Deep-Sea Pycnogonida from the Temperate West Coast of the United States

C. ALLAN CHILD

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ABSTRACT

Child, C. Allan Deep-Sea Pycnogonida from the Temperate West Coast of the United States. *Smithsonian Contributions to Zoology*, number 556, 23 pages, 5 figures, 1994.—Seventeen deep-sea pycnogonid species are reported from the west coast of the temperate United States (California, Oregon, and Washington). The distribution and a diagnosis of each known species is given and four new species, *Nymphon aculeatum, Colossendeis peloria, C. spicula*, and *Hedgpethia nasica*, are described and compared with known fauna. All species affinities and relationships with other fauna are discussed and an artificial key to the species of *Pallenopsis* (*Bathypallenopsis*) found in the study area is provided. One species, *Pallenopsis* (*B*.) *oculotuberculosis* Hilton, is recorded for only the second time and is illustrated because figures were never published with its original but superficial description.

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Contents

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C. Allan Child

Introduction

This first report on the deep-sea pycnogonids of the temperate west coast of the United States (California, Oregon, and Washington, but exclusive of Alaska) is based on several extensive collections. There are almost 2000 specimens (actual count: 1875) included in this report representing 17 species in seven genera and four families, including four new species. Deep-sea faunas are often conspicuous for their low species diversity while sometimes displaying an amazingly high abundance of a particular species. One new species, *Nymphon aculeatum*, for instance, consists of 280 specimens from almost as many stations. However, the other three new species are represented by only a few specimens. *Hedgpethia nasica* consists of only four type specimens from a series of four stations all in the same locality; *Colossendeis peloria* has four type specimens from a single locality; and *C. spicata* has only two type specimens from two stations.

Most of the known species in this report were thought to be rare, possibly due in part to a lack of deep-sea collections from the areas under study. The Oregon collections have proven that many of them are not rare except in collections. The wealth of material in the Oregon State University collections made over a long period and in consistently deep basins suggests that they truly represent the deep-water pycnogonid fauna found off Oregon. Most deep-sea collections are the result of a one-time series of stations in a restricted locality that can not produce a true picture of the fauna as does a prolonged monthly sampling program. Several species in this report were previously known only from their type material or from one or two additional localities besides their type localities, (i.e., *Colossendeis tenera* Hilton, *Pallenopsis (Bathypallenopsis) californica* Schimkewitsch, *P. (B.) stylirostris* Hedgpeth, and *P. (B.) oculotuberculosis* Hilton). All of these species are known to be fairly common or at least appear in multiple collections from off Oregon and some also occur in the deep-seas off California and Washington.

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ACKNOWLEDGMENTS.—I thank my good friend and colleague Joel Hedgpeth for contributing the bulk of specimens for this report. He contributed the magnificent Oregon State University collection for my examination and report, which is now housed with the National Museum of Natural History pycnogonids. I acknowledge with thanks the several contributions of deep-sea material made by Jim Nybakken and others of the Moss Landing Marine Lab from the repeated investigations of the deep-sea fauna off the Farallon Islands (acknowledgment is made for Navy CLEAN Contract No. N62474-88-D-1991) and Monterey Bay, California, and the several contributions of specimens by Ron Kaufmann, Roberta Baldwin, and others from the deep-sea program of the Scripps Institution of Oceanography off the California Channel Islands. Most of the material belonging to Moss Landing Lab was loaned to me and now is housed in that institution while most of the Scripps Institution material was a gift and is in the National Museum of Natural History collections. Voucher specimens of most species were returned to Moss Landing and Scripps for their research collections. All remaining specimens are deposited in the collections of the National Museum of Natural History.

Family CALLIPALLENIDAE Hilton, 1942

Genus *Pallenopsis* Wilson, 1881

Subgenus *Bathypallenopsis* Stock, 1975

Pallenopsis (Bathypallenopsis) Stock, 1975:1032.

It is significant to note that all specimens of *Pallenopsis* listed in this report are specimens of the relatively rare subgenus *Bathypallenopsis* with no members present of the much more common subgenus *Pallenopsis*. There are some collections of the latter subgenus reported in the literature as having been taken at approximately the same depths as these, but the consistently shallower depths at which specimens of *Pallenopsis (Pallenopsis)* are taken suggest that specimens of *Pallenopsis (Bathypallenopsis)* constitute a deep-water counterpart of the shallower and more common subgenus.

It is also noted that most of the larger specimens of this subgenus listed herein, particularly those with long leg setae, are heavily entwined and encrusted with flocculent debris which sometimes includes mud. A number of species now classified as *P. (Bathypallenopsis)* have been taken in midwater trawls or in other obvious bathypelagic conditions where the collecting apparatus has not touched the bottom (Hedgpeth, 1962:487–491, gives a good summary up to that date). Some specimens have been taken in direct association with Scyphomedusae (Child and Harbison, 1986) and it was suggested that other species may be bathypelagic and parasitic on midwater organisms. The debris and mud on so many of the specimens reported on here indicate that the setose species and perhaps all of those discussed herein are truly benthic members of the subgenus and are not normally pelagic in their habits. It will be interesting to discover what foods the debris-covered specimens prefer. With this bathypelagic versus benthic status more or less recognized in the literature, it may be possible at some future date to subdivide this genus further based on confirmation of their habitats and life habits in food gathering, although these two distinctions are hardly of taxonomic value among the pycnogonids.

Key to the Species of *Pallenopsis* (*Bathypallenopsis*)

(Known to the temperate United States Pacific coast or that could be expected in its deep waters.)

(*species reported on herein)

1. Proboscis slender, tapering distally (styliform) or inflated and wider medially than at the slender tip (Species of the *tydemani*-group) 2
   Proboscis with a distal inflation whether inflated medially or not (Species of other groups) 5
2. Proboscis not inflated, but gradually tapering from base to tip (styliform); abdomen not longer than four times its maximum width . . . . ***Pallenopsis (B.) stylirostris***
   Proboscis variously inflated medially; abdomen either short or as long as ten times its maximum width 3
3. Small species, leg span less than 50 mm; abdomen short, about four times its maximum diameter; proboscis only slightly inflated medially; scape segments subequal, palms shorter than inflated fingers . . . . . . ***Pallenopsis (B.) pacifica***
   Very large species, leg span more than 100 mm; abdomen long, about ten times maximum diameter or longer; proboscis inflated otherwise; first scape segment longer than second, palms shorter than slender tapering fingers 4
4. Proboscis broadly inflated medially; propodal sole with 8–9 sole spines, some almost as large as largest of two moderate heel spines, main claw about 0.55–0.6 as long as propodus, auxiliaries about 0.3 as long as main claw; femoral cement gland tube slightly longer than femur diameter, without inflated base . . . . ***Pallenopsis (B.) profundis***
   Proboscis slightly inflated medially; propodus with few tiny sole spines, main heel spine huge, almost half propodal length, main claw subequal in length to propodus, auxiliaries tiny, little longer than main claw diameter; femoral cement gland tube short, less than half as long as femoral diameter, small basal hump . . . . ***Pallenopsis (B.) californica***
5. Proboscis of the *longirostrum*-group with greatest inflation distally; abdomen short; chelae fingers long, carried synaxially on palm; auxiliary claws lacking; species known to have been taken bathypelagically 6
   Proboscis of the *mollissima*-group with proboscis inflated both medially and distally but broadest at midpoint; abdomen short or long; chelae fingers short, carried anaxially or only at slight angle to palm; auxiliary claws present; species not known to have been taken bathypelagically 7
6. Proboscis greatly inflated distally with less inflation medially; ocular segment broadly triangular lateral to ocular tubercle in dorsal view; tibiae with lateral setae

longer than segment diameters; tarsus and propodus soles hidden by dense field of short spines . . . . ***Pallenopsis (B.) scoparia***

Proboscis only slightly inflated medially and distally; ocular segment narrow, not expanded dorsolaterally; tibiae without rows of long lateral setae; propodus with distinct heel with pair of moderately long spines, without dense field of short sole spines . . . . ***Pallenopsis (B.) calcanea***

7. Size moderately small; abdomen short, four times longer than maximum diameter; proboscis short, subequal in length to ocular segment only; ocular tubercle more than twice taller than slender diameter, with paired laterodistal tubercles; legs with random spines only little longer than segment diameters . . . . ****Pallenopsis (B.) oculotuberculosis***

Size very large; abdomen long, slender; proboscis at least as long as anterior two trunk segments or longer; ocular tubercle not taller than its diameter, distal tubercles lacking; tibiae with lateral rows of setae longer than segment diameters 8

8. Trunk segmentation lines with distinct dorsomedian anterior pointing curve or invagination; second scape segments only 0.8 length of first; propodus with 2 large basal spines, 9–10 short sole spines . . . . . . ****Pallenopsis (B.) longiseta***

Trunk segmentation lines without dorsomedian curve; scape segments almost subequal in length; 2 basal propodal spines separated by smaller spine, sole with 20+ short sole spines . . . . ****Pallenopsis (B.) comosa***

Pallenopsis (Bathypallenopsis) californica Schimkewitsch

Pallenopsis californica Schimkewitsch, 1893:39–41, pl. I: fig. 11, pl. II: figs. 18–23.—Hilton, 1942:40.

Pallenopsis (Bathypallenopsis) californica.—Stock, 1975:1036–1038, figs. 33–34.—Turpaeva, 1991:39; 1992:92.

MATERIAL EXAMINED.—OREGON: Cr 6304c, sta OTB 5-02 (1♂); cr 6312c, sta OTB 19-29c (1♀); cr 6405, sta OTB 30-06B (1♀); cr 6408, sta OTB 38-03 (2♀); cr 6501B, sta OTB 50-19 (1♂, 1♀); cr 6507, sta OTB 76-46 (1♂, 1 juv); cr 6510, sta OTB 88-17B (1♂, 1♀); cr 6510, sta OTB 90-27 (1♀); cr 6510, sta OTB 92-19B (1♂); cr 6603A, sta OTB 112-24B (1♀); cr 6710, sta OTB 207-04 (1 juv).

Cr 6907C, sta BMT 95-11 (1♀); cr 6910A, sta BMT 120-22 (1 juv); cr 7003B, sta BMT 188-18c (1♂); cr 7005C, sta BMT 229-20 (1♀); cr 7005C, sta BMT 230-20 (1♀); cr 7102B, sta BMT 259-22 (1♀); cr 7102B, sta BMT 268-31 (1♂); cr 7102B, sta BMT 271-31 (1♀); cr 7105B, sta BMT 277-32 (1♀); cr 7206A, sta BMT 288-38 (1♂); cr 7206B, sta BMT 291-32 (2♂); cr 7206B, sta BMT 293-32 (1♀); cr 7301F, sta BMT 319-35 (1♂, 1♀, 1 juv); cr 7303A, sta BMT 321-43 (1♀); cr 7303A, BMT 323-47 (2♂, 1♀).

DISTRIBUTION.—This species was known from the syntypes which were taken almost exactly one hundred years ago in the Gulf of Panama in 2323 m and in the Gulf of California in 1819 m. Considering the 35 specimens listed above, the species is not uncommon in the deep-seas off Oregon. The depths for these specimens range from 2665 m to 3358 m along the northern Oregon coast. This is a distant northern range extension from the tropical localities of the types, but the types were taken at similar depths in Panama and Mexico. The water in the depths off Oregon has a far from tropical temperature. The capture depths of this Oregon material are also deeper than those of the syntypes, and add an additional thousand meters to the species depth range as now known. Turpaeva (1991:39) recently listed a male specimen of this species from the Mozambique Channel in 2140–2240 m. This specimen would more likely be attributed to *P. (B.) oscitans* Hoek, a closely related species which is known to inhabit that Channel.

DIAGNOSIS.—A member of the *tydemani*-group (Stock, 1975:1032). Very large species, easily recognized by very large heel spine of propodus. Huge basal propodal spine, shorter distal spine and very long main claw very conspicuous. Without marked heel and heel area is on same curved plane as sole. Other characters of species: a very long slender abdomen; proboscis slightly wider at inflated midpoint than at distal end; legs with randomly placed long slender setae; and a very short cement gland tube.

REMARKS.—Many of the female specimens have legs which are very flaccid and without any stiffness, as though they had just released their eggs. However, none of the males bear eggs on their ovigers, suggesting that the females had not just released eggs and that the legs of females are normally thin walled and lack rigidity.

This is the largest species among a group of rather large species of this genus treated in this report, and is easily recognized.

Pallenopsis (Bathypallenopsis) comosa Stock

Pallenopsis (Bathypallenopsis) comosa Stock, 1975:1043–1045, fig. 37.—Child, 1992:30.

MATERIAL EXAMINED.—CALIFORNIA: Farallons trawl 1

(2♂,1♀, 2 juv); Farallons trawl 3 (1♂ with eggs, 1♀); Farallons trawl 4 (1♂,1♀); Farallons trawl 5 (2♀, 1 juv); Farallons trawl 6 (1♂ with eggs, 5♂,5♀, 1 juv); Farallons trawl 8 (1♂,1♀, 1 juv); Farallons trawl 9 (1♂ with eggs); Farallons trawl 16 (1♂ with eggs, 2♂,3♀, 1 juv); Pioneer sta P-1 (1♂,1♀); Pioneer sta P-3 (1♂).

OREGON: Cr 6108, sta OTB-24 (1♂ with eggs); cr 6408, sta OTB 41-01 (1♂ with eggs, 2♂,1♀); cr 6507, sta OTB 78-28 (1♂);cr 6508, sta OTB 81-29 (1♂);cr 6510, sta OTB 89-29B (1♀); cr 6610A, sta OTB 132-20B (1♀); cr 6701, sta OTB 155-04 (1♀); cr 6707, sta OTB 184-10 (1 juv).

