7-1-1977

Neotanais Persephone, a New Species of Hadal Tanaidacean (Crustacea: Peracarida)

Charles G. Messing
University of Miami, messingc@nova.edu

BULLETIN OF MARINE SCIENCE, 27(3): 511–519, 1977

BIOLOGICAL RESULTS OF THE UNIVERSITY OF MIAMI DEEP-SEA EXPEDITIONS. 123.

NEOTANAIS PERSEPHONE, A NEW SPECIES OF HADAL TANAIDACEAN (CRUSTACEA: PERACARIDA)

Charles Garrett Messing

ABSTRACT

Neotanais persephone, a new species of tanaidacean and the first reported from the Puerto Rico Trench, is described and figured. The material represents the greatest depth record for the order from the Atlantic Ocean and for the genus worldwide. The species is placed within the *americanus* group of species and is most similar to *N. hadalis* Wolff. Rudimentary oostegites are present on several copulatory males.

In the course of faunal investigations of the tropical Atlantic Ocean, the research vessels JOHN ELLIOTT PILLSBURY and JAMES M. GILLISS of the University of Miami's Rosenstiel School of Marine and Atmospheric Science occupied 30 bottom stations at depths greater than 6,000 m in the Puerto Rico Trench. Tanaidaceans, all belonging to a new species of *Neotanais*, were collected at nine of these stations. This material includes the deepest confirmed records of any known member of the genus (but see bathymetric distribution below).

The recent publication of a monograph on the Neotanaidae (Gardiner, 1975) allows these specimens to be placed properly in the family. They are described below. It is my intention to follow this brief report with a fuller account of the species, particularly with regard to the unusual combination of secondary sexual characteristics displayed by some of the specimens.

In the following description, length to width and width to length ratios are abbreviated LW and WL, respectively. Depths in meters are corrected for sound velocity using Matthews' tables (Matthews, 1939). In the diagnoses, especially important characters are preceded by an asterisk (*). Characters shared by copulatory males and other instars are preceded by a dagger (†). Terminology follows that of Gardiner (1975).

Neotanais persephone new species
Figures 1–5

Material examined.—PILLSBURY Sta. 1166, 19° 47'N, 66°17.5'W, 8,005 m, 10-ft Blake trawl, 20 January 1970; 4 juveniles (one with what may be very weak ♂ gonopore rudiments and another unusually large—19.4 mm), 3 P♀1, 1 P♀2, 3 P♂, 1 Cop♂, fragments of 2 (not Cop♂).—PILLSBURY Sta. 1168, 19°42.5'N, 67°05'W, 8,381 m, 40-ft otter trawl, 21 January 1970; 1 P♀2, 1 P♂, 9 Cop♂ (six of these with rudimentary oostegites and one represented only by fragments of carapace and pereonite 2).—PILLSBURY Sta. 1380, 19°37.7'N, 65°04.0'W, 7,709–7,732 m, 40-ft otter trawl, 4 July 1971; 3 juveniles (of which 2 may be P♂[1]).—PILLSBURY Sta. 1382, 19°16'N, 65°50.7'W, 7,622–7,714 m, 40-ft otter trawl, 5 July 1971; 2 juveniles (one is large enough to be P♂—17.7 mm[1]), 1 P♀1.—PILLSBURY Sta. 1384, 19°45'N, 67°00'W, 8,320–8,360 m, 40-ft otter trawl, 6 July 1971; 2 juveniles.—PILLSBURY Sta. 1406, 19°31.8'N, 68°07.5'W, 8,245–8,320 m, 40-ft otter trawl, 16–17 July 1971; 12 juveniles (one with what may be very weak ♂ gonopore rudiments), 5 P♀1, 1 P♀2 (holotype), 1 P♂, 1 Cop♂ (allotype).—GILLISS Sta. 56, 19°38'N, 68°00'W, 7,781–8,343 m, 40-ft otter trawl, 16–17 January 1973; 2 juveniles (of which one may be P♂[1]), 1 P♀2, 1 Cop♂, 1 fragment (not Cop♂).—GILLISS Sta. 59, 19°22.9'N, 66° 50.0'W, 7,820–7,860 m, 40-ft otter trawl, 18 January 1973; 1 juvenile.—GILLISS Sta. 113, 19°26'N, 66°25.1'W, 8,016–8,027 m, 40-ft otter trawl, 14 July 1975; 1 P♀1.

Diagnosis.—*Neotanais* belonging to the *americanus* group of species (Gardiner, 1975:43–44). *Stages other than copulatory male.* *†Pereonite 6 always and *pereonites

[1] The material for PILLSBURY 1380, 1382, 1384 and GILLISS 56, 59 was preserved in Bouin's fixative. As a result, the specimens have completely decalcified and the ♂ gonopore rudiments, if present, are invisible.

