Neanthes limnicola

A mussel worm

Phylum: Annelida
Class: Polychaeta
Order: Phyllodocida
Family: Nereididae

Taxonomy: Depending on the author, *Neanthes* is currently considered a separate or subspecies to the genus *Nereis* (Hilbig 1997). *Nereis sensu stricto* differs from the genus *Neanthes* because the latter genus includes species with spinigerous notosetae only. Furthermore, *N. limnicola* has most recently been included in the genus (or subgenus) *Hediste* due to the neuropodial setal morphology (Sato 1999; Bakken and Wilson 2005; Tusuji and Sato 2012). However, reproduction is markedly different in *N. limnicola* than other *Hediste* species (Sato 1999). Thus, synonyms of *Neanthes limnicola* include *Nereis limnicola* (which was synonymized with *Neanthes lighti* in 1959 (Smith))*, Nereis (Neanthes) limnicola, Nereis (Hediste) limnicola* and *Hediste limnicola*. The predominating name in current local intertidal guides (e.g. Blake and Ruff 2007) is *Neanthes limnicola*.

Description

Size: Individuals 25–45 mm in length, 2.5–4 mm in width (without parapodia) and have 45–82 segments (Hartman 1938). The illustrated specimen, from Coos Bay, was 25 mm long.

Color: The illustrated specimen was pale, translucent to pale yellow green.

General Morphology: Very thick worms that are rather wide for their length (Fig. 1).

Body: Individuals are flattened dorso-ventrally and extremely active. Nereids are recognizable by their anterior appendages including two prostomial palps and four peristomial tentacular cirri (see **Anterior appendages**) (Blake and Ruff 2007).

Anterior: Prostomium trapezoidal, wider than long, with a longitudinal depression (Fig. 2b).

Trunk: Very thick segments that are wider than they are long, gently tapers to posterior (Fig. 1).

Posterior: Pygidium bears two, styliform ventrolateral anal cirri that are as long as last seven segments (Fig. 1) (Hartman 1938).

Parapodia: The first two setigers are uniramous. All other parapodia are biramous (Nereididae, Blake and Ruff 2007) where both notopodia and neuropodia have acicular lobes and each lobe bears 1–3 additional, medial and triangular lobes (above and below), called ligules (Blake and Ruff 2007) (Figs. 1, 5). The notopodial ligule is always smaller than the neuropodial one. The parapodial lobes are conical and not leaf-like or globular as in the family Phyllodocidae. (A parapodium should be removed and viewed at 100x for accurate identification). Notopodial lobes at posterior end of animal are normal, not elongate, but smaller than anterior lobes (Hartman 1938).

Setae (chaetae): All setae are composite. The notopodia (Fig. 5) bears only one kind of seta – homogomph spinigers, which are long, sharp composite spines with basal prongs of equal length (Fig. 4a). The neuropodia (Fig. 5) contain several each of three kinds of setae – homogomph and heterogomph spinigers, and heterogomph falcigers (with basal prongs of unequal length) (Fig. 4a, b, c). They also have heterogorph and homogomph falcigers with blunt, short and curved setae (Fig. 4c) (Fauchald 1977). *N. limnicola* has one special fused falciger in the upper acicular neuropodium (Figs. 4d, 5) (Johnson 1903). (Differentiation among these setae must be made with a compound microscope after placing the parapodium in glycerin or mounting medium, on a slide.) Acicula or heavy, black spines, are present at the base of each parapodial lobe (Fig. 5).

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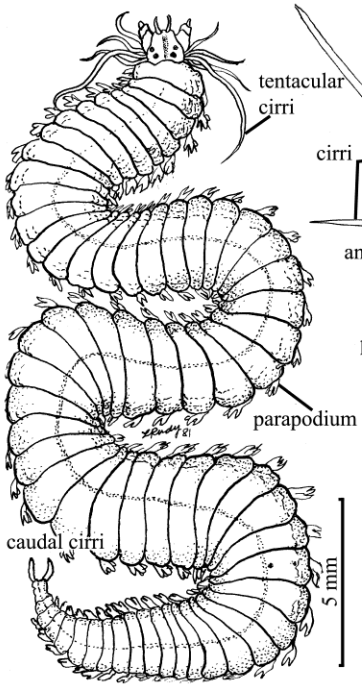
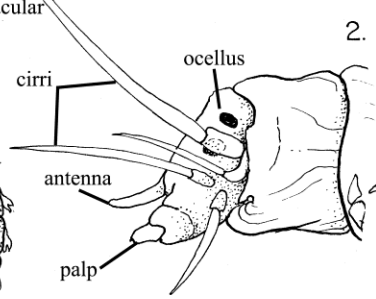
Neanthes limnicola

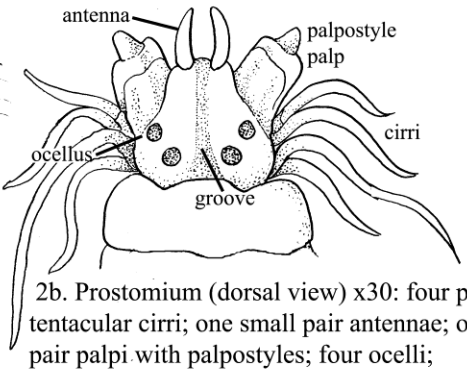


1. *Neanthes limnicola* x8.5: typical nereid tentacular cirri; body 25-45 mm long, 45-82 segments; pale, translucent; two caudal cirri.