Cr 6907C, sta BMT 90-16 (1♂);cr 6907C, BMT 93-29 (2♀, 1 juv); cr 6907C, sta BMT 94-23 (1♂,1♀); cr 6910A, sta BMT 117-26 (1♀); cr 6910A, sta BMT 118-35 (3♀); cr 7001B, sta BMT 154-22 (1 juv); cr 7001B, sta BMT 157-30 (1♀); cr 7001B, sta BMT 159-28 (1♀); cr 7001B, sta BMT 163-27 (1♀); cr 7003B, sta BMT 186-40 (1 juv); cr 7003B, sta BMT 191-21 (1♀); cr 7003B, sta BMT 194-24 (1♀); cr 7005C, sta BMT 229-20 (1 juv); cr 7102B, sta BMT 260-15 (1♂,1♀); cr 7102B, sta BMT 265-28 (3♀, 2 juv); cr 7102B, sta BMT 268-31 (1♂, 2♀, 1 juv); cr 7102B, sta BMT 269-35 (1♀); cr 7105B, sta BMT 281-25 (1♀); cr 7206A, sta BMT 288-38 (1♂, 1♀, 1 juv); cr 7206B, sta BMT 289-39 (2♀); cr 7206B, sta BMT 291-32 (1♀); cr 7210A, sta BMT 300-39 (1♀, 1 juv); cr 7210A, BMT 302-37 (2♀); cr 7301F, sta BMT 315-30 (1♂,1♀, 1 juv); cr 7301F, sta BMT 316-39 (1♀); cr 7301F, sta BMT 317-31 (1♀); cr 7301F, sta BMT 318-35 (1♀); cr 7303A, sta BMT 321-42 (1♀); cr 7310B, sta BMT 331-39 (1♀); cr 7310B, sta BMT 332-50 (2♀); cr 7310B, sta BMT 333-36 (1♀); cr 7310B, sta BMT 334-39 (1♀, 2 juv); cr 7310B, sta BMT 336-48 (1♂,1♀).

WASHINGTON: Cr DWD, sta BMT-5 (1♀, 1 juv); cr DWD, sta BMT-5 (1♂);cr DWD, sta BMT-8 (1♀, 1 juv).

DISTRIBUTION.—This is another species whose type series was taken from the Gulf of Panama with a recorded depth of about 3200 m. Child (1992:30) has found it on the slopes of the Milne-Edwards Deep off Trujillo, Peru, in only slightly shallower water of about 2950 m. The above 111 specimens greatly extend this southern distribution in the north to California, Oregon, and Washington off the Straits of Juan de Fuca in depths from 2086 m to 3300 m, with most stations shallower than the previously recorded known depths. This was another supposed rare species (or at least rarely collected) that appears to be fairly common off the coast of the contiguous United States.

DIAGNOSIS.—Of the *mollissima*-group (Stock, 1975:1038-1040). Proboscis inflated at both midpoint and distal end. Species has two or three major heel spines larger than sole spines but not nearly as large as heel spines of *P. (B.) californica*. Abdomen very long; tibiae with rows of long, slender, lateral setae, and cement gland tube nearly as long as femoral diameter. Chelae conspicuously smaller relative to those of other species.

REMARKS.—Stock (1975) discussed the differences between this species and its look-alike congener, *P. (B.) mollissima*.

This was the most commonly captured among the *Pallenopsis* species of the Oregon basin. It is more obvious with each of these many records that *Bathypallenopsis* is the deep-sea counterpart of the shallower subgenus *Pallenopsis*.

Pallenopsis (Bathypallenopsis) longiseta Turpaeva

Pallenopsis mollissima.—Schimkewitsch, 1893:41-43, pl. II: fig. 24 (nec Hoek, 1881).
Pallenopsis longiseta Turpaeva, 1957:359-361, fig. 2.
Pallenopsis (Bathypallenopsis) longiseta.—Stock, 1975:1042-1043, fig. 36.

MATERIAL EXAMINED.—CALIFORNIA: Cr Pulse III, sta 312M (2♀); Pulse VIII, sta 803M (1♀); Pulse IX, sta 910M (1♀). Farallons sta F-1 (5♂,6♀); Farallons sta F-3 (1♂,2♀); Monterey sta M-1 (1♂ without legs); Monterey sta M-6 (1♂).

DISTRIBUTION.—This species was described from the Sea of Okhotsk and the Bering Sea in 1228 and 3820 m respectively. These specimens from mid-California in 2820-3200 m and the San Clemente Basin off southern California in 4100 m greatly extend the known distribution of the species and slightly extend its depth range.

Schimkewitsch (1893) deposited his American specimens with the National Museum of Natural History and Stock (1975) reexamined the Gulf of Panama specimen which Schimkewitsch had called *Pallenopsis mollissima*, and discovered it to be a male of Turpaeva's *P. longiseta*. Schimkewitsch's specimen is from 3058 m. The species then, is known from the Russian Arctic, the Bering Sea, middle and southern California, and from the Gulf of Panama, certainly a scattered distribution which probably reflects the lack of extensive collections from deep-water localities rather than any rarity of the species. It and other species in this report are possibly quite common in the deep slopes and basins of the Pacific Ocean.

DIAGNOSIS.—A species of the *mollissima*-group (Stock, 1975). Species with mixed setae/spines on oviger terminal segment which differentiates this species from *P. (B.) mollissima*. Trunk segmentation lines with distinctive middorsal point directed anteriorly and not raised above curved surface of dorsum. Second scape segments not as long as first and leg tibiae bear long lateral setae as with *P. (B.) comosa*. This species with notably fewer sole spines than *P. (B.) comosa*, but it bears two long heel spines. Lateral processes with several short dorsal spines which are inconspicuous.

REMARKS.—This species may actually be rare since none were taken during the years of continued sampling off the Oregon coast. Perhaps it prefers depths deeper than those sampled off Oregon. None of the Oregon stations reached the 4100 m at which it was taken off southern California, but those from mid-California were from shallower depths. The Gulf of Panama specimens described by Schimkewitsch were taken at slightly greater than 3000 m. This is well within the Oregon sampling depths. Its preferred depths therefore remain inconclusive.

Pallenopsis (Bathypallenopsis) oculotuberculosis Hilton

FIGURE 1

Pallenopsis oculotuberculosis Hilton, 1942c:40.

MATERIAL EXAMINED.—OREGON: Cr 6907C, sta BMT 89-14 (3♂ with eggs, 4♂, 7♀, 1 juv); cr 6907C, sta BMT 90-16 (5♂, 2♀); cr 6907C, sta BMT 94-23 (1♀); cr 6910A, sta BMT 113-24 (1♀); cr 6910A, sta BMT 115-10 (4♂, 1♀); cr 6910A, sta BMT 120-22 (1♂); cr 7001B, sta BMT 156-31 (1 juv); cr 7001B, sta BMT 157-30 (1♂, 2♀); cr 7001B, sta BMT 159-28 (1♂, 1♀); cr 7003B, sta BMT 191-21 (1♀ without legs); cr 7003B, sta BMT 192-37 (6♂, 7♀); cr 7003B, sta BMT 193-35 (1 juv); cr 7003B, sta BMT 194-24 (1 juv); cr 7102B, sta BMT 264-26 (1♀); cr 7102B, sta BMT 272-26 (1♂); cr 7301F, sta BMT 317-31 (1♂, 1♀); cr 7310B, sta BMT 330-28 (1♂, 1♀); cr 7301B, sta BMT 333-36 (1♂).

WASHINGTON: Cr DWD, sta BMT-10 (1♀).

DISTRIBUTION.—This is another species previously known only from a single type specimen (an ovigerous female) collected in the Aleutian Islands off Alaska in 155 m, a very shallow depth if reported correctly. The above 60 specimens from Oregon and the single female from Washington were all taken in 2225–2720 m, contrasting with the shallow depth for the Aleutian Islands type. I believe the 155 m recorded by Hilton is in error, but the depth is correct for the listed R/V *Albatross* station. It seems probable that the station number was incorrectly listed for the specimen. The next station, off Kamchatka Island, is recorded at 1500+ fathoms (2743 m) which is consistent with the depths found in the Oregon collection.

DIAGNOSIS.—Of the *mollissima*-group. Species small in size, only half that of *P. (B.) californica*. Most easily recognized by two laterodistal projections of ocular tubercle and relatively short proboscis which is only 0.6 as long as anterior trunk segment, shorter than in most other members of subspecies. Abdomen quite short and legs bear randomly placed spines of modest length without any long slender lateral setae. Chelae very curved and have appearance of ice tongs. Heel spines modest and not greatly larger than sole spines. Oviger only moderately setose, and male cement gland tube equal in length to femoral diameter.

REMARKS.—Since this species was inadequately described and never illustrated, I include a set of figures of the diagnostic characters. The species is striking in a group of species with very short ocular tubercles by having one twice as tall as its diameter and with laterodistal tubercles. The legs of this species are fairly short in relation to the legs of most other species in this subgenus, certainly very much shorter than those of *P. (B.) comosa* and *P. (B.) californica*, both of which have very slender long legs.

Pallenopsis (Bathypallenopsis) stylirostris Hedgpeth

Pallenopsis stylirostre Hedgpeth, 1949:278–280, fig. 36a–e.
Pallenopsis (Bathypallenopsis) stylirostrum.—Stock, 1975:1032 [text].
Pallenopsis (Bathypallenopsis) stylirostris.—Nakamura and Child, 1991:40.

MATERIAL EXAMINED.—OREGON: Cr 6707, sta OTB 188-02c (1♂); cr 6710, sta OTB 208-02 (1♀).

WASHINGTON: Cr DWD, sta BMT-10 (8♂ with eggs, 1♂, 13♀, 3 juv).

DISTRIBUTION.—This species was only known from off Honshu Island, Japan, with the type specimens and one other lot taken in about 1000 to 1300 m. As in most of the known species of this report, the 27 specimens recorded herein are reported for the first time from the eastern North Pacific off the Oregon and Washington coasts. The depths at these three stations also extend the species to deeper waters in 1550 m off the Straits of Juan de Fuca and 1400–1600 and 2030 m off northern Oregon.

DIAGNOSIS.—A member of Stock's (1975) *tydemani*-group. Species has tapering or styliform proboscis giving easier recognition among other species with inflated proboscides. Ocular tubercle taller than its basal diameter and taller than tubercle of most other species. Abdomen short; propodus also fairly short with few sole spines; heel spines little larger than sole spines. Male cement gland tube slightly longer than half femoral diameter with tendency to point distally at low oblique angle (as shown in Hedgpeth, 1949, fig. 36e).

REMARKS.—The taper and shape of the proboscis in this species shows variation. The proximoventral area may be concave, swollen with a small bulge making the area convex, or just straight as figured by Hedgpeth (1949, fig. 36a). In the majority of the above specimens, it tapers from the base like a bottle neck and throat. The bulge does not seem to be associated with the sex of the specimens.

Pallenopsis (Bathypallenopsis) sp.

MATERIAL EXAMINED.—OREGON: Cr 7005C, sta BMT 232-29 (1 spec.)

REMARKS.—This single specimen is without legs and is damaged so that it is impossible to make a determination.

Family AMMOTHEIDAE Dohrn, 1881

Genus *Ammothea* Leach, 1814

Ammothea verenae Child

Ammothea verenae Child, 1987:892–896, fig. 1.—Stock, 1991:158 [text].
Scipiolus thermophilus Turpaeva, 1988:950–953, figs. 1, 2. [New synonymy.]

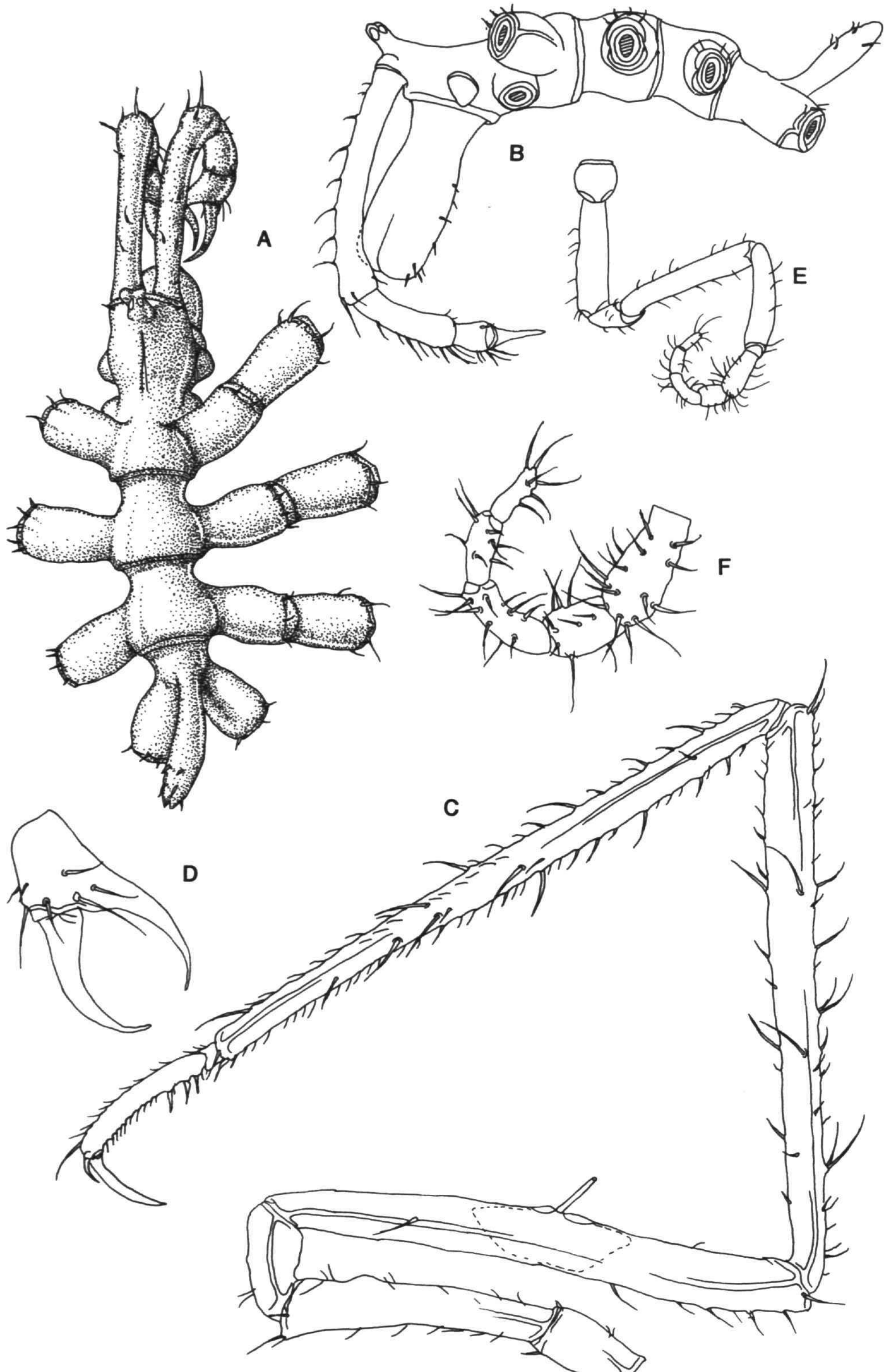

A
B
E
F
C
D

FIGURE 1.—*Pallenopsis (Bathypallenopsis) oculotuberculosis* Hilton, male: A, trunk, dorsal view; B, trunk, lateral view; C, third leg; D, chela; E, oviger; F, oviger terminal segments, enlarged.

