
Nippoleucon hinumensis

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Cumacea
Family: Leuconidae

Taxonomy: *Nippoleucon hinumensis* was described as a member of the genus *Hemileucon* at the same time many other cumacean species were described, in the early 1900s. Watling revised the Leuconidae in 1991 and described the first new leuconid genera since 1907. In his manuscript, Watling transferred two *Hemileucon* species (including *H. hinumensis*) to the newly erected genus *Nippoleucon* based on morphological characters (e.g. male antenna two, peduncular articles, Watling 1991) (Lee and Lee 2003).

Description

Size: The illustrated males and females are both 5 mm in length (from the Columbia River Estuary).

Color: Descriptions of color in the Cumacea are difficult as many species were described based on preserved material, where the color fades.

General Morphology: Cumaceans are easily recognizable by a large and inflated carapace and a (relatively) slender, flexible thorax and abdomen (Kozloff 1993; Gerken and Martin 2014). Their bodies can be divided into these three major regions: the **cephalon** (head) that is covered by a **carapace** and includes the first five pairs of appendages (antennae, mandibles, maxillae, collectively the **mouthparts**). Posterior to the cephalon is the **pereon** (thorax), usually consisting of five thoracic somites, followed by the **pleon** (abdomen) with consistently six pleonites. The fifth pleonite is usually the longest and the pleonites are lacking **pleopods** in female individuals. The cumacean family Leuconidae are characterized by the lack of a free telsons and uropod endopods that are biarticulate (Watling 2007). (For general morphology of *N. hinumensis*, see also Plate 229A, Watling 2007.)

Cephalon: A carapace covers the cephalon and first three thoracic somites and is expanded on either side to form a branchial chamber (Watling 2007).

Carapace: Female carapace with a wide antennal notch that is pronounced into a tooth at an anterolateral angle (Fig. 1). Anterior and posterior edges are slightly serrate and the anterior half of the carina (ridge) is finely and irregularly serrate. (Jones 1963 found two oblique ridges on the carapace sides, which were not observed here.) The carapace in males has an anterolateral edge that is not pronounced into a tooth and no serrations on anterolateral or lower edges (Jones 1963) and no antennal notch (Calman 1907) (Fig. 2).

Rostrum: Two pseudorostral lobes (together called a pseudorostrum), or extensions of the carapace, extend anteriorly but do not fuse in front of the head in cumaceans (Watling 2007). The pseudorostrum in female *N. hinumensis* is abruptly upturned (Fig. 1) and is more horizontal and truncate in males (Fig. 2).

Eyes: None in either sex.