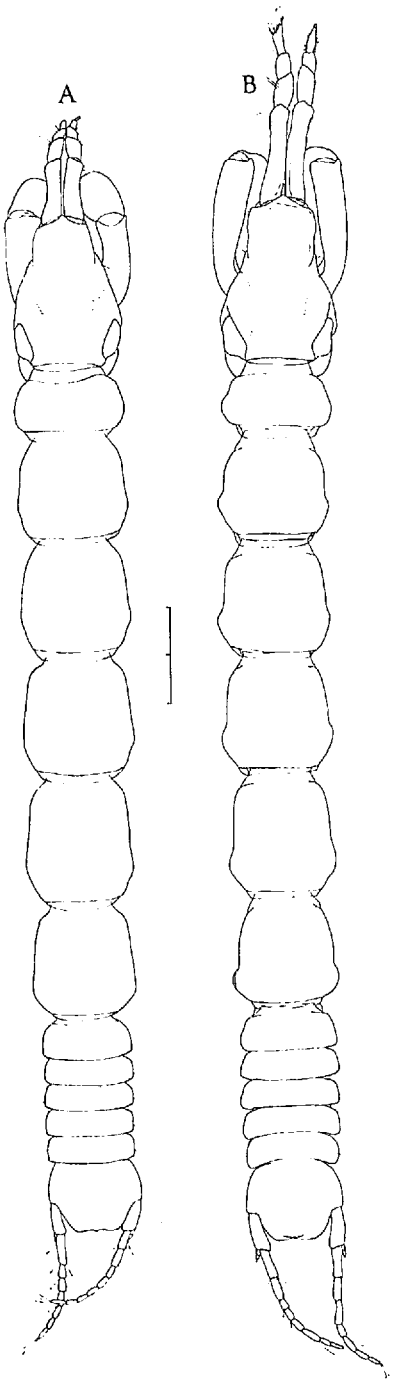


Figure 1. *Neotanais persephone* n. sp. A. Holotype, dorsal view (P♀2, R/V PILLSBURY Sta. 1406, specimen C). B. Allotype, dorsal view (Cop♂, R/V PILLSBURY Sta. 1406, specimen A). (Scale: 2 mm).

5 and 7 sometimes longer than broad. *Pleonites 1–5 narrower than pereon. *†Pleotelson long; WL from 1.2 to 1.55 (average: 1.4). Lateral margins of pleonite tergites parallel in dorsal view, with posterolateral corners sharper than anterolateral corners. †Uropod endopods of 6–8 segments; length 0.5–0.6 times that of pleon. †Carpus of cheliped with fewer than 10 dorsal setae. *†Carapace with one anterolateral and one posterolateral seta. Short terminal propodal spine of pereopod II bearing about 6–8 strong, triangular teeth. Short subterminal carpal spine of pereopods II–V smooth.

Copulatory Male.—Pereonites 3–7 tapering anteromedially, more strongly than in other instars but less strongly than in male of *N. hadalis*. *Pleon as wide as or narrower than pereonite 7. Pleonites 2–4 usually slightly wider than pleonites 1 and 5. Pleotelson as wide as or narrower than pleonites 1–5, always narrower than pereonite 7. Anterolateral keels on carapace parallel. Chelipedal carpus moderately bent and bearing few short dorsal setae. Dactylus of cheliped usually with two strong teeth but sometimes with a small tooth developed between. *Fixed finger bearing proximally a broad tubercle (which slopes distally, is cleft or is completely divided in two) and distally a sharp, finely irregular ridge occupying more than half the length of the finger and bearing a tubercle at both ends. *Broom setae absent from first endopodal segment of uropod.

Description of Preparatory Female 2 Holotype.—PILLSBURY Sta. 1406, specimen C.—*Body* (Fig. 1A): 20.9 mm long and 9.2 times longer than wide. *Carapace*: Similar to that figured by Gardiner (1975:72, fig. 29A) for *N. hadalis* but more elongate; LW = 1.4. One posterolateral seta on each side. Anterolateral setae lacking. (Virtually all other specimens in the type series have one on each side. The carapace and chelipeds of this specimen and a few others from this station were covered with tar when collected; these setae may have been lost