MATERIAL EXAMINED.—CALIFORNIA: R/V *Sea Cliff*, Dive 764 (4♂ with eggs, 3♂, 4♀, 4 juv).

DISTRIBUTION.—This species was described from specimens taken on the Explorer and Juan de Fuca Ridges of the northeast Pacific in 1570–2250 m. Turpaeva's specimens were taken also from the Juan de Fuca Ridge in 1800 m. The above lot extends this distribution slightly to the south and to the much greater depth of about 3500 m, the species' deepest known depth. This lot was also taken in an area of hydrothermal vents off northern California which suggests, since all specimens of this species are known only from such vents, that it is endemic to hydrothermal vent areas, at least to those in the northeast Pacific.

DIAGNOSIS.—An atypical member of genus, species without dorsomedian trunk tubercles and with very low, blind, ocular tubercle. Proboscis massive, constricted medially and distally; chelifores almost tiny compared with two massive proximal palp segments. Palps of nine segments, very setose distally as are distal segments of male oviger. Male legs with crowded field of lateral and ventral setae on third coxae and proximally on femorae while legs of females lack dense fields of setae. Propodi bear similar sole and heel spines with no major or larger spines.

REMARKS.—This species is one of only two members of this large genus found thus far exclusively in hydrothermal vent areas. It differs morphologically from most other species in lacking dorsomedian tubercles and by the other diagnostic characters outlined above, particularly in the identical propodi with undifferentiated heel and sole spines.

Genus *Ascorhynchus* Sars, 1877

Ascorhynchus japonicum Ives

Ascorhynchus japonicus Ives, 1891:218–223, pl. 12.—Hedgpeth, 1954:147.—Utinomi, 1971:333 [literature].
Ascorhynchus japonicum.—Nakamura and Child, 1983:19 [key].—Nakamura, 1987:30–31, pls. 27, 38.—Nakamura and Child, 1991:8.

MATERIAL EXAMINED.—OREGON: R/V *Commando:* 2 Sep 1963 (4♂); 28 May 1964 (4♂, 6♀, 1 juv); 29 May 1964 (11♂, 8♀).

CALIFORNIA: Farallons 3-1 (1♂, 1♀); Farallons unknown trawl (FVC1-77) (30 specimens); Monterey sta M-4 (1♂, 1♀).

DISTRIBUTION.—The Oregon specimens, from off the Columbia River mouth, were trawled in 1554–1829 m. The Farallon Islands specimens were collected in 512–686 m and 1682 m; the Monterey specimens were taken in the deepest of the above stations, 2750 m. The species is known from many localities in Japanese waters, from as shallow as 53 m to as deep as 1923 m, but it has never been known prior to these records in the waters off Oregon or California. The depth range of these specimens adds nothing new to the minimum, but greatly increases the maximum known depth for the species with the Monterey capture at 2750 m.

DIAGNOSIS.—A very large or giant species bearing low rounded ocular tubercle, dorsomedian trunk tubercles taller than ocular tubercle, and very low lateral process tubercles, rounded and inconspicuous. Proboscis slightly shorter, but much more stocky and round than Atlantic Ocean counterpart of this species, *A. armatus* (Wilson).

REMARKS.—The height of the dorsomedian tubercle tips varies to some degree in this huge species. They can be rather low and rounded distally as if considerably worn or they can be sharply pointed and acute. The ocular tubercle apparently is always low and distally rounded.

Family NYMPHONIDAE Wilson, 1878

Genus *Heteronymphon* Gordon, 1932

Heteronymphon bioculatum Turpaeva

Heteronymphon bioculatum Turpaeva, 1956:67 [key], 69–71, fig. 2.— Stock, 1965:22 [text].—Turpaeva, 1970:1723–1725 [text], figs. 1(4), 2(4); 1971:279–280; 1973:180–181.—Nakamura, 1985:33 [key].

MATERIAL EXAMINED.—OREGON: Cr 7206B, sta BMT 292-31 (1♂); cr 7206B, sta BMT 294-33 (1♂ with eggs); cr 7303A, sta BMT 323-47 (2♂); cr 7310B, sta BMT 334-39 (1♀).

WASHINGTON: Cr DWD, sta BMT-10 (1♀ ovigerous).

DISTRIBUTION.—This rare species of a rare deep-water genus has been found along the Kuril-Kamchatka Trench, in the Sea of Japan, in the Sea of Okhotsk, and in the Gulf of Alaska, in depths of 756–3940 m. These six specimens captured off the Strait of Juan de Fuca in 2030 m and off Oregon in 2997–3000 m greatly extend the known distribution for this species well to the south and into temperate waters in the eastern Pacific. The species is, as far as is known, confined to the temperate and arctic slopes and basins of the North Pacific Ocean.

DIAGNOSIS.—Ocular tubercle well developed with large anterior pair of eyes, posterior pair either inconspicuous or lacking. With two of above males, anterior pair of eyes quite conspicuous and slightly pigmented, smaller posterior pair of eyes present, but very inconspicuous, apparently unpigmented. Lateral processes well separated in quite slender species. Terminal palp segment shorter than penultimate segment. Oviger claw short, without teeth, no longer than distal denticulate spines of terminal segment. Spines with either two or three lateral lobes. Propodus slightly shorter than slender tarsus with terminal claw little more than half length of propodus. Male cement gland apertures several inconspicuous ventral pores on femorae. Male carrying eggs from station BMT 294-33 with single small strip of dark eggs wound around left oviger.

REMARKS.—The tarsus varies in length in relation to the propodus in this species. It is slightly longer in the above female than that of the type (Turpaeva, 1956, fig. 2(8)). The ocular tubercles of these six specimens are not as tall as that of the type. The long oviger fourth segment bears a low proximal tubercle (Turpaeva, 1956, fig. 2(5)), but the organelle or gland under this tubercle of the type is not apparent in the males of this collection. Nakamura (1985:33) has the latest key to the few species in this genus.

Genus *Nymphon* Fabricius, 1794

Nymphon aculeatum, new species

FIGURE 2

MATERIAL EXAMINED.—CALIFORNIA: Cr Pulse II, sta 216M (1♂ with eggs, holotype, USNM 234633; 1♀, paratype, USNM 234634); cr Pulse II, sta 224M (2♂, paratypes, USNM 234635); cr Pulse III, sta 314M (2♂, 1♀, paratypes, USNM 234636).

OTHER MATERIAL.—CALIFORNIA: Cr Pulse IV; sta 426M (1♂); cr Pulse V, sta 505M (1♀); cr Pulse VI, sta 606M (1♂, 1♀ trunk only); cr Pulse VII, sta 721M (1♂, 1♀); cr Pulse VIII, sta 803M (1♂, 1♀); cr Pulse IX, sta 907M (2♂); cr Pulse IX, sta 910M (1♂, 1♀); cr Pulse X, sta 1007M (1 juv); cr Pulse X, sta 1017M (1♂ with eggs, 1♂, 1♀).

Farallons 14-1 (1♂); Farallons 14-2 (1♂ with eggs, 1♂, 1♀); Farallons 14-3 (1♂ with eggs, 1♀); Farallons 14-4 (1♂, 2♀); Farallons 14-12 (2♂, 1♀); Farallons 16-6 (1♂ with larvae and juveniles); Farallons 16-7 (1♀ ovig., 2♀); Farallons sta F-3 (1♀); Monterey sta M-7 (1♀).

OREGON: Cr 6405, sta OTB 30-06B (1♀); cr 6405, sta OTB 31-08 (2♀); cr 6501, sta OTB 49-30 (1♂); cr 6501B, sta OTB 50-19C (1♂, 1♀); cr 6507, sta OTB 76-11B (2♂, 3♀, 2 juv); cr 6508, sta OTB 79-22 (1♂, 1♀); cr 6508, sta OTB 81-29 (2♀); cr 6510, sta OTB 87-09 (1♀); cr 6510, sta OTB 88-17B (1♂, 1♀ juv); cr 6510, sta OTB 89-29B (1♂); cr 6510, sta OTB 91-18B (2♂, 2♀); cr 6610, sta OTB 131-19 (1♀); cr 6610A, sta OTB 132-20B (1♂, 1♀).

Cr 6907c, BMT 94-23 (4♂, 3♀); cr 6910A, sta BMT 117-26 (1♀); cr 6910A, sta BMT 118-35 (1♂, 3♀); cr 6910A, sta BMT 120-22 (2♀, 1 juv); cr 7001B, sta BMT 154-22 (2♀, 1 juv); cr 7001B, sta BMT 155-25 (1♀, 1 juv); cr 7001B, sta BMT 156-31 (1♂, 2 juv); cr 7001B, sta BMT 159-28 (1 juv); cr 7001B, sta BMT 163-27 (3♂, 2♀); cr 7003B, sta BMT 185-29 (2♂, 2♀); cr 7003B, sta BMT 186-40 (2♂, 3♀, 1 juv); cr 7003B, sta BMT 188-18c (13 spec.); cr 7003B, sta BMT 190-17 (2♂, 2♀); cr 7003B, sta BMT 190-17 (3♂, 4♀, 1♀ juv, 1 juv); cr 7003B, sta BMT 191-21 (2♂, 3♀, 1 juv); cr 7003B, sta BMT 192-37 (1♂); cr 7102B, sta BMT 257-09 (1♂); cr 7102B, sta BMT 259-22 (2♂, 1♀, 5 juv); cr 7102B, sta BMT 261-20 (1♂, 1♀); cr 7102B, sta BMT 264-26 (1♂); cr 7102B, sta BMT 265-28 (1 juv); cr 7102B, sta BMT 266-23 (1♀); cr 7102B, sta BMT 267-32 (2♂, 2♀, 1 juv); cr 7102B, sta BMT 268-31, 32 (1♂, 2♀, 1 juv); cr 7102B, sta BMT 272-26 (1♂, 3♀, 3 juv); cr 7105B, sta BMT 276-26 (1♂, 1♀, 2 juv); cr 7105B, sta BMT 278-12 (4♂, 1 juv); cr 7105B, sta BMT 279-18 (1 juv); cr 7105B, sta BMT 280-25 (3♂, 2♀, 1 juv); cr 7105B, sta BMT 281-25 (1♂, 3♀); cr 7105B, sta BMT 282-23 (1♂, 1♀, 1 fragment); cr 7206B, sta BMT 292-31 (1♂, 1♀); cr 7206B, sta BMT 293-31 (2♂, 2♀); cr 7206B, sta BMT 294-33 (1♀); cr 7301F, sta BMT 315-30 (1♂ with eggs, 1♂, 4♀); cr 7301F, sta BMT 316-39 (4♂, 4♀, 3 juv); cr 7301F, sta BMT 317-31 (3♂, 2♀, 1 juv); cr 7301F, sta BMT 318-35 (16 spec.); cr 7301F, sta BMT 319-35 (10+ spec.); cr 7303A, sta BMT 322-49 (1♂ with eggs, 4♀, 4 juv); cr 7303A, sta BMT 323-47 (2♂, 2♀, 4 juv); cr 7310B, sta BMT 331-39 (1 juv); cr 7310B, sta BMT 332-50 (5+ spec.); cr 7310B, sta BMT 333-36 (1♂, 1♀); cr 7310B, sta BMT 334-39 (1♀); cr 7310B, sta BMT 335-34 (1♀); cr 7310B, sta BMT 336-48 (1♂, 2 juv).

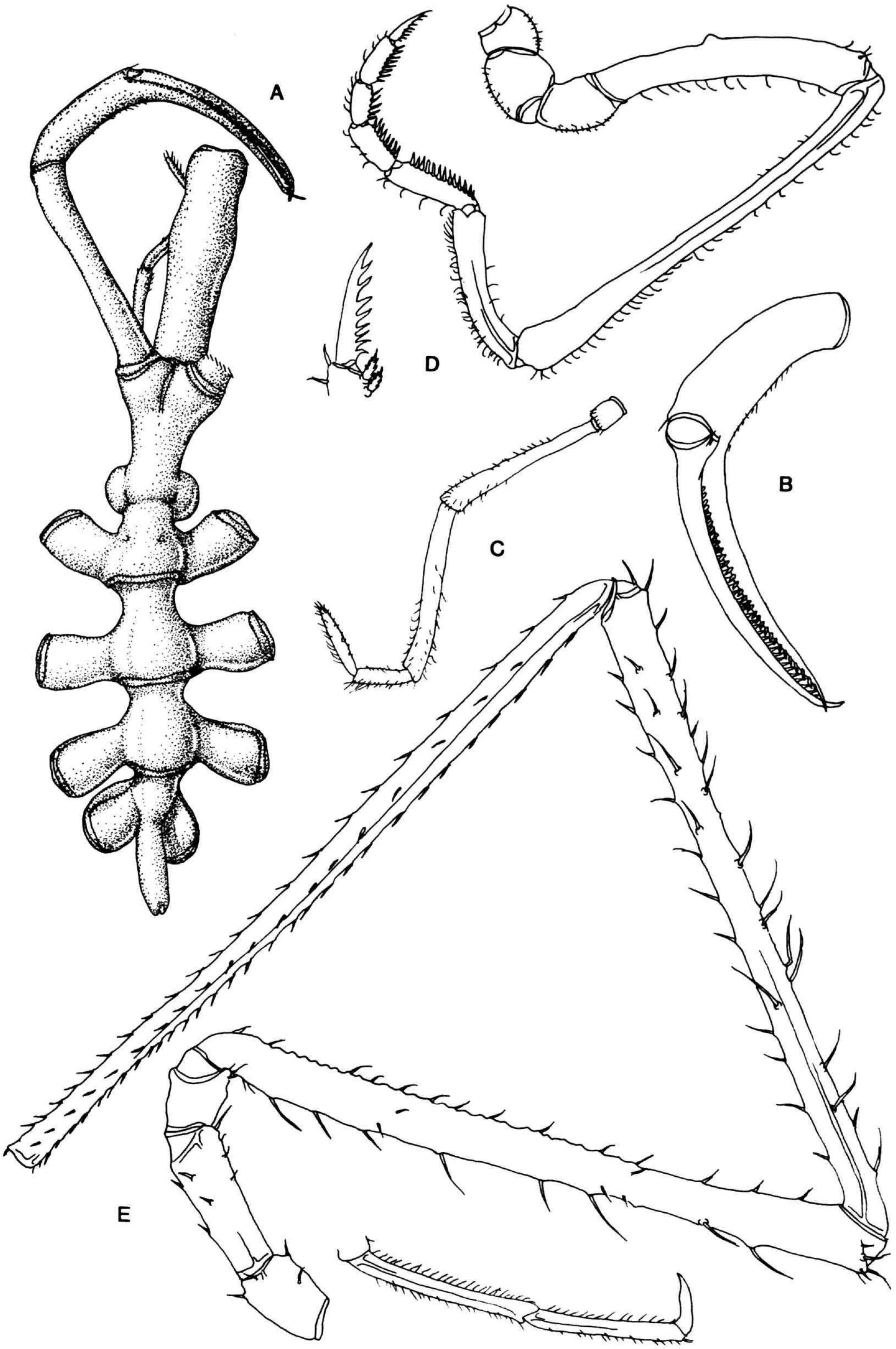
DISTRIBUTION.—This new species is reported from an amazing number of specimens (279+) reported from a wide variety of the stations listed here and was found in all areas collected from southern California to northern Oregon. There are no Washington specimens known, although it probably occurs in waters of similar depths there. The depths at which the specimens were found vary from 2450 to 3000 m in the Farallons and Oregon collections and it was recorded from 4100 m off southern California in the Scripps collection. That this new species has not been described up to this time, with so many specimens available, is a clear indication that very little collecting has been done in the basins and the slopes of the temperate United States west coast.