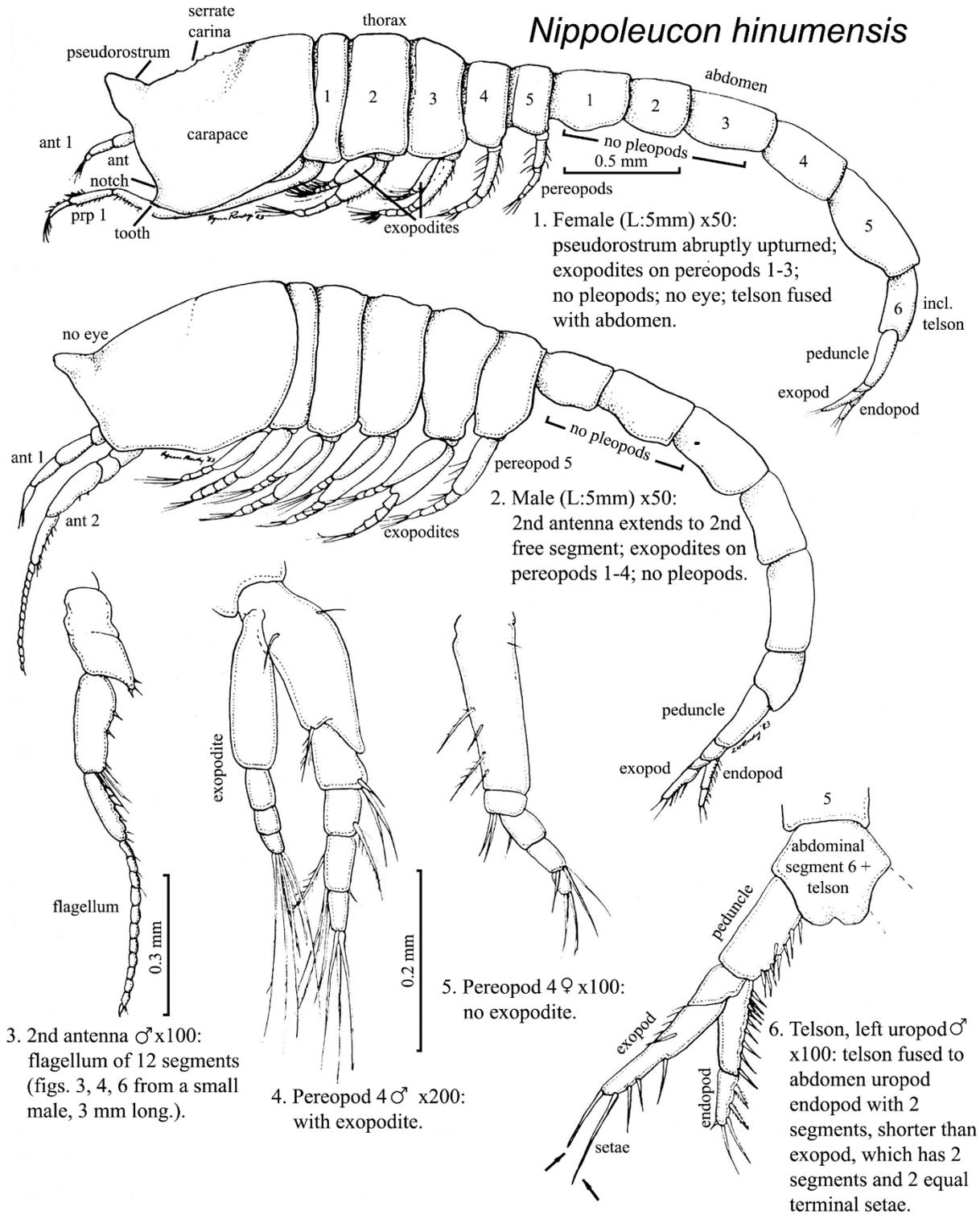
Antennae: Antennae one are non-unique and short in females while antennae two are rudimentary (Jones 1963). In males, the second antenna has a peduncle with five articles and a long flagellum (12 segments) that extends into the second thoracic segment (Calman 1907) (Fig. 3).

Mouthparts: Two pairs maxillae and three pairs maxillipeds. Mandibles are with massive truncate bases, without palp and with strong molar process, incisor process and lacinia mobilis (Fage 1951) (not figured).

Pereon: Consists of five thoracic somites, each with paired appendages (**pereopods**).

Pereopods: Female pereopod exopodites on somites 1–3 (Leuconidae, Stebbing 1913) (Fig. 1). Pereopods four and five without exopodites (Fig. 5). Male

Nippoleucon hinumensis



1. Female (L:5mm) x50:
 pseudorostrum abruptly upturned;
 exopodites on pereopods 1-3;
 no pleopods; no eye; telson fused
 with abdomen.

2. Male (L:5mm) x50:
 2nd antenna extends to 2nd
 free segment; exopodites on
 pereopods 1-4; no pleopods.

3. 2nd antenna ♂ x100:
 flagellum of 12 segments
 (figs. 3, 4, 6 from a small
 male, 3 mm long.).

4. Pereopod 4 ♂ x200:
 with exopodite.

5. Pereopod 4 ♀ x100:
 no exopodite.

6. Telson, left uropod ♂
 x100: telson fused to
 abdomen uropod
 endopod with 2
 segments, shorter than
 exopod, which has 2
 segments and 2 equal
 terminal setae.

pereopod exopodites on pereopods 1–4, none on five (Calman 1907) (Figs. 2, 4).