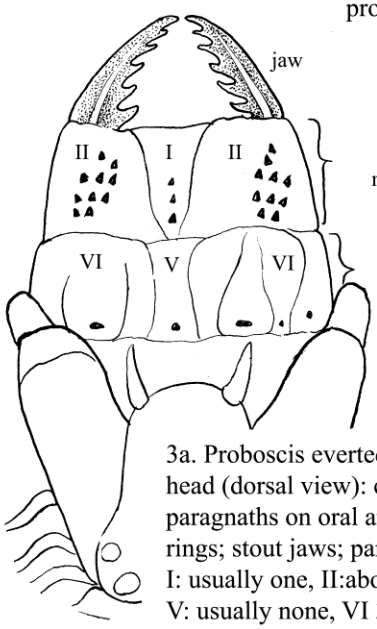


2a. Prostomium (lateral view) x30.

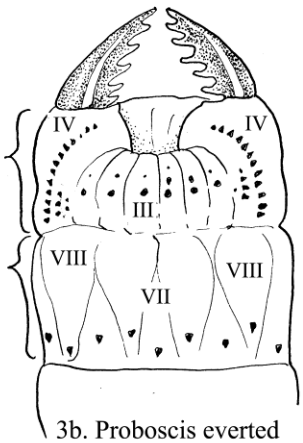
2.



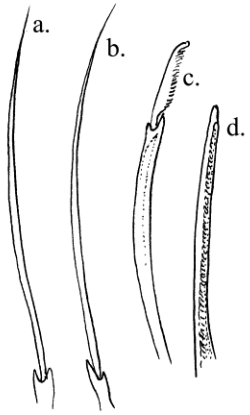
2b. Prostomium (dorsal view) x30: four pairs tentacular cirri; one small pair antennae; one pair palpi with palpostyles; four ocelli; prostomium trapezoidal, grooved.



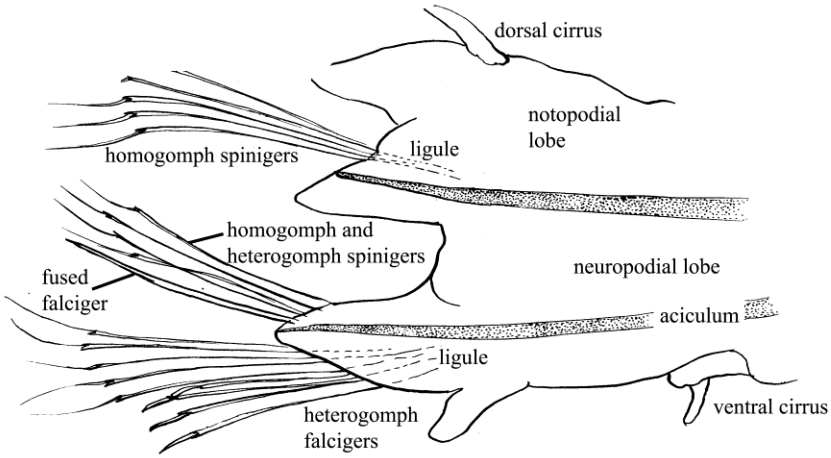
3a. Proboscis everted and head (dorsal view): conical paragnaths on oral and maxillary rings; stout jaws; paragnaths area I: usually one, II:about 12 large, V: usually none, VI 3 small.



3b. Proboscis everted (ventral view): paragnaths area III: 20- 25, IV: crescent, 30-35, VII: continuous rows, VIII: continuous rows.



4. Setae:
a. homogomph spiniger
b. heterogomph spiniger
c. heterogomph falciger
d. fused falciger



5a. 60th parapodium x100: biramous, notopodium dorsal and neuropodium ventral; all lobes conical; small dorsal ligule.