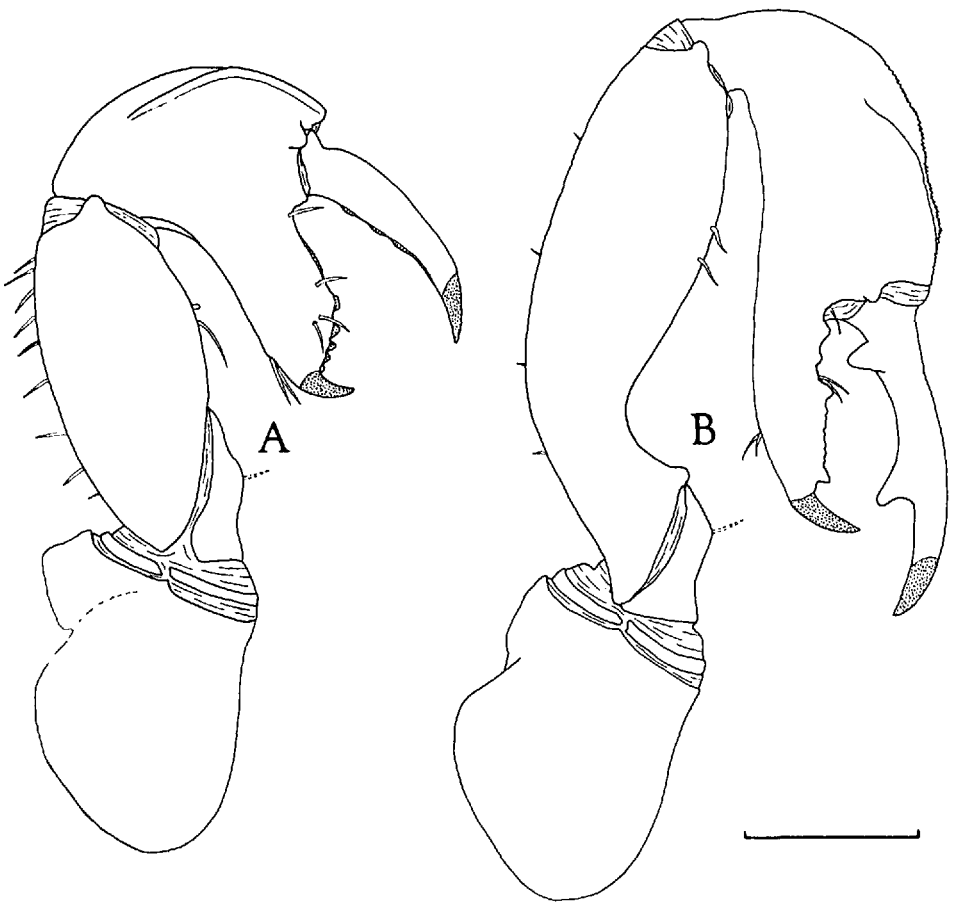
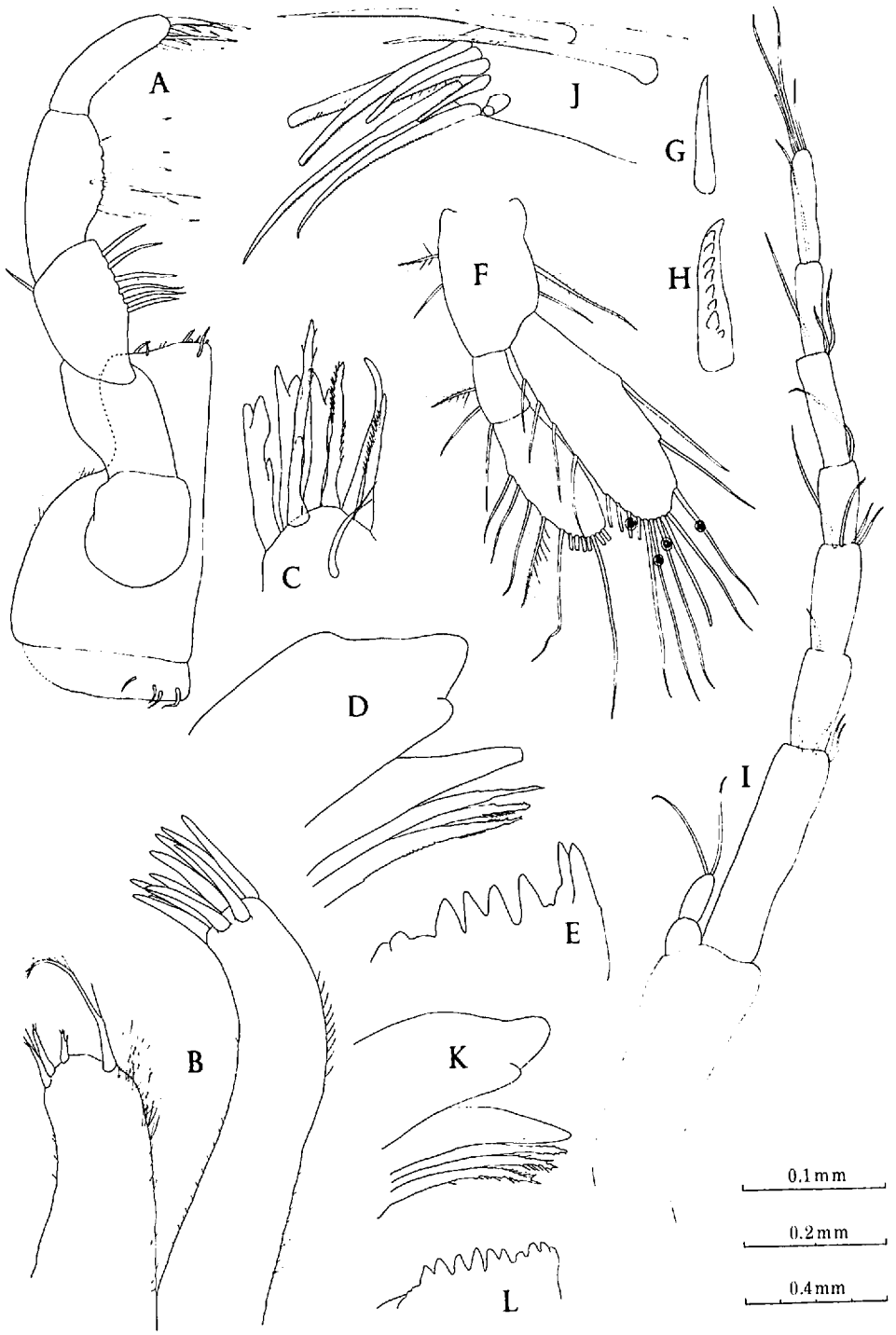