DESCRIPTION.—Male holotype: species large with leg span of about 90 mm. Trunk slender, lateral processes separated by their diameters or slightly greater widths, glabrous. Neck moderately short, large oviger implant bulges at narrowest point of neck, well separated from anteriors of first lateral processes. Ocular tubercle and eyes lacking. Neck anterior at chelifore insertion fairly narrow. Proboscis short, semicylindrical with slight swellings at midpoint and distally around flat lips. Abdomen a curved cylinder, moderately short, tapering distally, glabrous. Chelifore scapes cylindrical, moderately slender, not as long as proboscis extended horizontally. Chelae very long, slender, very curved across mouth. Fingers little longer than palm, slender, overlapping at tips; movable finger armed with 45 short pointed teeth; immovable finger with 36 similar teeth.

Palps slender, very lightly setose; third segment little longer than second; fourth and fifth segments combined about length of third; fourth shorter than fifth segment.

Oviger long, slender; major segments lightly setose laterally. Fourth segment slightly robust, curved, with tiny ectal bulge at midpoint. Fifth segment more slender except at clubbed distal

FIGURE 2.—*Nymphon aculeatum*, new species, holotype: A, trunk, dorsal view; B, chela; C, palp; D, oviger with enlargement of terminal claw; E, third leg.


A
B
C
D
E

end, almost twice length of fourth segment; sixth segment about 0.3 length of fifth, curved with many tiny setae. Strigilis moderately small; seventh, eighth, and ninth segments each shorter than last; tenth segment subequal to ninth; all armed with denticulate spines in the formula 13 : 8 : 6 : 8. Terminal claw equal in length to terminal segment and bears 8 slender teeth. Denticulate spines bear 3 lateral lobes and slender with long terminal lobe.

Legs rather long, robust, armed with randomly placed spines; most spines shorter than segment diameters on coxae and femorae and mostly longer than segment diameters and in increasing numbers on tibiae. Femorae and first tibiae subequal in length; second tibiae 0.2 longer and more slender. Tarsus slightly longer than propodus; both cylindrical, very slender, slightly curved, armed with short ventral and dorsal setae of equal length. Terminal claw broad, short, only slightly curved, about 0.4 length of propodus, without auxiliary claws.

Female paratype: when ovigerous, distal second coxae, third coxae, and proximal half of femorae swollen with ova to twice their normal diameters. Legs of female almost always bearing fewer and shorter spines than those of males.

MEASUREMENTS (holotype, in mm).—Trunk length (chelifore insertion to tip 4th lateral processes) 11.7; trunk width (across 2nd lateral processes), 4.8; proboscis length, 6.9; abdomen length, 1.8; third leg, coxa 1, 1.26; coxa 2, 2.29; coxa 3, 1.16; femur, 10.51; tibia 1, 10.48; tibia 2, 11.14; tarsus, 2.23; propodus, 1.93; claw, 0.73.

ETYMOLOGY.—The name (Latin: *aculeatus*, meaning pointed or prickly) refers to the increasingly spinose distal segments of its legs.

REMARKS.—This new species belongs to the so called *hamatum*-group (Stock, 1972:259) with nine known species and it is very similar to four species of this closely related world-wide group, but is unlike any known west coast species. Similar species are all deep-sea, uniunguiculate, blind, and have their oviger bases well in advance of the first lateral processes (the main distinctive characters of the group). They are *N. profundum* Hilton, 1942, *N. femorale* Fage, 1956, *N. walvisense* Stock, 1981, *N. hamatum* Hoek, 1881, and perhaps one or two other more distantly related species.

This species is perhaps closest to *N. profundum* (= *N. noctum* Hilton), taken off the Aleutian Islands, but the new species has a longer tarsus relative to the propodus while the terminal claw is much shorter than that of Hilton's species. There are more chelae teeth in *N. aculeatum* and the terminal oviger claw has one or two more teeth, all of which are thicker in diameter. The oviger denticulate spines also have one or two additional lateral lobes than do those of *N. profundum* according to Hedgpeth (1949:270–271, fig. 33a–f).

According to Stock's key to the group, this species can be carried to couplet 3 at which point it does not conform to either selection (very long setae on the legs or setae shorter than the segment diameters). Instead, the thicker spines of the proximal leg segments are shorter than the diameters while the spines of the tibiae are slightly longer than the tibiae diameters. It also falls out of the key at couplet 4 where it has 8 teeth on the oviger claw instead of 4–6 or more than 10 teeth, the two choices available.

The 36 to 45 chelae teeth do not conform to any of the known species of the group, e.g., *N. hamatum*, although closely related, has 50 to 65 teeth on the two fingers. The species is also closely related to *N. femorale* in most characters except that the new species has shorter leg segments, shorter chelifore scapes, a longer tarsus and shorter propodus, and fewer terminal oviger claw teeth.

The new species is least like and differs from *N. walvisense* by having much longer chelifore palms in relation to the fingers, has lateral processes with much more separation between each, legs which have shorter major segments, no dorsodistal femur tubercle, and a much longer tarsus and propodus in relation to the terminal claw. The tarsus is shorter than the propodus in Stock's species, just the opposite situation from *N. aculeatum*.

Family COLOSSENDEIDAE Hoek, 1881

Genus *Colossendeis* Jarzynsky, 1870

Colossendeis colossea Wilson

Colossendeis colossea Wilson, 1881:244–246, pl. 1: fig. 1, pl. 3: figs. 5–7.—Stock, 1988:508 [literature]; 1991:163.—Turpaeva, 1992:94.

MATERIAL EXAMINED.—CALIFORNIA: Farallons 2-3 (2 spec.); Farallons 3-2 (1 spec.); Farallons 3-4 (3 spec.); Farallons 5-7 (1 spec.); Farallons 6-7 (2 spec.); Farallons 9-7 (5 spec.); Farallons 12-4 (1 spec.); Monterey sta M-1 (2 spec.); Monterey sta M-2 (6 spec.); Monterey sta M-3 (7 spec.); Monterey sta M-4 (2 spec.); Monterey sta M-8 (1 spec.).

OREGON: Cr 6507, sta OTB 78-28 (29 spec.); cr 6510, sta OTB 90-27 (1 spec.); cr 6610A, sta OTB 132-20B (1 spec.); cr 6701, sta OTB 155-04 (3 spec.); cr 6702, sta OTB 162-11 (1 spec.); cr 6704, sta OTB 172-02 (1 spec.); cr 6704, sta OTB 173-12 (1 spec.); cr 6707, sta OTB 186-15 (2 spec.); cr 6710, sta OTB 207-04 (4 spec.); cr 6710, sta OTB 208-22 (2 spec.); cr 6801, sta OTB 223-25 (4 spec.); cr 6807C, sta OTB 258-07 (1 spec.); cr 6903F, sta OTB 283-04 (2 spec.); cr 7009D, sta OTB 354-01 (1 spec.).

Cr 6903G, sta BMT 70-? (3 spec.); cr 6903F, sta BMT 73-02 (2 spec.); cr 6907C, sta BMT 89-14B (1 spec.); cr 6907C, sta BMT 90-16 (3 spec.); cr 6907C, sta BMT 93-29 (30 spec.); cr 6907C, sta BMT 94-23 (42 spec.); cr 6907C, sta BMT 95-11 (19 spec.); cr 6907C, sta BMT 96-04 (5 spec.); cr 6907C, sta BMT 97-23 (3 spec.); cr 6910A, sta BMT 113-24 (6 spec.); cr 6910A, sta BMT 115-10 (1 spec.); cr 6910A, sta BMT 116-21 (32 spec.); cr 6910A, sta BMT 117-26 (14 spec.); cr 6910A, sta BMT 118-35 (43 spec.); cr 6910A, sta BMT 120-22 (9 spec.); cr 7001B, sta BMT 154-22 (9 spec.); cr 7001B, sta BMT 155-25 (6 spec.); cr 7001B, sta BMT 156-31 (29 spec.); cr

7001B, sta BMT 157-30 (29 spec.); cr 7001B, sta BMT 159-28 (6 spec.); cr 7001B, sta BMT 163-27 (9 spec.); cr 7003B, sta BMT 185-29 (6 spec.); cr 7003B, sta BMT 190-16 (36 spec.); cr 7003B, sta BMT 191-21A (21 spec.); cr 7003B, sta BMT 192-37 (~65 spec.); cr 7003B, sta BMT 193-35 (32 spec.); cr 7005C, sta BMT 229-20 (1 juv); cr 7005C, sta BMT 230-20 (4 spec.); cr 7005C, sta BMT 232-29 (1 juv); cr 7102B, sta BMT 258-17 (11 spec.); cr 7102B, sta BMT 260-15 (11 spec.); cr 7102B, sta BMT 261-20 (4 spec.); cr 7102B, sta BMT 262-24 (6 spec.); cr 7102B, sta BMT 263-26 (10 spec.); cr 7102B, sta BMT 267-32 (3 spec.); cr 7102B, sta BMT 269-35 (3 spec.); cr 7102B, sta BMT 270-37 (9 spec.); cr 7105B, sta BMT 276-26 (1 juv); cr 7210A, sta BMT 306-36 (1 spec.); cr 7301F, sta BMT 316-39 (4 spec.); cr 7301F, sta BMT 318-35 (1 juv); cr 7301F, sta BMT 319-35 (3 spec.); cr 7310B, sta BMT 331-39 (1 spec.); cr 7310B, sta BMT 332-50 (1 juv); cr 7310B, sta BMT 334-39 (2 juv).

WASHINGTON: Cr DWD, sta BMT-1 (5 spec.); cr DWD, sta BMT-2 (4 spec.); cr DWD, sta BMT-3 (11 spec.); cr DWD, sta BMT-5 (15 spec.); cr DWD, sta BMT-5 (1 spec.); cr DWD, sta BMT-8 (1 spec.).

DISTRIBUTION.—This is a worldwide deep-water species having few previous records from the American temperate west coast due only to the lack of collections from these depths. The above 650+ specimens do not add any new information to its known distribution.

DIAGNOSIS.—Largest species in terms of leg span of any taken during surveys recorded here. Many samples contain achelate young and chelate juveniles in these records, making size alone a deceptive character.

Proboscis of *C. colossea* about 1.5 times longer than robust trunk, with large swelling at midpoint, and tapers to narrow flat oral surface. Three terminal palp segments long, almost equal in length, and carried synaxially. Terminal leg segments relatively short, with tarsus shorter than propodus, and variably short claw (sometimes extremely short). Terminal oviger claw quite short in relation to adjacent segment.

REMARKS.—This is the most common species in the genus and is reported in most deep-sea collections.

Colossendeis cucurbita Cole

Colossendeis cucurbita Cole, 1909:188–191, pl. 2: figs. 3, 4, pl. 3: figs. 8–12.—Stock, 1978:405–408, fig. 2 [literature].—Bamber, 1985:305.

MATERIAL EXAMINED.—CALIFORNIA: Cr Pulse I, sta 124 (1 spec.); cr Pulse V, sta 505M (2 juv); cr Pulse VIII, sta 803M, (1 juv); cr Pulse X, sta 1007M (1 spec.).

DISTRIBUTION.—This species has appeared in few collections, but those collections have originated in many diverse localities in both the Atlantic and Pacific Oceans. Its depth range is great although it is confined to deep slopes and basins in 1350–4400 m. Cole's three type specimens came from just south of the Equator near the Galapagos Islands in 2005 fathoms (3667 m). It is interesting to note that this species was taken at four stations (that is, repeatedly) in the San Clemente Basin study. The species is presumably fairly common at this location and perhaps at this depth.

DIAGNOSIS.—Proboscis moderately long, 8 to 9 times its maximum diameter, swollen at midpoint, which is widest area, and is straight, linear, or with a slight dorsal curve distally. Curve variable and usually not conspicuous. Distal 3 palp segments together no longer than next proximal or 7th segment, and 6th segment only about 0.75 as long as 7th. Terminal palp segment longer than penultimate 2 which are subequal in length. Tarsus varies from 2.5 to almost 3 times longer than slender tapered propodus. Claw relatively short at about 0.33 of propodal length. Species blind with low, anterior-pointing, conical, ocular tubercle.

REMARKS.—This species has been confused with several others, but Stock (1978) cleared up the confusion with a good description, comparison, and figures of this and several other species listed in this report.

Colossendeis japonica Hoek

Colossendeis japonica Hoek, 1898:295–296, pl. 2: fig. 3.—Hedgpeth, 1949:299–300, fig. 46a–d.—Fage, 1956:168 [list], 176.

MATERIAL EXAMINED.—CALIFORNIA: Farallons 3-1 (1 spec.).