Pleon: Consists of six segments and the fifth is longest. The telson is fused with the sixth somite (Figs. 1, 2, 6).

Pleopods: All female cumaceans lack pleopods and males in the genus *Nippoleucon* also lack pleopods.

Telson: Telson not independent and fused with last abdominal segment (Leuconidae) (Figs. 6).

Uropods: Uropod peduncles longer than abdominal segment six (Calman 1907) and more than 2/3 as long as the rami (Stebbing 1913). Uropods are slender, cylindrical, and biramous. The endopod inner branch is biarticulate. The first article of the endopod is longer than the second, and is with nine spines on the inner edge. The endopod is shorter than the exopod (Jones 1963) (Fig. 6). The exopod (outer branch) is also biarticulate (as in all Cumacea, Watling 1979), has two unequal terminal setae (Calman 1907; Jones 1963) (Fig. 6), and a series of setae on both inner and outer edges (Calman 1907). The uropods are similar in both sexes.

Sexual Dimorphism: Not as strong in this species as in those in which males have eyes and pleopods. Males are more slender and longer than females. Males also have long second antennae. A brood pouch is present in mature females only and is large, simple and transparent (not figured).

Possible Misidentifications

Cumaceans are very small (range 1 mm–1 cm) shrimp-like crustaceans. Their heads and thorax are fused to form a carapace, the abdomen is tubular and the uropods are slender and biramous. There are 1500 species worldwide, approximately 50 of which occur on the Pacific coast of the United States (Watling 2007; Gerken and Martin 2014). Cumaceans belong to the Malacostraca, and are characterized by a carapace that covers the first three or four thoracic somites and has an anterior extension (pseudolobes), a telson that is present or reduced and fused with the last pleonite, eyes that are united dorsally, a second antenna that is without an exopod and pleopods that are absent in females and

can be absent or reduced in males (Watling 2007).

The superorder Peracarida includes cumaceans, mysids, isopods, tanaids and amphipods. Cumaceans can be separated from mysids by their single compound eye (particularly in the males), as mysids have large stalked eyes. Mysids have a carapace which covers the entire thorax, while cumaceans have several posterior segments exposed. Euphausiids belong to the superorder Eucarida (along with decapods) and are pelagic and marine, but might occasionally be found in estuaries. They have biramous thoracic appendages (cumacean pereopods are uniramous, with some thoracic exopodites). Additionally, euphausiids have strong pleopods for swimming and cumacean pleopods, when present, are small.

The four local cumacean families can be divided into those with a freely articulated telson and those without, the former comprise the Lampropidae (see *Lamprops quadriplicata*, this guide) and Diastylidae, while the latter comprise the Leuconidae and Nannastacidae (see *Cumella vulgaris*, this guide) (Watling 2007). Cumacean families that lack an articulated telson are consistently monophyletic on molecular phylogenies and are likely derived within the Cumacea (Haye et al. 2004). However, morphological characters used to differentiate cumacean families (e.g. number of pleopods in males) may be homoplasious (see Haye et al. 2004).

The Leuconidae (like the Nannastacidae) lack the independent telson. However, they always have a biarticulate uropod endopod, not a uniramous one as in Nannastacidae. Members of the Leuconidae often have up to two pairs of male pleopods (there are none in Nannastacidae) and have exopodites on all five pairs of pereopods (rarely on three). Leuconid females have exopodites on four (rarely on three) pairs of pereopods (Watling 1979). Numbers of pereopodal exopodites in both sexes are too alike in the families Leuconidae and Nannastacidae and may not serve as dependable characters for identification. One of the oldest cumacean families (Watling 1991), the Leuconidae were recently been removed from the

Hemileuconidae (Given 1969). (This separation is not followed by Jones 1963, however, see below.) Both families lack an independent telson and both have a biarticulate endopod on the uropod. In Leuconidae, however, there are usually two pairs of male pleopods, rarely 1 or 0 pairs, while there are no male pleopods in the Hemileuconidae. Leuconid males have five (rarely three) pereopods with exopodites. Hemileuconid males, on the other hand, have four pairs of pereopodal exopodites. Male Leuconidae have second antennae that are as long as the body, but they are shorter in the Hemileuconidae (Given 1969). Female Leuconidae have four (rarely three) pairs of thoracic exopodites, while there are three pairs in the Hemileuconidae. Thus, it might be difficult separating females of these two families.