Figure 2. *Neotanais persephone* n. sp. A. Right cheliped of holotype, exterior view. B. Right cheliped of allotype, exterior view. (Scale: 1 mm).

when the tar was removed with toluene.) *Pereonites*: Increasing in length from 2 to 6; 3 and 4 about as broad as long; 5–7 longer than broad; 2–6 of equal width, 7 slightly narrower. Widest above coxae and narrowing gently anteriorly. Coxae not visible in dorsal view. Single lateral hair very short and fine. Pereonite 2 with moderately developed ventromedial ridge. *Pleonites* (Fig. 5A): Slightly narrower than pereon and of equal width. Viewed dorsally, posterolateral corners sharper than anterolateral corners. Sternites each bearing extremely weak posteromedial process which is best developed on pleonite 1. Single, short, unfeathered, ventrally directed hair on most epimeres. *Pleotelson*: Long; WL = 1.4. *First Antenna*: First segment with 5–6 distolateral setae; LW = 3.3. *Right Mandible* (Fig. 3D, E): Bearing four incisive spines of which the first two are narrow and irregularly serrate, the third also narrow but bearing only a few sharp irregularities, the fourth broad and smooth. Molar teeth as in Fig. 3E. *Left Mandible*: Broken. Lacinia mobilis with three strong teeth and cleft posterior lobe. *First Maxilla* (Fig. 3B): External endite with crown of 11 smooth spines. *Second Maxilla*: Medial row of 18 setae and three spines with irregularly


A
J
G
F
H
C
D
I
E
B
K
L
0.1mm
0.2mm
0.4mm

forked tips. Fixed endite (Fig. 3C) with seven terminal spines: two trifid, one bifid, three combed and one naked. *Maxilliped* (Fig. 3A): Four setae on coxa. Setal formula of palp (0, 0, 6+1, 7, 11). *Cheliped* (Fig. 2A): Carpus bearing nine short dorsal setae. Propodal crest well developed. Proximal ridge on fixed finger smooth (finely denticulate proximally when viewed under high magnification); five distal teeth decreasing in size distally. Dactylus with three low, elongate and contiguous swellings. *Pereopod II* (Fig. 3G, H): Posterior setae much slenderer and longer than strong, strongly serrate, anterior spines. Terminal propodal spine short, distally hooked and bearing eight strong teeth. Short subterminal carpal spine smooth. Setal formula (9, 7, 10, 7). *Pereopods III–VII*: Setal formulae for III and IV, (12, 12, 11, 12) and (11, 12–14, 9, 11), respectively. VII with row of nine short subterminal propodal spines. *Pleopods* (Fig. 3F): Setal formula (left, first pleopod) (2, 3) (4, 9, 5) (0, 3; 0, 7, 5). All setae feathered. The figure also shows some of the round, cystlike bodies that are attached proximally to the terminal setae of the pleopodal exopod and endopod in many specimens. They can be numerous and their identity is unknown (possibly ciliate protozoans, Gardiner, 1975:234). *Uropods* (Fig. 3I): Left endopod with seven, right endopod with eight segments. Endopods about 0.5 times length of pleon. Exopods 0.4–0.6 times length of first endopodal segment.