OREGON: Cr 6108, sta OTB24-29 (26 spec.); cr 6408, sta OTB 41-01 (18 spec.); cr 6701, sta OTB 156-14 (7 spec.); cr 6710, sta OTB 206-04 (1 spec.).

Cr 6903F, sta BMT 73-02 (1 spec.); cr 6907C, sta BMT 89-14 (2 spec.); cr 6907C, sta BMT 90-16 (4 spec.); cr 6907C, sta BMT 95-11 (2 spec.); cr 6910A, sta BMT 113-24 (8 spec.); cr 7003B, sta BMT 190-17 (2 spec.); cr 7003B, sta BMT 194-24 (10 spec.); cr 7005C, sta BMT 230-20 (1 spec.); cr 7102B, sta BMT 268-31 (3 spec.); cr 7102B, sta BMT 270-37 (6 spec.); cr 7206B, sta BMT 289-39 (3 spec.); cr 7206B, sta BMT 291-32 (2 spec.).

R/V *Commando:* 28 May 64 (3 spec.); 29 May 64 (3 spec.); 30 May 64 (1 spec.).

WASHINGTON: Cr DWD, sta BMT-8 (4 spec.); cr DWD, sta BMT-9 (10 spec.); cr DWD, BMT-10 (43 spec.).

DISTRIBUTION.—This species had a limited known distribution off Kyushu Island, Japan, in 703–800 m, and from the Kermadec Trench in 4390 m. The above 161 specimens suggest that it is not rare at all, but that it is just another example of the lack of collecting in deep-sea basins. This is the first time the species has been taken in temperate American Pacific waters and it appears to be fairly common in the 2000–3000 m depth range.

DIAGNOSIS.—Size of specimens consistently small with a long, straight, slightly inflated proboscis. Distal 3 palp segments very short in relation to next proximal 2. Tarsus

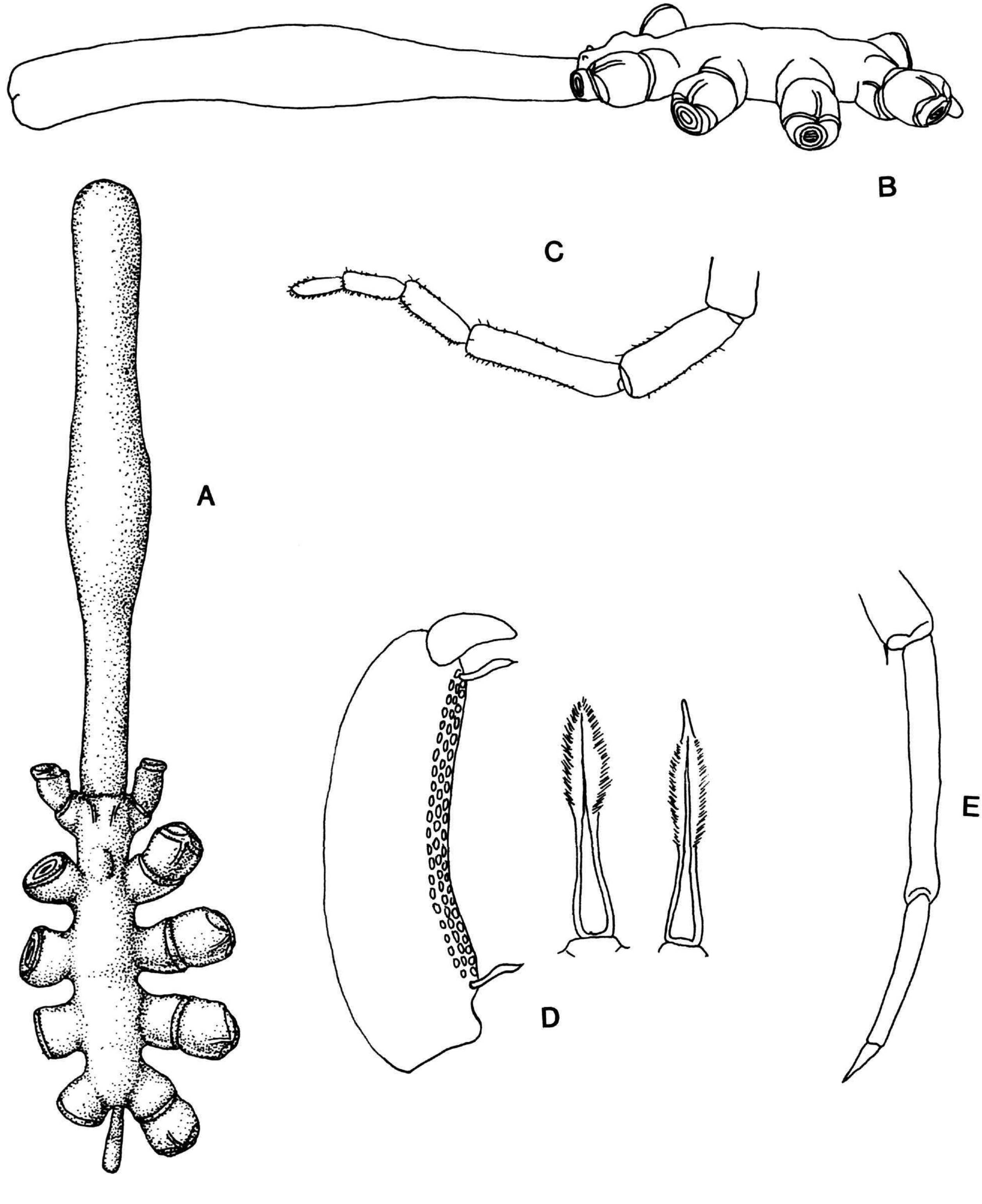


FIGURE 3.—*Colossendeis peloria*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp terminal segments, enlarged; D, oviger strigilis terminal segment, two denticulate spines, enlarged; E, leg terminal segments, enlarged.

almost twice propodal length, claw of moderate length. Terminal oviger claw very long.

REMARKS.—Species of this genus often bear long proboscides, but none among these many stations from southern California to northern Washington bear a long, slender, straight proboscis combined with a very long tarsus and short propodus.

Colossendeis macerrima Wilson

Colossendeis macerrima Wilson, 1881:246–247, pl. 1: fig. 2, pl. 4: figs. 9–12, pl. 5: fig. 32.—Stock, 1988:508 [literature]; 1991:163.—Turpaeva, 1992:94.

MATERIAL EXAMINED.—CALIFORNIA: Farallons 2-3 (1 spec.); Farallons 3-1 (1 spec.); Farallons 3-4 (3 spec.); Farallons 4-4 (1 spec.); Farallons 5-10 (1 spec.); Farallons 6-1 (1 spec.); Farallons 6-2 (1 spec.); Farallons 6-7 (15 spec.); Farallons 8-1 (3 spec.); Farallons 9-1 (1 spec.); Farallons 9-5 (1 spec.); Farallons 9-7 (4 spec.); Farallons 10-2 (2 spec.); Farallons 14-12 (3 spec.); Farallons sta F-1 (5 spec.); Farallons sta F-3 (3 spec.); Farallons sta F-5 (1 spec.); Monterey sta M-1 (1 spec.); Monterey sta M-2 (16 spec.); Monterey sta M-3 (11 spec.); Monterey sta M-4 (30 spec.); Monterey sta M-5 (2 spec.); Monterey sta M-7 (2 spec.); Monterey sta M-8 (1 spec.); Pioneer sta P-4 (2 spec.).

OREGON: Cr 63-?, sta OTB 23-06 (1 spec.); cr 6405, sta OTB 31-08 (1 spec.); cr 6501B, sta OTB 48-07 (1 spec.); cr 6508, sta OTB 79-22 (1 spec.); cr 6603A, sta OTB 112-24B (1 spec.); cr 6610A, sta OTB 132-20B (3 spec.); cr 6704, sta OTB 173-12 (1 spec.); cr 6801, sta OTB 223-25 (1 spec.); cr 6807C, sta OTB 258-07 (2 spec.).

Cr 6907C, sta BMT 93-29 (1 spec.); cr 6907C, sta BMT 95-11 (3 spec.); cr 6907C, sta BMT 97-23 (2 spec.); cr 7001B, sta BMT 155-25 (1 spec.); cr 7001B, sta BMT 156-31 (1 spec.); cr 7003B, sta BMT 185-29 (3 spec.); cr 7003B, sta BMT 190-17 (7 spec.); cr 7003B, sta BMT 191-21 (2 spec.); cr 7003B, sta BMT 192-37 (4 spec.); cr 7003B, sta BMT 193-35 (1 spec.); cr 7102B, sta BMT 260-15 (1 spec.); cr 7102B, sta BMT 262-24 (2 spec.); cr 7102B, sta BMT 270-37 (1 spec.); cr 7102B, sta BMT 272-26 (2 spec.); cr 7102B, sta BMT 276-26 (2 spec.); cr 7206B, sta BMT 290-22 (1 spec.); cr 7301F, sta BMT 315-30 (1 spec.); cr 7301A, sta BMT 317-31 (1 spec.); cr 7301F, sta BMT 319-35 (2 spec.); cr 7303A, sta BMT 322-49 (1 spec, 2 juv); cr 7310B, sta BMT 328-20 (1 spec.); cr 7310B, sta BMT 334-39 (1 spec.).

WASHINGTON: Cr DWD, sta BMT-5 (1 spec.).

DISTRIBUTION.—The above records add no new information except that the species has seldom been taken off the American West Coast due to the lack of extensive sampling for any fauna from the depths listed herein, but is now found to be more common than was known. It is worth noting that almost the same number of specimens (161) of *C. japonica*, a species thought to be exclusive or restricted to the Orient, were taken off Oregon during this survey as the more widespread *C. macerrima* (168), a species of worldwide distribution long known to United States waters.

DIAGNOSIS.—A species with very long narrow proboscis which almost invariably has distal upturn at terminus of extremely slender and tubular section. It has very short terminal leg segments with tarsus longer than propodus and very short claw. Terminal three palp segments tiny and short. Species quite small in comparison to others of this report and those of genus.

REMARKS.—The proboscis of this small species is usually characteristic and is similar to the curved proboscis of *C. nasuta* Hedgpeth, a species from Japan and the Aleutian Islands.

Colossendeis peloria, new species

FIGURE 3

MATERIAL EXAMINED.—CALIFORNIA: Monterey sta M-2 (1 spec., holotype, USNM 234641; 1 spec. paratype, MLML); Monterey M-3 (1 juv spec., paratype, USNM 234642); Monterey M-7 (1 juv spec., paratype, MLML).

DISTRIBUTION.—Distribution of this new species is confined to three stations ranging from 2620 m to 2900 m in Monterey Canyon, California.

DESCRIPTION.—Huge species with moderately short legs having leg span of about 438 mm. Entire animal with scattered tiny short setae or spines increasing in numbers distally on appendages. Trunk typical with short lateral processes separated by about half their diameters. Ocular tubercle low, a single or double bump without eyes (or eyes not visible), with a pair of low dorsolateral bumps at anterior of trunk. Proboscis very long, slightly less than twice length of trunk, expanding from narrow base to median and distal swellings, slightly downcurved distally in lateral view. Abdomen club-shaped from narrow base, extending slightly beyond first coxae of fourth legs, carried either horizontally or slightly ventrally.

Palp long, third and fifth segments subequal in length; sixth little shorter than seventh; terminal 3 segments subequal in length; the ultimate segment slightly shorter than preceeding 2.

Ovigers typical with many spatulate denticulate spines in at least seven rows. Terminal claw very small, not quite as long as terminal segment diameter.

Legs moderately short and robust in comparison with trunk size. Femorae longer than either tibiae with first tibiae only slightly shorter than femorae, second tibiae shorter than either. Tarsus long, almost twice length of propodus, which tapers distally to a very short triangular claw slightly less than 0.25 the length of propodus. Terminal segments with sparse tiny setae.

MEASUREMENTS (holotype, in mm).—Trunk length (proboscis insertion to tip 4th lateral processes), 23.5; trunk width (across 2nd lateral processes), 12.0; proboscis length, 42.0; abdomen length, 5.4; third leg, coxa 1, 3.5; coxa 2, 6.3; coxa 3, 6.0; femur, 64.5; tibia 1, 62.0; tibia 2, 54.5; tarsus, 9.2; propodus, 5.5; claw, 1.3.

ETYMOLOGY.—The name of this new species (Greek: *pelorios*, meaning huge or prodigious) refers to the conspicuously long inflated proboscis and the gross size of the species.

REMARKS.—This species is the eastern Pacific counterpart of Stock's (1975:988–990, figs. 11c–f, 12) *C. melancholicus*, and after superficial examination would have been identified as that species were it not for the very different proboscis of *C. peloria*. Stock's description and figure (11c,d) of his species' proboscis reveal an almost straight sided (without swellings) and continually downcurved appendage of greater than twice the trunk length. The proboscis of this new species is shorter than twice the trunk length and is swollen at midlength with a distinct distal flare or swelling around bulbous lips. The proboscis downcurve of *C. peloria* is only present in its distal third and is very gradual or shallow.

Reexamination of Stock's type male of *C. melancholicus* (USNM 149221, from Florida Straits in 779 m), and another unreported specimen (from the Caribbean off Jamaica in 732 m), reveals that these Pacific specimens are not Stock's species. There are other less conspicuous differences between the two species: the tarsus and claw are of slightly different lengths in relation to the propodus in Stock's species according to his measurements, although his figure 11f does not show that the propodus is half the length of the tarsus. Stock's figure 12b illustrates the ocular tubercle laterally with a pair of large anterior eyes which are lacking in this new species. The terminal three palp segments of the new species are subequal in length while the eighth segment is slightly longer than the terminal two segments in Stock's species. Of the two long palp segments, the fifth segment is notably shorter than the third in *C. peloria*, while the two segments are equal in length in *C. melancholicus*. The terminal oviger claw is shorter than the terminal segment diameter in the new species while it is figured as being longer or as long as the terminal segment diameter in Stock's species. This may be due only to excessive wear of the claw in each of the specimens of the new species. Otherwise, the two species are very similar in most characters including size.

Comparing *C. peloria* with the only other known large species in the northeastern Pacific, *C. colossea*, the differences are more pronounced. Wilson's species has much longer and more slender legs and its proboscis is notably shorter with broader median and distal inflated areas.

***Colossendeis spicula*, new species**

FIGURE 4

MATERIAL EXAMINED.—OREGON: Cr 7003B, sta BMT 185-29 (1 spec., holotype, USNM 234643); cr 7102B, sta BMT 272-26 (1 juv, paratype, USNM 234644).

DISTRIBUTION.—This new species is known only from the type locality, well off the Oregon coast in 2816–2832 m.

DESCRIPTION.—Of moderate size among species of this genus, with a leg span of about 285 mm. Conspicuously spinose on lateral processes, palps, and legs with spines of various sizes; those of the palps and legs in rows. Lateral processes shorter than their diameters, closely spaced but not touching, armed with from 2 to 7 dorsodistal and lateral spines. Ocular tubercle low, blind, with small apical cone. Proboscis with median swelling which tapers distally to broad flat mouth, constricted in first quarter-length, with few scattered spines. Abdomen slender, clubbed distally, extending slightly beyond tip of first coxae of fourth legs, and armed with few tiny distal setae.

Palps with second segment longest; fourth segment not as long as combined length of fifth and sixth; sixth almost twice length of fifth; distal three segments each slightly shorter and narrower than the one next proximal, bearing few short scattered spines but without ventral setae.

Ovigers typical, with strigilis bearing several rows of denticulate spines; the longest ones very slender, constricted at midpoint, and bear many very tiny distal denticulations.

Legs with rows of well-separated spines, a few longer than segment diameters. First tibiae longest of all segments, with femorae longer than second tibiae. Tarsus almost twice as long as slender propodus and claw only about 0.3 as long as propodus. Terminal segments with few spines.

MEASUREMENTS (holotype, in mm).—Trunk length, 12.3; trunk width (across 2nd lateral processes), 5.5; proboscis length, 17.9; abdomen length, 3.1; third leg, coxa 1, 2.0; coxa 2, 3.3; coxa 3, 3.2; femur, 41.6; tibia 1, 43.8; tibia 2, 34.8; tarsus, 6.7; propodus, 3.8; claw, 1.3.

ETYMOLOGY.—The name given to this species (Latin: *spicula*, the diminutive of *spica*, a point, tuft, or spear) refers to the many spines on its lateral processes and appendages.

REMARKS.—This species appears superficially to be a spiny version of *C. colossea* because many of its proportions are very similar to those of Wilson's species, except for the leg lengths which are notably shorter. A spiny species in this usually smooth and almost glabrous genus is rare; there are none recorded which have as conspicuous a series of spines as this new species. Most species bear an inconspicuous pile of small setae which are not as long as the appendage on which they are found. Most specimens examined of *C. colossea*, a very common species, bear a series of conspicuous but scattered spines on the long segments of each oviger. These spines are not found on the long oviger segments of the new species, but are much more evident and numerous on the palps and legs.

***Colossendeis tenera* Hilton**

Colossendeis tenera Hilton, 1943:2–4.—Hedgpeth, 1943:223–224, fig. 1.

MATERIAL EXAMINED.—CALIFORNIA: Farallons 1-2 (1 adult, 1 juv); Farallons 4-4 (1 spec.); Farallons 5-10 (2 spec.); Farallons 6-7 (1 spec.); Farallons 12-1 (2 spec.); Farallons 14-1 (1 spec.); Farallons 14-9 (1 spec.); Farallons 14-12 (23 spec.); Farallons 16-7 (3 spec.); Farallons 16-8 (1 spec.); Farallons 16-12 (3 spec.); Farallons unknown (FVC1-77) (1 spec.); Farallons 4-1 (2 spec.); Farallons sta F-1 (1 spec.); Farallons sta F-3 (6 spec.); Monterey sta M-1 (2 spec.); Monterey sta M-2

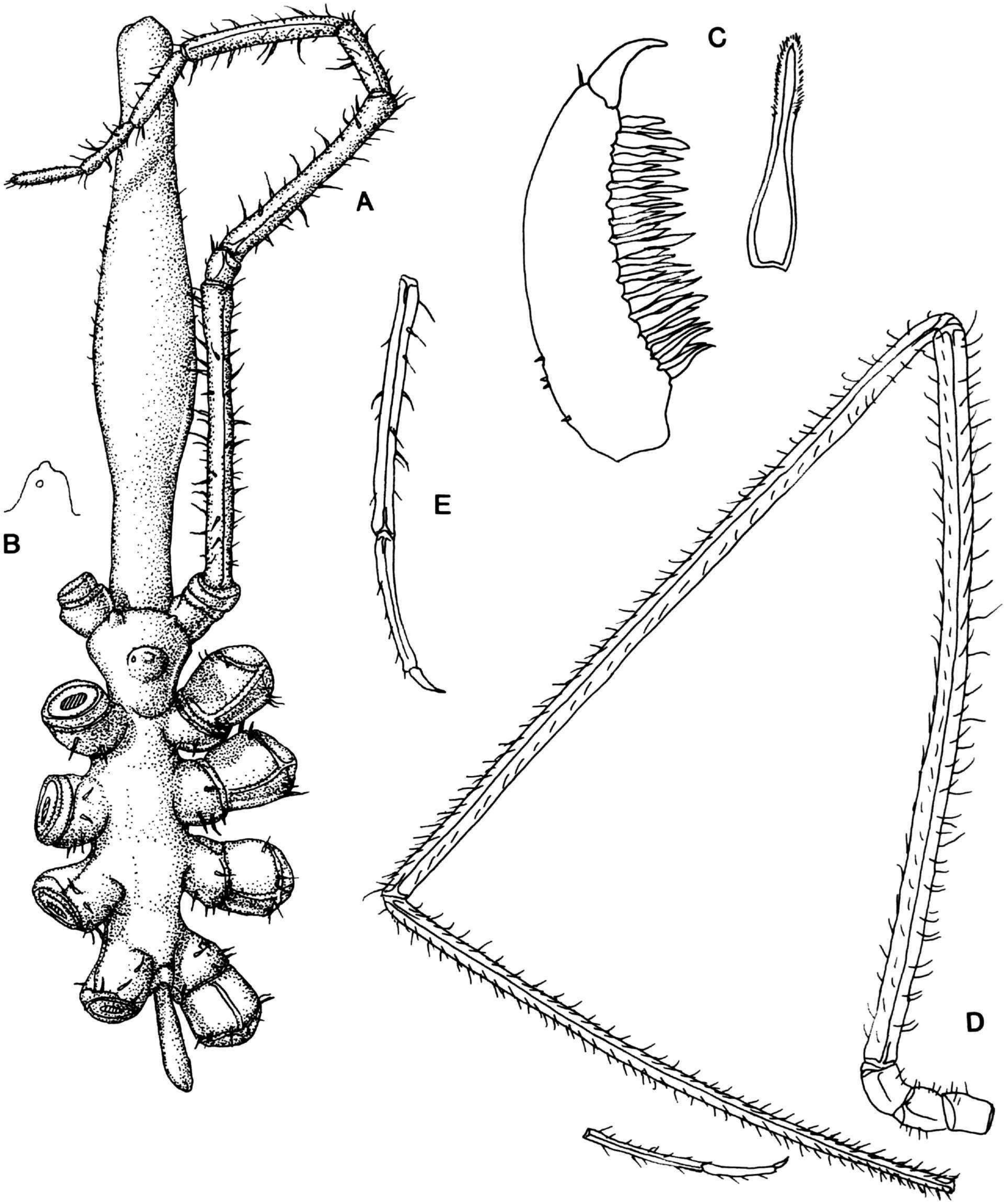


FIGURE 4.—*Colossendeis spicula*, new species, holotype: A, trunk, dorsal view with palp attached; B, ocular tubercle, lateral view; C, oviger terminal segment and denticulate spine, enlarged; D, third leg; E, leg terminal segments, enlarged.

(14 spec.); Monterey sta M-3 (8 spec.); Monterey sta M-4 (18 spec.); Monterey sta M-7 (6 spec.); Monterey sta M-8 (5 spec.); Pioneer sta P-1 (1 spec.); Pioneer sta P-2 (1 spec.); Pioneer sta P-3 (1 spec.); Pioneer sta P-4 (2 spec.).

OREGON: Cr 6112, sta OTB 40-29 (1 spec.); cr 6312C, sta OTB 18-? (1 spec.); cr 63-?, sta OTB 23-06 (1 spec.); cr 6405C, sta OTB 29-13 (1 spec.); cr 6405, sta OTB 30-06B (1 spec.); cr 6405, sta OTB 31-08 (2 spec.); cr 6408, sta OTB 40 (4 spec.); cr 6408, sta OTB 41-01 (6 spec.); cr 6408, sta OTB 42-13B (1 spec.); cr 6501, sta OTB 49-30 (1 spec.); cr 6501B, sta OTB 50-19 (3 spec.); cr 6501B, sta OTB 51-13 (1 spec.); cr 65-?, sta OTB 63-21 (1 spec.); cr 6507, sta OTB 76-11B (2 spec.); cr 6507, sta OTB 77-01 (2 spec.); cr 6507, sta OTB 78-28 (1 spec.); cr 6508, sta OTB 79-22 (4 spec.); cr 6510, sta OTB 92-19 (1 spec.); cr 6510, sta OTB 93-09 (5 spec.); cr 6601, sta OTB 104-13 (1 spec.); cr 6610A, sta OTB 132-20B (1 spec.); cr 6707, sta OTB 184-10 (2 spec.); cr 6707, sta OTB 188-02C (4 spec.); cr 6710, sta OTB 207-04 (1 spec.); cr 6710, sta OTB 208-02 (1 spec.).

Cr 6907C, sta BMT 93-29 (1 spec.); cr 6907C, sta BMT 94-23 (1 spec.); cr 6907C, sta BMT 95-11 (1 spec.); cr 6910A, sta BMT 116-21 (2 spec.); cr 6910A, sta BMT 117-26 (1 spec.); cr 7001B, sta BMT 154-22 (1 spec.); cr 7003B, sta BMT 185-29 (1 spec.); cr 7003B, sta BMT 190-17 (3 spec.); cr 7003B, sta BMT 191-21 (3 spec.); cr 7003B, sta BMT 192-37 (8 spec.); cr 7102B, sta BMT 267-32 (1 spec.); cr 7102B, sta BMT 268-31 (1 spec.); cr 7102B, sta BMT 270-37 (2 spec.); cr 7206B, sta BMT 288-38 (5 spec.); cr 7206B, sta BMT 289-39 (4 spec.); cr 7206B, sta BMT 291-32 (2 spec.); cr 7206B, sta BMT 292-31 (2 spec.); cr 7206B, sta BMT 293-31 (5 spec.); cr 7206B, sta BMT 294-33 (3 spec.); cr 7301F, sta BMT 315-30 (1 spec.); cr 7301F, sta BMT 317-31 (1 spec.); cr 7301F, sta BMT 319-35 (1 spec.); cr 7303A, sta BMT 321-42 (1 spec.); cr 7406B, sta BMT 360-38 (1 spec.).

R/V *Commando:* 15 May 63 (1 spec.); 28 May 64 (4 spec.); 29 May 64 (11 spec.); 29 May 64 (1 spec.); 30 May 1964 (1 spec.); 30 May 64 (2 spec.).

WASHINGTON: Cr DWD, sta BMT-1 (2 spec.); cr DWD, sta BMT-2 (1 spec.); cr DWD, sta BMT-3 (2 spec.); cr DWD, sta BMT-5 (4 spec.); cr DWD, sta BMT-7 (5 spec.); cr DWD, sta BMT-8 (6 spec.).

DISTRIBUTION.—The types of this species were taken in much the same places as many of specimens reported in this paper. The holotype was taken off Oregon in 1437 m, paratypes were taken off Washington in 1604 m and off southern Alaska in deeper waters at 2869 m. The species is apparently fairly common (249 specimens listed herein) at the above depths and at those of stations reported here. These captures extend its known depths from 914 to 3600 m (the latter from Oregon sta BMT 360-38).

DIAGNOSIS.—Species with a cylindrical proboscis almost equal in length to trunk and a tall conical ocular tubercle. Other conspicuous characters are: a slender tarsus slightly longer than equally slender propodus and a very long claw almost equal to or longer than propodus. Eighth palp segment tiny, as wide as long, and much shorter than more distal segments. Oviger claw slender and about half terminal segment length.

REMARKS.—Almost all of the above specimens are preserved with their eight legs raised vertically and gathered together above the trunk. This has been described (and photographed) as an escape mechanism: while swimming, some species collapse their legs above the trunk in order to sink through the water column faster. This trait assisted superficially in sorting out specimens of this species prior to a more detailed examination.

FIGURE 5.—*Hedgpethia nasica*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, oviger with enlargement of terminal claw; E, terminal segments of third leg.

Genus *Hedgpethia* Turpaeva, 1973

Hedgpethia nasica, new species

FIGURE 5

MATERIAL EXAMINED.—CALIFORNIA: Cr Pulse I, sta 124 (1 spec., paratype, USNM 234638); cr Pulse V, sta 505M (1♀, paratype, USNM 234639); cr Pulse VII, sta 721M (1 spec., holotype, USNM 234637); cr Pulse X, sta 1017M (1 spec., paratype, USNM 234640).