Two genera, *Eudorella* and *Nippoleucon*, each with a single species, are currently reported from central California to Oregon (Watling 2007). *Eudorella pacifica* has a truncate edge to the carapace, like *N. hinumensis*. *Eudorella pacifica* females, however, have a uropod exopod that is shorter than the endopod.

The family Nannastacidae lack an independent telson, the males have no pleopods and the endopod of the uropod is uniarticulate. The Lampropidae and Diastylidae have a freely articulated telson and the former family has three or more terminal setae on the telson while the latter has 0–2. The Lampropidae includes six local species in the genera *Hemilamprops* and *Mesolamprops* (each with one local species) and the *Lamprops* (four local species, see *L. quadriplicata*, this guide). In the Diastylidae there are five local species in three genera including *Anchicolurus* and *Diastylopsis* (one local species each) and *Diastylis* (three local species) (Watling 2007).

Ecological Information

Range: Type locality is New Zealand, but this species was introduced to west coast estuaries (e.g. San Francisco and Coos bays) from Japan in ballast water (Castillo et al. 2000; Watling 2007).

Local Distribution: Oregon distribution includes the Columbia River Estuary and sites

in Coos Bay, such as the North Bend Airport site and South Slough.

Habitat: In sediment during the day and becoming planktonic at night.

Salinity:

Temperature:

Tidal Level:

Associates: Occurs with the cumacean, *Cumella vulgaris*, where individuals are found at up to 5,600 individuals per square meter in South Slough of Coos Bay (M. Posey, OIMB, unpublished data.)

Abundance: Most common species found in Columbia River estuary (R. Emmett, NOAA, Astoria, personal communication).

Life-History Information

Reproduction: Development in cumaceans is direct, where eggs hatch within a marsupium, and development is thought to be similar among cumacean genera (e.g. *Leucon*, *Lamprops* and *Pseudocuma*, Gerken and Martin 2014). The life-history of *N. hinumensis* was documented by Akiyama and Yamamoto in 2004 from individuals collected from Seto, Japan. In that region, ovigerous females are 1.2 times larger than males and begin to incubate their first brood (containing 57 larvae) in February, often incubating a second brood (containing 42 larvae) until late April. In *Manocuma stellifera*, an Atlantic intertidal cumacean, mating occurs at night in plankton (Gnewuch and Croker 1973; Watling 1979), during the short swarming period. Females molt 12–96 hours before oviposition (in the lab). Eggs are probably fertilized as they are released into the marsupium, where they are carried to nauplius larval stage. Some other intertidal species have two breeding generations per year, one in summer and in fall (see Corey 1969, 1976 in Watling 1979).

Larva: Cumacean development proceeds from an egg to two manca stages, a subadult and finally, an adult. The manca stage resembles the adult, but is defined by a lack of the fifth pair of pleopods (see Fig. 41.1F, Gerken and Martin 2014). In *N. hinumensis*, manca larvae are released and most recruitment takes place in April. Post-marsupial individuals undergo eight in-stars in males and nine in females, with 10 days between molts in the first four in-stars and two

weeks thereafter (when not in diapause) (Akiyama and Yamamoto 2004a). The mancae of *M. stellifera* molt three times and the young leave the marsupium, molt several more times into subadult morphology, with mature gonads and secondary sexual characteristics present (see Corey 1969, 1976 in Watling 1979).

Juvenile:

Longevity: The life-span of many cold water leuconid cumaceans is on the order of a few years. In Seto, Japan, population generation times occur on an annual cycle and the life-span can be divided into three phases (see **growth rate**) (Akiyama and Yamamoto 2004a).