Description of Copulatory Male Allotype.—PILLSBURY Sta. 1406, specimen A.—*Body* (Fig. 1B): 21.9 mm long and 8.9 times longer than wide. *Carapace*: 1.4 times longer than wide. Rostral area transversely creased. Anterolateral keels parallel. Oblique furrows moderately deep anterior to chelipedal coxae. One anterolateral and one posterolateral seta on each side. *Pereonites*: Increasing in length from 2 to 6; 4, 5 and 7 about as wide as long; 6 longer than wide; 7 narrower than preceding pereonites. Narrowing anteromedially from coxal articulations. Coxae not visible in dorsal view. Lateral hairs 0–2, extremely short and fine, posterior or anterior to coxae. *Pleonites* (Fig. 5B): Narrower than pereon; 2–3 widest; 5 narrowest. 1–4 with lateral margins of tergites flat in dorsal view and narrowing anteromedially; posterolateral corners not as sharp as in noncopulatory male instars but sharper than in *N. hadalis*. Lateral hairs 0–1, short and fine. Moderately developed, elongate, medial process on each sternite; weakest on pleonite 5 although increasing in strength posteriorly on each sternite. *Pleotelson*: Long; WL = 1.2. As wide as pleonite 4 and wider than pleonite 5. *First Antenna*: LW of first segment 4.6. (Other specimens range from 4.5–5.3.) *Right Mandible*: Strongly reduced. Molar process low and rounded. Pars incisiva reduced to short, irregular projection. *Second Maxilla* (Fig. 4A): Projection representing movable endite bearing nine setae of which seven are finely setulose. Medial row of six naked setae present. *Maxilliped* (Fig. 4H): Coxa fused to basis. Setal formula of palp (0, 0, 6+1, 4, 15). Fifth (terminal) segment less calcified than remainder of palp. *Cheliped* (Fig. 2B): Carpus moderately bent. Four very short, fine dorsal setae

←

Figure 3. *Neotanais persephone* n. sp. A–I. Appendages of holotype. A. Right maxilliped, posterior view. B. Right first maxilla, anterior view. C. Right second maxilla, setae of fixed endite, anterior view. D. Right mandible, pars incisiva. E. Same, molar teeth. F. Left first pleopod, posterior view. G. Left pereopod II, short subterminal carpal spine. H. Same, short terminal propodal spine. I. Left uropod, ventral view. J–L. Appendages of juvenile (R/V PILLSBURY Sta. 1406, specimen F). J. Right maxilliped, terminal segment, anterior view. K. Right mandible, pars incisiva. L. Same, molar teeth. (Scales: C, D, E, G, H, J, K, L—0.1 mm; B—0.2 mm; A, F, I—0.4 mm).

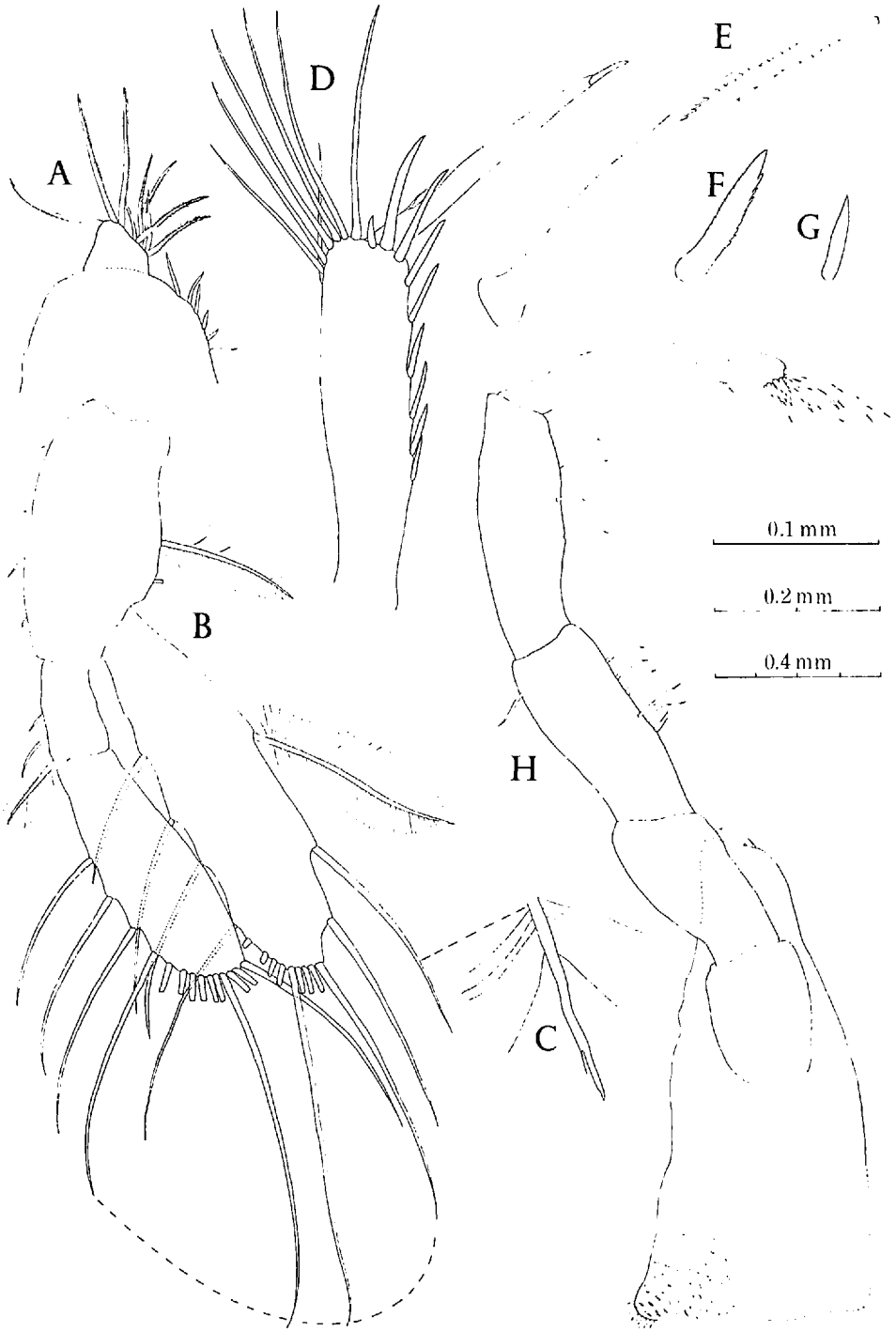


Figure 4. *Neotanais persephone* n. sp. Appendages of allotype. A. Right second maxilla, posterior view. B. Right first pleopod, anterior view. C. Tip of medial seta, pleopodal endopod. D. Propodus of left pereopod II. E. Same, long terminal spine. F. Same, short terminal spine. G. Short subterminal carpal spine of left pereopod II. H. Right maxilliped, posterior view. (Scales: C, E, F, G—0.1 mm; A—0.2 mm; B, D, H—0.4 mm).

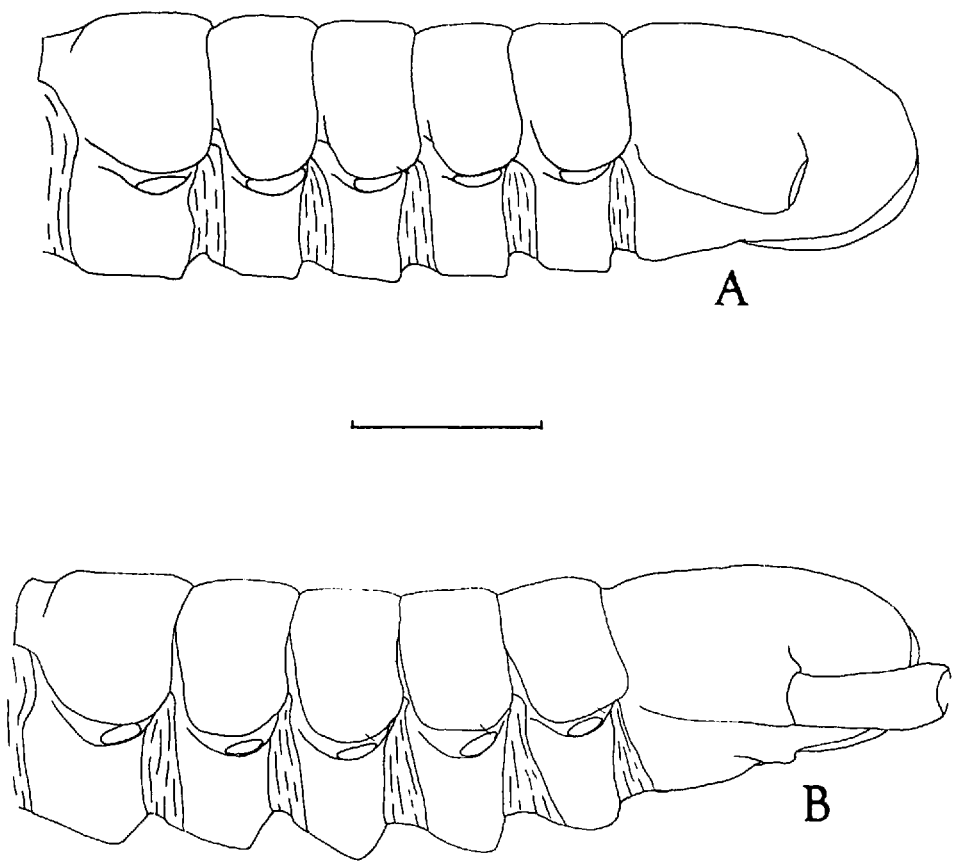


Figure 5. *Neotanais persephone* n. sp. A. Pleon of holotype, lateral view. B. Pleon of allotype, lateral view. (Scale: 1 mm).

present. Dorsal keel of propodus finely serrate. Exterior surface of propodus with very weak, smooth ridge extending obliquely proximally from dorsal keel. Fixed finger with proximal tubercle divided into two low tubercles. Dactylus with two teeth. *Pereopod II* (Fig. 4D, E, F, G): Anterior spines stronger and shorter than posterior setae but slenderer and with much finer teeth than in other instars. Short terminal propodal spine finely serrate. Short subterminal carpal spine smooth. Setal formula (8, 7, 9, 6). *Pereopods III–VII*: Setal formulae for III and IV, (11, 11, 10, 11) and (10, 10, 8, 11), respectively. VII with row of five short subterminal propodal spines. *Pleopods* (Fig. 4B, C): Setal formula (right, first pleopod) (2, 4) (3, 10, 4) (0, 3; 0, 9, 5). Setae more densely feathered than in holotype. Four exterior lateral setae of the protopod very short and fine. *Uropods*: Left endopod with eight segments, right endopod with seven. Endopods about 0.6 times length of pleon. Exopods between 0.4 and 0.5 times length of first endopodal segment. Setation similar to that of holotype. Broom setae absent.

Geographical Distribution.—Known only from the Puerto Rico Trench north of Puerto Rico.

Bathymetrical Distribution.—7,622–8,381 m. The greatest depth reported for the Tanaidacea is 8,928–9,174 m at VITJAZ Sta. 3827T in the Kermadec Trench, 28°53′S, 176°01′W, 2 January 1958 (Wolff, 1960, 1970; Belyaev, 1966; MacDonald, 1975). Wolff's first reference is to unidentified material in the Russian deep-sea exhibit during the International Congress of Zoology in London in 1958. He gives *Neotanais serratispinosus hadalis* (= *N. hadalis*) as the deepest identified species (8,210–8,300 m). Belyaev refers to the material from this station as undetermined. However, Wolff (1970), in citing Belyaev, and MacDonald, in citing Wolff (1970), both refer to the material from this station as "?*Herpotanais kirkegaardi*." *Neotanais persephone* is certainly the deepest known tanaid in the Atlantic and probably represents the deepest record for the genus *Neotanais* worldwide.

Affinities.—*Neotanais persephone* definitely belongs to Gardiner's *americanus* group of species. Though he states that this group is "noted for a lack of distinctive morphologic features" and describes the non-copulatory male instars as "uniquely lacking in easily noticeable identifying characters," I have had no difficulty in placing this species here. Within the group, this species appears most closely related to *N. hadalis*. Among the similarities are (1) large body size (my largest specimen is a P♀1 from GILLISS Sta. 113, 22.8 mm long), (2) hadal distribution, (3) elongated pleotelson, (4) uropodal endopods short and composed of relatively few segments (6–9 for *hadalis* and 6–8 for *persephone*), and (5) pleopodal setation. *Neotanais persephone* differs in (1) elongated pereonites, (2) reduced setation of carapace and chelipedal carpus, (3) lack of broom setae on uropodal endopod of male, (4) three narrow and one broad incisive spine on right mandible in female, (5) finely serrate terminal propodal spine on pereopod II in male, (6) narrower pleonites, (7) sculpture of the fixed chelipedal finger in the male and (8) more elongate endopodal segments of uropods.

Remarks.—The material ranges in length from juveniles about 7 mm to a P♀1 22.8 mm in length. The juveniles occur in two poorly defined size groups: 7.0–9.3 mm (5 specimens) and 10.4–15.9 mm (12 specimens). Though the two groups are not easily distinguished and have not been subject to detailed morphometric analyses, the great range in length suggests the presence of two instars. Four additional specimens in the second size group may be preparatory males. Two larger specimens (17.7 and 19.4 mm) also appear to be juveniles. Preparatory♀♀1 fall into three size groups: 14.0–16.2 mm (5), 18.3–18.9 mm (2) and 22.8 mm (1). Gardiner (personal communication) has suggested that the largest of these may represent a second breeding cycle. The four P♀♀2 range from 16.9–20.4 mm. Of the specimens definitely identified as preparatory males, two are about 19 mm, two 21.5 mm and one only 13.5 mm. The copulatory males are all larger than 18 mm. These, however, fall into two groups: those lacking and those possessing rudimentary oostegites. The specimens in the former group are 18.1 and 21.5–21.9 mm (6); those in the latter group are 18.9–21.5 mm (6). The short male without oostegites was taken at a station without other males. Two forms of these oostegites exist: those similar to those of the P♀1 stage, borne on pereopods II–V, and those smaller, absent from pereopods II. Normal males were collected at four stations while males bearing oostegites were found only at one station, which was dominated by males of both kinds. This morphological pecularity is similar to that described by Gardiner (1975:225) for two copulatory males of *Neotanais armiger* from ANTON BRUUN Sta. 111. No other obvious morphological differences exist between the males of *N. persephone* possessing and lacking these structures, such as exist between type A and B males described by Gardiner for *N. micromopher* and *N. americanus* and by Wolff (1956) for *N. serratispinosus hadalis* (= *N. hadalis*). Gardiner called the occurrence of this "aberration"

in two males from the same station "surprising." Its occurrence in six males of *N. persephone* from one station is intriguing. These specimens will be the subject of a future histological investigation.

Though I intend to describe the infraspecific and developmental variations of *N. persephone* in a future paper, a few comments may be useful at this time. Like Gardiner, I have found the setation of the first antenna, pereopods and pleopods to increase with the size and stage of the animal. A juvenile, 9.3 mm long, has only three distolateral setae on the first article of the first antenna, and the setal formulae for its pereopods II, III and IV are (7, 7, 6, 5), (8, 8, 6, 6–8) and (7, 5–7, 7, 8–9), respectively. On the other hand, the setation of the pleopodal protopod varies considerably regardless of the size or stage, as follows: 0, 3; 1, 3; 1, 4; 2, 1; 2, 2; 2, 3; 2, 4; 3, 3 though it is possible that some may have been broken off. In copulatory males, however, the lateral setae are much shorter and finer.

Location of Type Material.—The holotype and allotype will be deposited at the National Museum of Natural History, Washington, D.C. The paratype series (the remaining material) will remain in the invertebrate museum of the University of Miami's Rosenstiel School of Marine and Atmospheric Science for future study.

Derivation of Name.—From Persephone, daughter of Demeter and Zeus, kidnapped and made queen of the Greek realm of the dead by Hades, its king. Persephone is female.

ACKNOWLEDGMENTS

I wish to thank Drs. Gilbert Voss and Frederick Bayer for making this material available to me, Dr. Lion Gardiner for sharing with me his intimate knowledge of this interesting group, and, with Dr. Torben Wolff, for commenting on the manuscript. This paper is one of a series resulting from the National Geographic Society-University of Miami Deep-Sea Biology Program and is a contribution from the University of Miami Rosenstiel School of Marine and Atmospheric Science.

LITERATURE CITED

Belyaev, G. M. 1966. Donnaya fauna naibolshikh glubin (ultra-abissali) mirovogo okeana. Akademiya Nauk SSSR. Institut Okeanologii. Moskva. 247 pp.

———. 1972. Hadal bottom fauna of the world ocean. Israel Program for Scientific Translations. vi + 199 pp.

Gardiner, L. F. 1975. The systematics, postmarsupial development, and ecology of the deep-sea family Neotanaidae (Crustacea: Tanaidacea). Smithson. Contrib. Zool. 170: iv + 265.

MacDonald, A. G. 1975. Physiological aspects of deep sea biology. Cambridge Univ. Press. xiv + 450 pp.

Matthews, D. J. 1939. Tables of the velocity of sound in pure water and sea water for use in echo-sounding and sound ranging. Second Ed., Hydrographic Dept., Admiralty, London. 3 charts + 52 pp.

Wolff, T. 1956. Crustacea Tanaidacea from depths exceeding 6,000 meters. Galathea Reps. 2: 187–241.

———. 1960. The hadal community, an introduction. Deep-Sea Res. 6: 95–124.

———. 1970. The concept of the hadal or ultra-abyssal fauna. Deep-Sea Res. 17: 983–1003.

NOTE ADDED IN PROOF: The USNM catalogue numbers are 169407 for the holotype and 169408 for the allotype.

DATE ACCEPTED: August 5, 1976.

ADDRESS: *Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149.*