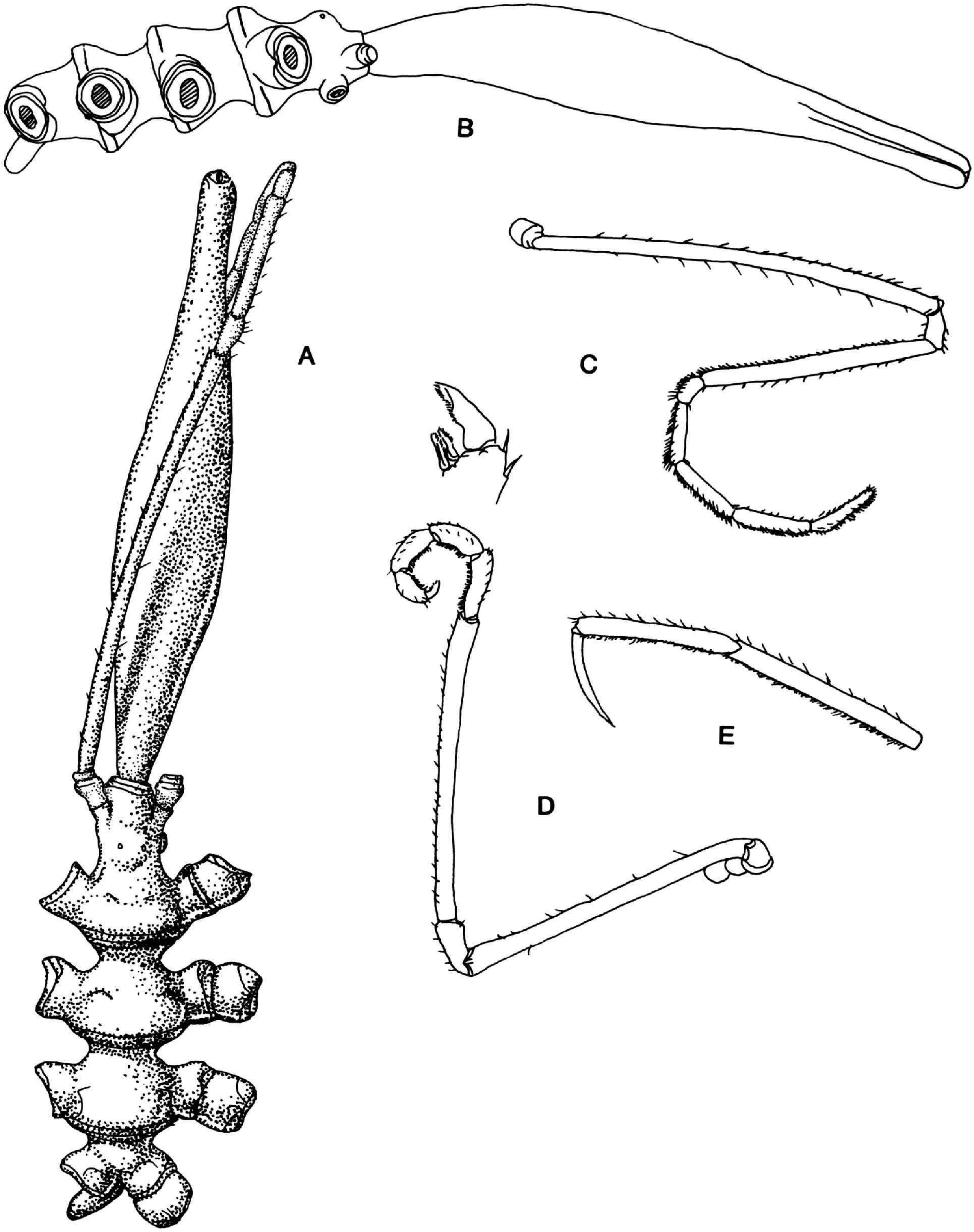
DISTRIBUTION.—This new species has only been collected W of Point Arguelo, California. All four stations were in approximately 4100 m depth.

DESCRIPTION.—Trunk fairly compact with raised dorsomedian rim on each trunk segment, without tubercles or setae. Lateral processes short, cylindrical, glabrous. Ocular tubercle very low, rounded, not as tall as trunk segment rims, without trace of eyes, lateral sensory papillae rather prominent. Abdomen cylindrical, rounded at tip, longer than fourth lateral processes, glabrous, carried at ventral oblique angle. Proboscis extremely long, measuring about 1.65 times trunk length, moderately inflated proximally, and gradually tapering distally to rounded lips.

Palps very long, slender; fifth segment 0.6 times length of third; 4 terminal segments subequal in length; all segments with many very short setae.

Oviger typical, very long, slender; fourth and sixth segments subequal; proximal segments with few scattered short setae increasing in numbers distally. Strigilis also typical, with few endal setae and many denticulate spines per segment. Terminal claw curved, with proximal swelling, distal cutting edge or lamella. Denticulate spines adjacent to claw with lamellar edges closest to claw and rounded or smooth on opposite edges.

Legs with few randomly placed spines increasing in numbers on distal segments; spines of tarsus and propodus all short but varying in lengths. Femorae slightly longer than second tibiae; first tibiae shorter than both; tarsus conspicuously longer than propodus and slender claw about 0.7 length of propodus.


B
A
C
D
E

MEASUREMENTS (holotype, in mm).—Trunk length (palp insertion to tip 4th lateral processes), 2.99; trunk width (across 2nd lateral processes), 1.17; proboscis length, 5.08; abdomen length, 0.74; third leg, coxa 1, 0.46; coxa 2, 0.61; coxa 3, 0.60; femur, 6.46; tibia 1, 5.68; tibia 2, 6.12; tarsus, 1.66; propodus, 1.42; claw, 1.04.

ETYMOLOGY.—The name (Latin: *nasicus*, meaning large- or long-nosed) proposed for this new species refers to its extremely long proboscis.

REMARKS.—There is only one known species of the genus *Hedgpethia* closely related to this new species and it is the only other blind species known, *H. articulata* (Loman, 1908), from the southwest Pacific in Indonesia. Both species have a very low blind ocular tubercle, and a very long slender proboscis. Superficially, they look alike, but there are a number of subtle differences. Loman's species has terminal leg segments which are much more slender than those of this species; they appear to be glabrous in Loman's figures and the claw of his species is longer in relation to the propodus than in *H. nasica*. The fifth palp segment in this new species is notably longer in relation to the sixth than the same segment in Loman's species. The principal difference lies in the abdomen of both species. The abdomen of *H. nasica* is about twice as long as that of *H. articulata* and appears to be carried at a more acute angle. The proboscis of Loman's species is apparently broader than that of the new species. However, the inflation may be correlated to feeding status and consequently, it may not be a reliable taxonomic character.

Appendix

Station List

(Data unknown ?, –.–, –)

Oregon State University

Deep-Sea Slope and Basin Stations off Oregon

Cruise	Station	Latitude (N)	Longitude (W)	Depth (m)	Date	Ship
6108	OTB24-29	44°23.9′	125°14.5′	1629–2000+	24 Aug 61	-
6112	OTB40-29	44°21.5′	125°14.4′	1426	10 Dec 61	R/V *Acona*
6304C	OTB5-02	44°35.5′	125°35.3′	2800	29 Apr 63	R/V *Acona*
6312C	OTB18-?	44°40.5′	125°42.0′	2850	29 Dec 63	R/V *Acona*
6312C	OTB19-29C	44°36.0′	126°06.4′	2850	30 Dec 63	R/V *Acona*
63-?	OTB23-06	44°42.–′	125°37.3′	2800	20 Feb 64	-
6405C	OTB29-13	44°39.1′	125°36.2′	2865	19 May 64	-
6405	OTB30-06B	44°40.0′	126°21.2′	2856	20 May 64	R/V *Acona*
6405	OTB31-08	44°38.9′	126°05.2′	2860	20 May 64	R/V *Acona*
6405C	OTB31-08B	44°40.2′	126°04.3′	2860	20 May 64	R/V *Acona*
6408	OTB38-03	44°–.–′	125°–.–′	2800	- Aug 64	R/V *Acona*
6408	OTB40-?	44°2-.–′	125°13.–′	1000	14 Aug 64	R/V *Acona*
6408	OTB41-01	44°21.3′	125°13.9′	2086	14 Aug 64	R/V *Acona*
6408	OTB42-13B	44°24.9′	125°13.3′	1530	14 Aug 64	R/V *Acona*
6501B	OTB48-07	44°–.–′	125°–.–′	2800	12 Jan 65	R/V *Acona*
6501	OTB49-30	44°44.8′	125°59.5′	2800	12 Jan 65	R/V *Acona*
6501B	OTB50-19	44°28.2′	125°32.3′	2800	13 Jan 65	R/V *Acona*
6501B	OTB51-13	44°–.–′	125°–.–′	1250	15 Jan 65	R/V *Acona*
65-?	OTB63-21	44°35.2′	125°13.1′	1600	08 Apr 65	R/V *Acona*
6507	OTB76-11B	43°17.0′	125°49.0′	3000	27 Jul 65	R/V *Acona*
6507	OTB76-46	43°17.0′	125°49.0′	3000	27 Jul 65	R/V *Acona*
6507	OTB77-01	44°–.–′	125°–.–′	2926	29 Jul 65	R/V *Acona*
6507	OTB78-28	45°59.6′	125°44.–′	2540	01 Aug 65	R/V *Acona*
6508	OTB79-22	44°41.7′	125°51.3′	2833	21 Aug 65	R/V *Yaquina*
6508	OTB81-29	45°–.–′	125°–.–′	2709	28 Aug 65	R/V *Yaquina*
6510	OTB87-09	44°40.0′	128°11.4′	2700	22 Oct 65	R/V *Yaquina*
6510	OTB88-17B	44°45.8′	127°23.6′	2790	22 Oct 65	R/V *Yaquina*
6510	OTB89-29B	44°38.3′	126°53.5′	2806	23 Oct 65	R/V *Yaquina*
6510	OTB90-27	44°36.0′	126°27.4′	2820	23 Oct 65	R/V *Yaquina*
6510	OTB91-18b	44°39.4′	126°05.1′	2794	23 Oct 65	R/V *Yaquina*
6510	OTB92-19	44°44.3′	125°41.4′	2800	24 Oct 65	R/V *Yaquina*
6510	OTB92-19B	44°45.9′	125°41.3′	2800	24 Oct 65	R/V *Yaquina*
6510	OTB93-09	44°32.5′	125°13.6′	1600	24 Oct 65	R/V *Yaquina*
6601	OTB104-13	40°13.4′	126°30.–′	4194	14 Jan 66	R/V *Yaquina*
6603A	OTB112-24B	44°35.5′	125°35.4′	2810	27 Mar 66	R/V *Yaquina*
6610	OTB131-19	44°33.4′	125°34.0′	2804	14 Oct 66	R/V *Yaquina*
6610A	OTB132-20B	44°35.3′	125°34.5′	2853	15 Oct 66	R/V *Yaquina*
6701	OTB155-04	44°36.9′	125°35.–′	2820	10 Jan 67	-
6701	OTB156-14	45°45.5′	125°30.2′	2176	11 Jan 67	R/V *Yaquina*
6702	OTB162-11	44°38.2′	132°29.5′	3700	28 Feb 67	R/V *Yaquina*
6704	OTB172-02	44°44.4′	125°35.5′	2810	04 Apr 67	R/V *Yaquina*
6704	OTB173-12	44°35.3′	125°13.1′	1600	04 Apr 67	R/V *Yaquina*
6707	OTB184-10	44°34.1′	125°11.6′	1462	25 Jul 67	R/V *Yaquina*
6707	OTB186-15	45°–.–′	125°–.–′	2800	26 Jul 67	R/V *Yaquina*
6707	OTB188-02C	45°50.1′	125°14.–′	1550	26 Jul 67	R/V *Yaquina*
6707D	OTB191-13	45°55.2′	124°38.2′	200	27 Jul 67	R/V *Yaquina*

Cruise	Station	Latitude (N)	Longitude (W)	Depth (m)	Date	Ship
6710	OTB206-04	45°49.2′	125°41.7′	2300	26 Jul 67	R/V *Yaquina*
6710	OTB207-04	44°49.0′	125°39.5′	2810	29 Oct 67	-
6710	OTB208-02	44°36.-′	125°10.8′	1400–1600	30 Oct 67	R/V *Yaquina*
6801	OTB223-25	44°40.9′	125°35.3′	2800	14 Jan 68	R/V *Yaquina*
6807C	OTB258-07	44°34.5′	125°34.5′	2807	15 Jul 68	R/V *Yaquina*
6903F	OTB283-04	44°45.4′	125°40.1′	2830	28 Mar 69	R/V *Cayuse*
6903G	BMT70-?	45°14.9′	125°34.0′	2816	29 Mar 69	R/V *Cayuse*
6903F	BMT73-02	45°58.4′	125°45.0′	2305	30 Mar 69	R/V *Yaquina*
6907C	BMT89-14	45°43.8′	125°26.8′	2225	14 Jul 69	R/V *Yaquina*
6907C	BMT90-16	45°-.-′	125°-.-′	2283	- Jul 69	R/V *Yaquina*
6907C	BMT93-29	45°09.3′	125°38.3′	2669	15 Jul 69	R/V *Yaquina*
6907C	BMT94-23	45°-.-′	125°-.-′	2688	15 Jul 69	R/V *Yaquina*
6907C	BMT95-11	45°-.-′	125°-.-′	2706	15 Jul 69	R/V *Yaquina*
6907C	BMT97-23	44°-.-′	125°-.-′	2862	- Jul 69	R/V *Yaquina*
6909C	BMT96-04	44°37.8′	125°35.6′	2800	16 Jul 69	R/V *Yaquina*
6910A	BMT113-24	46°04.6′	125°34.6′	2156	03 Oct 69	R/V *Yaquina*
6910A	BMT115-10	45°49.2′	125°40.1′	2196	04 Oct 69	R/V *Yaquina*
6910A	BMT116-21	45°21.0′	125°37.3′	2500	05 Oct 69	R/V *Yaquina*
6910A	BMT117-26	45°19.0′	125°39.9′	2633	05 Oct 69	R/V *Yaquina*
6910A	BMT118-35	45°02.0′	125°35.0′	2652	05 Oct 69	R/V *Yaquina*
6910A	BMT120-22	44°42.6′	125°32.0′	2825	06 Oct 69	R/V *Yaquina*
7001B	BMT154-22	45°52.5′	126°40.8′	2666	16 Jan 70	R/V *Yaquina*
7001B	BMT155-25	45°45.5′	126°42.4′	2675	16 Jan 70	R/V *Yaquina*
7001B	BMT156-31	45°34.5′	126°18.5′	2661	17 Jan 70	R/V *Yaquina*
7001B	BMT157-30	45°27.4′	126°19.2′	2606	17 Jan 70	R/V *Yaquina*
7001B	BMT159-28	45°16.6′	126°40.5′	2720	18 Jan 70	R/V *Yaquina*
7001B	BMT163-27	44°43.6′	126°30.8′	2787	19 Jan 70	R/V *Yaquina*
7003B	BMT185-29	44°37.5′	125°40.5′	2816	16 Mar 70	R/V *Yaquina*
7003B	BMT186-40	44°34.8′	125°35.6′	2816	16 Mar 70	R/V *Yaquina*
7003B	BMT188-18C	44°58.7′	124°42.3′	2790	19 Mar 70	R/V *Yaquina*
7003B	BMT190-17	45°19.6′	125°45.8′	2597	18 Mar 70	R/V *Yaquina*
7003B	BMT191-21	45°17.4′	125°49.0′	2605	18 Mar 70	R/V *Yaquina*
7003B	BMT192-37	45°37.9′	125°46.5′	2450	19 Mar 70	R/V *Yaquina*
7003B	BMT193-35	45°39.0′	125°52.9′	2425	19 Mar 70	R/V *Yaquina*
7003B	BMT194-24	45°55.3′	125°36.0′	2030	20 Mar 70	R/V *Yaquina*
7005C	BMT229-20	44°54.4′	131°25.4′	3358	31 May 70	R/V *Yaquina*
7005C	BMT230-20	44°25.8′	132°13.5′	3655	01 Jun 70	R/V *Yaquina*
7005C	BMT232-29	44°39.9′	133°37.3′	3724	03 Jun 70	R/V *Yaquina*
7009D	OTB354-01	45°57.3′	125°43.4′	2350	27 Sep 70	R/V *Cayuse*
7102B	BMT257-09	46°02.2′	126°31.0′	2706	15 Feb 71	R/V *Yaquina*
7102B	BMT258-17	45°55.9′	126°37.5′	2670	15 Feb 71	R/V *Yaquina*
7102B	BMT259-22	45°46.3′	126°34.3′	2665	15 Feb 71	R/V *Yaquina*
7102B	BMT260-15	45°52.7′	126°29.4′	2650	16 Feb 71	R/V *Yaquina*
7102B	BMT261-20	45°38.7′	126°43.8′	2670	16 Feb 71	R/V *Yaquina*
7102B	BMT262-24	45°38.3′	126°45.8′	2721	17 Feb 71	R/V *Yaquina*
7102B	BMT264-26	45°20.8′	126°37.7′	2750	17 Feb 71	R/V *Yaquina*
7102B	BMT265-28	45°18.6′	126°31.5′	2750	18 Feb 71	R/V *Yaquina*
7102B	BMT266-23	45°17.5′	126°28.4′	2710	18 Feb 71	R/V *Yaquina*
7102B	BMT267-32	44°58.2′	126°38.4′	2795	18 Feb 71	R/V *Yaquina*
7102B	BMT268-31	44°58.8′	126°37.4′	2770	19 Feb 71	R/V *Yaquina*
7102B	BMT269-35	44°57.6′	126°40.0′	~2700	19 Feb 71	R/V *Yaquina*
7102B	BMT270-37	44°38.4′	126°42.0′	2850	20 Feb 71	R/V *Yaquina*
7102B	BMT271-31	44°39.1′	126°41.8′	2832	20 Feb 71	R/V *Yaquina*
7102B	BMT272-26	44°39.9′	124°48.4′	2832	20 Feb 71	R/V *Yaquina*
7105B	BMT276-26	45°57.6′	127°38.6′	2761	17 May 71	R/V *Yaquina*
7105B	BMT277-32	45°54.9′	127°32.7′	2765	17 May 71	R/V *Yaquina*
7105B	BMT278-12	45°24.0′	127°39.0′	2811	18 May 71	R/V *Yaquina*
7105B	BMT279-18	45°22.2′	127°34.1′	2798	18 May 71	R/V *Yaquina*
7105B	BMT280-25	45°21.6′	127°20.7′	2800	19 May 71	R/V *Yaquina*
7105B	BMT281-25	44°38.5′	127°39.1′	2816	19 May 71	R/V *Yaquina*
7105B	BMT282-23	44°37.5′	127°31.5′	2816	19 May 71	R/V *Yaquina*
7206A	BMT288-38	44°06.2′	125°22.7′	2940	14 Jun 72	R/V *Yaquina*
7206B	BMT289-39	44°02.9′	125°23.7′	2938	15 Jun 72	R/V *Yaquina*
7206B	BMT290-22	44°06.4′	125°24.5′	2938	15 Jun 72	R/V *Yaquina*