Growth Rate:

Cumacean growth occurs in conjunction with molting where the exoskeleton is shed and replaced. Post-molt individuals will have soft shells as the cuticle gradually hardens. During a molt, arthropods have the ability to regenerate limbs that were previously autotomized (Kuris et al. 2007). In *N. hinumensis*, growth can be divided into three phases: early growth from April to May, no growth (or diapause) from May to November and a later growth phase from December to March (Akiyama and Yamamoto 2004a). This summer period of diapause or arrested growth is unique to this species and, interestingly, not all populations undergo a diapause phase (see Akiyama and Yamamoto 2004b).

Food: Filters small particles from below sediment surface or grazes on surface grains (Watling 1979; Kozloff 1993).

Predators:

Behavior:

Bibliography

1. AKIYAMA, T., and M. YAMAMOTO. 2004a. Life history of *Nippoleucon hinumensis* (Crustacea: Cumacea: Leuconidae) in Seto Inland Sea of Japan. I. Summer diapause and molt cycle. *Marine Ecology Progress Series*. 284:211-225.
2. —. 2004b. Life history of *Nippoleucon hinumensis* (Crustacea: Cumacea: Leuconidae) in Seto Inland Sea of Japan. II. Non-diapausing

- subpopulation. *Marine Ecology Progress Series*. 284:227-235.
3. CALMAN, W. T. 1907. On new or rare crustacea of the order Cumacea from the collection of the Copenhagen Museum Part I, The families Bodotriidae, Vauntomponiidae, and Leuconidae. *The Transactions of the Zoological Society of London*. 18:1-42.
4. CASTILLO, G. C., H. W. LI, and P. A. ROSSIGNOL. 2000. Absence of overall feedback in a benthic estuarine community: A system potentially buffered from impacts of biological invasions. *Estuaries*. 23:275-291.
5. FAGE, L. 1951. Cumacés. *Faune de France*:1-136.
6. GERKEN, S., and J. W. MARTIN. 2014. Cumacea, p. 216-218. *In: Atlas of crustacean larvae*. J. W. Martin, J. Olesen, and J. T. Høeg (eds.). Johns Hopkins University Press, Baltimore, MD.
7. GIVEN, R. R. 1969. The Cumacean fauna of the Southern California continental shelf. No. 1, Family Leuconidae. *Bulletin, Southern California Academy of Sciences*. 60:129-146.
8. GNEWUCH, W. T., and R. A. CROKER. 1973. Macrofauna of northern New England marine sand. 1. Biology of *Mancocuma stellifera* (Zimmer, 1943) (Crustacea, Cumacea). *Canadian Journal of Zoology*. 51:1011-1020.
9. HAYE, P. A., I. KORNFIELD, and L. WATLING. 2004. Molecular insights into Cumacean family relationships (Crustacea, Cumacea). *Molecular Phylogenetics and Evolution*. 30:798-809.
10. JONES, N. S. 1963. The marine fauna of New Zealand: Crustaceans of the order Cumacea. *Bulletin of the New Zealand Department of Scientific and Industrial Research*. No. 152:1-81.
11. KOZLOFF, E. N. 1993. *Seashore life of the northern Pacific coast: an illustrated guide to northern California, Oregon, Washington, and British Columbia*. University of Washington Press, Seattle.

12. KURIS, A. M., P. S. SADEGHIAN, J. T. CARLTON, and E. CAMPOS. 2007. Decapoda, p. 632-656. *In*: The Light and Smith manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley, CA.
13. LEE, C., and K. LEE. 2003. A new record of genus *Nippoleucon* (Cumacea: Leuconidae) from Korea. Korean Journal of Systematic Zoology. 19:257-265.
14. STEBBING, T. R. 1913. Crustacea, Cumacea (Sympoda) Das Tierreich. 39:152-153.
15. WATLING, L. 1979. Marine flora and fauna of the northeastern United States: Crustacea, Cumacea. NOAA Technical Report NMFS Circular, Washington.
16. —. 1991. Revision of the Cumacean family Leuconidae. Journal of Crustacean Biology. 11:569-582.
17. —. 2007. Arthropoda: Cumacea. *In*: The Light and Smith manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley.