereiopod has 22 movable spines on dactyli. Fourth pereiopod missing.

4.—CL 6.5 mm; TL 17.2 mm. (USNM 144492). Female. Eyes visible from above. Telson, uropods and mandibular palp same as paratype. Antennal scale margin with 8 teeth. Third pereiopod has 24 and fourth pereiopod has 15 movable spines on dactyli.

Systematic Position of Naiishonia

Order Decapoda
Supersection Macrura Reptantia
Section Thalassinidea

The Decapod section Thalassinidea is considered to be much different from other groups of decapods. It is characterized by a well calcified, symmetrical, extended, often feebly calcified abdomen ending in a well-developed tail fan; first pereiopods chelate or subchelate or simple, and third legs always non-chelate. There are 6 families and 29 genera in the family Laomediidae, and the simple instead of subchelate last pereiopods.

Family LAOMEDIIDAE Borradaile 1908

The family Laomediidae at present consists of 8 described species. According to Wear and Yaldwyn (1966), there are 2 subfamilies: Laomediinae and Naushoniinae. The family Laomediidae is characterized by having a linea thalassinica; first legs subchelate; second pereiopods subchelate or simple; pleopods with transverse sutures; podobranchs on at least second and third maxillipeds and first and second pereiopods. Wear (1972), all examined adult species of the family Laomediidae have 18 gills. Therefore, in the present study, all adult species of the family Laomediidae have 18 gills. There are only Javea, Laomedia, and Naiishonia are included.
The genus Nausionia Kingsley, 1897 is known from 4 species: *N. crangonoides* from off Massachusetts (Kingsley, 1897); *N. portoricensis* from Puerto Rico (Rathbun, 1901); *N. perrieri* from the Red Sea (Nobili, 1904); and *N. macginitiei* from southern California (Glassell, 1939). Larval stages probably belonging to *N. portoricensis* were described by Gurney and Lebour (1939) from Bermuda and larvae found off Samoa and the Great Barrier Reef (Gurney, 1938) might belong to *N. perrieri*. There are at least 2 additional, apparently separate, species of *Nausionia* that are undescribed and known only from their larvae, off New South Wales (Dakin and Colefax, 1940) and from the Adriatic Sea (Kurian, 1956; Goy and Provenzano, 1978).

### Subfamily Naushoniinae

*Nausionia* was founded by Kingsley (1897) for a single adult male specimen collected in the sand on Naushon Island, near Woods Hole, Massachusetts. A second adult, an ovigerous female, was collected by Gray (1901) from a 10 inch deep burrow in the sand on Ram Island, in Great Harbor, Woods Hole. Both of these specimens are now in the Gray Museum, Marine Biological Laboratory, Woods Hole. Four more adults are known from Massachusetts at Bass River, Vineyard Sound, and Elizabeth Islands (Williams, 1974), which are in the USNM collection. Larvae believed to belong to *N. crangonoides* have been collected from the Woods Hole area during July, August, and September (Thompson, 1903; Fish, 1925); in Delaware Bay from August to October (Deevey, 1960); in Narragansett Bay in August (Hillman, 1964); and in Chesapeake Bay from August to September (San-
The early juvenile stages of *N. crangonoides* bear a close resemblance to specimens of the much smaller species *N. portoricensis*. The first juvenile stage of *N. portoricensis* described by Gurney and Lebour (1939) is quite similar to the first juvenile stage of *N. crangonoides*, but they show some differences (Table 1). Many of the characters proposed to separate these 2 species will overlap at the smaller size ranges. The antennal scale, telson and uropods at these sizes will enable one to differentiate the 2 species. The smallest *N. portoricensis* we examined (5.6 mm TL) has an antennal scale with 4 marginal teeth with the distal tooth curved inward, while the fifth juvenile stage of *N. crangonoides* (6.0 mm TL) has an antennal scale with 5 marginal teeth. The telsons of both species have no external spines but the uropodal exopodite of *N. portoricensis* has 2 spines on the lateral margin which ends in a strong movable spine while the fifth juvenile stage of *N. crangonoides* has 5 external spines on the lateral margin which ends in a stout movable spine.

The adults of the 4 species of *Naushonia* are generally similar in morphology but show differences in detail. Their carapaces...
are very much the same but that of *N. macginitei* is more granulose in the rostral area. The mandibles (Figs. 6E, F, G, H) are essentially the same, except that *N. crangonoides* has a fusion of segments in the palp giving the general appearance of a 2-segmented palp whereas the other species clearly have a 3-segmented palp. The chelipeds (Figs. 7A, B, C, D) show differences. The ischium is toothed in *A'. portoricensis* and *N. macginitei* but smooth in *N. crangonoides* and *N. perrieri*. *N. crangonoides* has teeth on the inner border of the merus, as does *N. portoricensis* and *N. macginitei*, but the inner border of *N. perrieri*’s merus is smooth. The outer margin of the merus is toothed in *N. portoricensis* and *N. macginitei*, smooth in *N. crangonoides* and *N. perrieri*, and with 2 teeth at the base in *N. macginitei*. The propodus is very similar in *N. crangonoides* and *N. perrieri* but shows some differences in the other 2 species. In *N. portoricensis*, the inner border of the propodus is toothed below the prominent tooth and has its outer margin toothed along its entire length. In *N. macginitei*, the inner border of the propodus is smooth below the prominent tooth and the outer margin is only toothed on its upper length. The telson, uropods and antennal scales of the species of *Naushonia* seem to show the largest differences in morphology. In *N. crangonoides*, the telson (Fig. 8A) has no spines, the uropods have complete transverse sutures, and the uropodal exopodite has 5 spines on its lateral margin which ends in a strong movable spine. In *N. portoricensis* (Fig. 8B) has a spine on its lateral margin, the uropods have complete transverse sutures, and the exopodite of the uropod has 2 spines on its lateral margin ending with 2 small spines and a large movable spine. In *N. macginitei* (Fig. 8C) has 3 spines on its lateral margin, the uropods have complete transverse sutures, and the uropodal exopodite has a spine on its lateral margin ending with 2 small spines and a large movable spine. The antennal scale of *N. crangonoides* (Fig. 8D) bears 11 marginal teeth; the antennal scale of *N. portoricensis* (Fig. 8E) bears 6 marginal teeth, with the distal tooth curved inward. Nobili (1904, 1906) did not adequately describe or illustrate the telson, uropods and antennal scale of *N. perrieri* from the other 3 species of *Naushonia*. Some or all of the 3 pereiopods in *Naushonia* have lateral movable spines on the third and fourth pereiopods (Figs. 8G, H, K, L) of *N. crangonoides* and *N. macginitei*; on the fourth pereiopod of *N. portoricensis*; and on the last three pairs of pereiopods in *N. perrieri*.

Although more material of the Red Sea species needs to be examined, the following key will distinguish the 4 species:

1. **Uropods with complete transverse sutures.**
   A. Linea thalassinica pronounced, carinae of the carapace weak; telson without lateral spine; antennal scale with 10 or more marginal teeth  
   *N. crangonoides*
   B. Linea thalassinica not pronounced, carinae of the carapace well marked; antennal scale with less than 10 marginal teeth
      a. Telson with lateral spine; antennal scale with distal tooth largest and curved inward; lateral movable spines present on the fourth pereiopod only  
      *N. portoricensis*
      b. Lateral movable spines present on all 3 posterior pereiopods  
      *N. perrieri*
   2. **Uropods with incomplete transverse sutures; uropodal exopodites with 2 lateral spines, margin ending with 2 small spines and a large movable spine**

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**Literature Cited**