Cruise	Station	Latitude (N)	Longitude (W)	Depth (m)	Date	Ship
7206B	BMT291-32	44°04.0′	125°23.8′	2992	15 Jun 72	R/V *Yaquina*
7206B	BMT292-31	43°46.1′	125°26.2′	2992	16 Jun 72	R/V *Yaquina*
7206B	BMT293-31	43°42.0′	125°30.0′	2997	17 Jun 72	R/V *Yaquina*
7206B	BMT294-33	43°45.6′	125°26.0′	3000	17 Jun 72	R/V *Yaquina*
7210A	BMT300-39	44°58.1′	132°14.7′	3595	06 Oct 72	R/V *Yaquina*
7210A	BMT302-37	44°58.0′	133°14.5′	3500	07 Oct 72	R/V *Yaquina*
7210A	BMT306-36	45°02.0′	134°42.2′	3900	09 Oct 72	R/V *Yaquina*
7301F	BMT315-30	44°43.8′	127°27.3′	2803	02 Feb 73	R/V *Yaquina*
7301F	BMT316-39	44°44.4′	127°25.8′	2749	02 Feb 73	R/V *Yaquina*
7301F	BMT317-31	44°44.5′	127°29.0′	2810	03 Feb 73	R/V *Yaquina*
7301F	BMT318-35	45°27.0′	127°28.7′	2783	03 Feb 73	R/V *Yaquina*
7301F	BMT319-35	45°31.7′	127°28.4′	2740	03 Feb 73	R/V *Yaquina*
7303A	BMT321-42	45°57.1′	127°32.9′	2763	11 Mar 73	R/V *Yaquina*
7303A	BMT322-49	46°02.0′	127°31.8′	2740	12 Mar 73	R/V *Yaquina*
7303A	BMT323-47	45°56.4′	127°39.1′	2763	13 Mar 73	R/V *Yaquina*
7310B	BMT328-20	44°43.0′	128°23.0′	2780	02 Nov 73	R/V *Cayuse*
7310B	BMT330-28	44°40.5′	128°25.7′	2794	03 Nov 73	R/V *Cayuse*
7310B	BMT331-39	44°33.0′	128°19.2′	2820	03 Nov 73	R/V *Cayuse*
7310B	BMT332-50	44°53.5′	127°22.5′	2826	04 Nov 73	R/V *Cayuse*
7310B	BMT333-36	44°53.8′	127°28.7′	2838	04 Nov 73	R/V *Cayuse*
7310B	BMT334-39	45°02.6′	127°32.5′	2838	05 Nov 73	R/V *Cayuse*
7310B	BMT335-34	44°59.9′	127°29.1′	2884	05 Nov 73	R/V *Cayuse*
7310B	BMT336-48	45°01.6′	127°31.0′	2850	05 Nov 73	R/V *Cayuse*
7406B	BMT360-38	44°43.0′	127°22.8′	3621	12 Jun 74	R/V *Yaquina*

Oregon State University

Deep-Sea Stations off Washington

Cruise	Station	Latitude (N)	Longitude (W)	Depth (m)	Date
DWD	BMT-1	48°-.-′	127°-.-′	2–	01 Sep 71
DWD	BMT-2	48°-.-′	127°-.-′	2520	02 Sep 71
DWD	BMT-3	48°-.-′	127°-.-′	2532	05 Sep 71
DWD	BMT-5	48°-.-′	127°-.-′	25–	08 Sep 71
DWD3	BMT-7	48°-.-′	127°-.-′	25–	10 Sep 71
DWD	BMT-8	48°09.0′	127°04.2′	2515	10 Sep 71
DWD	BMT-9	48°36.3′	127°00.3′	2129	11 Sep 71
DWD	BMT-10	48°38.0′	126°58.5′	2030	11–12 Sep 71

Scripps Institution of Oceanography

Recent Deep-Sea Stations

Cruise	Station	Location	Latitude (N)	Longitude (W)	Depth (m)	Date	Apparatus	Ship
Pulse I	124	San Clemente Basin, CA	34°49.-′	123°07.-′	~4100	25 Jun 89	otter trawl	R/V *New Horizon*
Pulse II	216M	San Clemente Basin, CA	34°48.-′	123 00.-′	4100	26 Oct 89	otter trawl	R/V *New Horizon*
Pulse II	224M	San Clemente Basin, CA	34°41.-′	123 08.-′	4100	30 Oct 89	otter trawl	R/V *New Horizon*
Pulse III	312M	W of Point Arguelo, CA	34°43.-′	123 11.-′	4100	17 Feb 90	otter trawl	R/V *New Horizon*
Pulse III	314M	W of Point Arguelo, CA	34°44.-′	123 11.-′	4100	18 Feb 90	otter trawl	R/V *New Horizon*
Pulse IV	426M	W of Point Arguelo, CA	34°44.-′	123 08.-′	4100	24 Jun 90	otter trawl	R/V *New Horizon*
Pulse V	505M	W of Point Arguelo, CA	34°43.-′	123 10.-′	4100	23 Oct 90	otter trawl	R/V *New Horizon*
Pulse VI	606M	W of Point Arguelo, CA	34°46.-′	123 06.-′	4100	20 Feb 91	otter trawl	R/V *New Horizon*
Pulse VII	721M	W of Point Arguelo, CA	34°45.-′	123 07.-′	4100	24 Jun 91	otter trawl	R/V *New Horizon*
Pulse VIII	803M	W of Point Arguelo, CA	34°44.-′	123 07.-′	4100	22 Jul 91	otter trawl	R/V *New Horizon*
Pulse IX	907M	W of Point Arguelo, CA	34°43.-′	123 07.-′	4100	01 Aug 91	otter trawl	R/V *New Horizon*
Pulse IX	910M	W of Point Arguelo, CA	34°43.-′	123 06.-′	4100	02 Aug 91	otter trawl	R/V *New Horizon*
Pulse X	1007M	W of Point Arguelo, CA	34°45.-′	123 04.-′	4100	21 Oct 91	otter trawl	R/V *New Horizon*
Pulse X	1017M	W of Point Arguelo, CA	34°42.-′	123 03.-′	4100	25 Oct 91	otter trawl	R/V *New Horizon*
Surfsup	113	San Clemente Basin, CA	32°29.2′	118 06.1′	1840	07 Jul 89	otter trawl	R/V *R.G. Sproul*
Dive	764	Hydrothermal vent area 6X, Gorda Ridge, Escanaba Trough off Eureka, CA, 03 Sep 88, ~3500 m, associated with vestimentiferans, R/V *Sea Cliff*						

U.S. Atomic Energy Commission

Deep-Sea Stations off Columbia River Mouth

Location	Latitude (N)	Longitude (W)	Date	Depth (m)	Apparatus	Ship
SW of Columbia River mouth, OR	45°37.1′	124°54.6′	15 May 63	1372	trawl	R/V *Commando*
SW of Columbia River mouth, OR	45°53.-′	125°07.-′	02 Sep 63	1646	trawl	R/V *Commando*
SW of Columbia River mouth, OR	45°53.-′	125°07.-′	02 Sep 63	1554–1646	trawl	R/V *Commando*
SW of Columbia River mouth, OR	45°-.-′	125°-.-′	28 May 64	1829	trawl	R/V *Commando*
SW of Columbia River mouth, OR	45°55.-′	125°09.-′	29 May 64	1646	trawl	R/V *Commando*
SW of Columbia River mouth, OR	45°55.-′	125°09.-′	29 May 64	1554	trawl	R/V *Commando*
SW of Columbia River mouth, OR	46°03.2′	125°05.7′	30 May 64	1463	trawl	R/V *Commando*
SW of Columbia River mouth, OR	46°02.7′	124°57.3′	30 May 64	914	trawl	R/V *Commando*

Moss Landing Marine Lab

Farallon Islands Expedition, 1991

"Farallones Expedition"

Trawl #	Sample #	Latitude (N)	Longitude (W)	Depth (m)	Apparatus	Date
1	1, 2, 3	37°38.5′	123°29.8′	2975–3010	beam trawl	27 Jul 91
2	3	37°38.9′	123°27.9′	2795–2865	beam trawl	27 Jul 91
3	1, 2, 4	37°38.4′	123°60′ (= 124°?)	2850–2910	beam trawl	27 Jul 91
4	1, 4	37°37.4′	123°30.6′	2945–3075	beam trawl	27 Jul 91
5	3, 7, 10	37°38.4′	123°29.4′	2840–3075	beam trawl	27 Jul 91
6	1, 2, 7	37°38.9′	123°27.7′	2760–2865	otter trawl	28 Jul 91
8	1	37°37.6′	123°29.3′	2760–2875	beam trawl	28 Jul 91
9	1, 5, 7	37°39.1′	123°27.4′	2775–2840	beam trawl	28 Jul 91
10	2	37°39.2′	123°25.4′	2605–2760	beam trawl	29 Jul 91
12	1, 2, 4	37°38.4′	123°21.5′	2300–2375	beam trawl	29 Jul 91
14	1, 2, 3, 4, 6, 9, 12	37°35.0′	123°30.1′	2690–3015	beam trawl	30 Jul 91
16	6, 7, 8, 12	37°35.5′	123°30.0′	2900–3000	beam trawl	30 Jul 91

Farallon Islands Expedition, 1992

"Farallones Expedition"

F-1	8	37°39.5′	123°30.2′	2850–2990	beam trawl	27 Feb 92
F-3	12	37°38.1′	123°29.6′	2890–2970	beam trawl	28 Feb 92
F-5	19	37°39.1′	123°29.8′	2850–2950	beam trawl	28 Feb 92

Monterey Canyon, 1992

M-1	7	36°15.9′	122°36.7′	2820–2960	beam trawl	1 Mar 92
M-2	21	36°16.6′	122°35.6′	2650–2680	beam trawl	1 Mar 92
M-3	9	36°20.3′	122°36.2′	2620–2750	beam trawl	1 Mar 92
M-4	15	36°18.4′	122°36.4′	2750	beam trawl	1 Mar 92
M-5	7	36°23.9′	122°39.3′	3250	beam trawl	2 Mar 92
M-6	3	36°25.7′	122°37.7′	3150–3200	beam trawl	2 Mar 92
M-7	1	36°26.5′	122°30.7′	2810–2900	beam trawl	2 Mar 92
M-8	1	36°26.6′	122°30.7′	2800–2900	beam trawl	2 Mar 92

Pioneer Canyon, 1992

P-1	16	37°04.4′	123°26.4′	3150–3280	beam trawl	29 Feb 92
P-2	15	37°05.4′	123°24.9′	3200	beam trawl	29 Feb 92
P-3	5	37°03.3′	123°26.3′	3090–3300	beam trawl	29 Feb 92
P-4	6	37°04.4′	123°24.4′	3175	beam trawl	29 Feb 92

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