Eyes/Eyespots: Two pairs of eyes in trapezoidal arrangement on prostomium (Fig. 2b) (Nereididae, Hartman 1968; Blake and Ruff 2007). The eyes of epitokous individuals are enlarged (Hilbig 1997).
Anterior Appendages: One small pair of frontal antennae, which are separated at their bases, occurs on the prostomium (Fig. 2b). Also on the prostomium are a pair of palps, with cylindrical processes and small hemispherical palpostyles at the distal ends (Fig. 2b). Four pairs of tentacular cirri are found on the peristomium. The second of dorsal pairs longest (Fig. 2b) (Johnson 1903) and the others, including a more ventral pair, are quite short for a nereid.
Branchiae: Absent (Blake and Ruff 2007).
Burrow/Tube: Individuals build thin, pale brown, loosely constructed tubes in vertical burrows that are Y-shaped and mucus lined (Smith 1950). Newly hatched young build protective tubes of sand grains and mucus.
Pharynx: The pharynx bears a distinct eversible proboscis. The everted proboscis has two rings, oral (or proximal) and distal (or maxillary) and terminates with two fang-shaped jaws (Fig. 3). The oral ring is used largely in burrowing, while the distal ring is used in feeding (Barnes and Head 1977). Each ring is equipped with many papillae and conical paragnaths and their patterns are taxonomically relevant. In this species Area I usually has one tooth; Area II has the largest teeth and about 12 in a crescent; Area Ill has a broad patch of 20–25; IV has broad crescents of 30–35; V usually has no paragnaths (Hartman 1938); VI has three small points and Areas VII and Vlll have two continuous rows (Figs. 3a,b).
Genitalia:
Nephridia:

Possible Misidentifications

The prostomia of nereid worms are quite alike, with four eyes, a pair of frontal antennae and biarticulate palps, and 3–4 pairs of tentacular cirri. The genus *Neanthes* currently, includes 3–4 local species (Blake and Ruff 2007). *Neanthes* species have only homogomph spinigerous setae in the posterior notopodia, a trait it shares with *Hediste,* but without the fused falcigers. Some authors currently place *N. limnicola* in the genus *Hediste* (Sato 1999; Bakken and Wilson 2005; Tusuji and Sato 2012). The genus *Neanthes* is further distinguished by having only conical paragnaths on both proboscis rings, and biramous parapodia with composite setae (Hartman and Reish 1950). *Neanthes limnicola* is distinct because individuals are usually pale and translucent, not dark green and its posterior parapodial lobes are not expanded like those of *N. brandti*.

Neanthes brandti has been at times considered a subspecies or a synonym of *N. virens*, the large (50–50 cm in length), cold-water form (Breton et al. 2004). This latter species, however, has only a few paragnaths on its proboscis rings, (i.e. 2–3 rows in Areas VII, VIII), not many as in *N. brandti* (4–5 rows in Areas VII, VIII). The prostomium of *N. virens* is small and triangular, its eyes are small and on the posterior half of the prostomium. It has short antennae and massive palps. These species exhibit overlapping geographic distributions and it is possible that they are the same species (Breton et al. 2004).

Neanthes succinea is one of the most common nereids in the NE Pacific but is recognizable from *N. brandti* by its very enlarged posterior notopodial lobes, with a small distal dorsal cirrus attached at the end of the lobe (Blake and Ruff 2007). It has a heteronereid form and *N. limnicola* does not. *N. succinea* is thought to be a more southern form (although it has been reported from Netarts Bay).

Neanthes species have spinigerous notosetae only (Hilbig 1997). The morphologically similar genus, *Nereis sensu stricto*, is characterized by species with spinigerous notosetae in the anterior half of the body and falcigerous notosetae posteriorly (Pettibone 1963; Smith 1959). Common *Nereis* species include the very abundant *Nereis vexillosa*, an olive green to brown worm found in many diverse marine environments, especially in mussel beds. It has greatly elongated, strap-like notopodial lobes in the posterior parapodia. *Nereis*

eakini, from rocky habitats, has a long prostomium and proboscis rings covered with small round paragnaths. The bright green *Nereis grubei* has greatly expanded posterior notopodial parapodial lobes and no paragnaths in Area V of the proboscis. *Nereis procera* is subtidal in sand, has tiny eyes, a very long body, and unusually inconspicuous paragnaths on its proboscis (Hartman 1968). The genus *Nereis* differs from *Hediste* because members of the latter genus has 1–3 fused falcigers on the supra-acicular bunch of posterior neuropodial setae (no local species are known, Blake and Ruff 2007).

Ecological Information

Range: Type locality is Lake Merced, California (Johnson 1903). Known range includes Salinas River, California, north to Vancouver Island, B.C. (Smith 1958).
Local Distribution: Coos Bay distribution includes sites along the South Slough estuary as well as Coos Bay, Kentuck Inlet and the Coos River mouth.
Habitat: Isolated populations occur in loose burrows in sand and clay banks. Individuals prefer soft mud, sometimes in channels with *Salicornia* (Smith 1953). However, *N. limnicola* is not limited by substrate and can survive in almost entirely dry mud. Thus, this species can survive in unstable environment (e.g. Salinas River, Smith 1953). The unique reproductive strategy (see **Reproduction**) of *N. limnicola* may have evolved in response to the unstable or extreme habitats in which they live (Tosuji et al. 2010).
Salinity: Adapts to a wide range in salinity from 2–25, but is usually found in areas of reduced salinity (Smith 1950). This species is known to inhabit brackish or freshwater (Sato 1999; Blake and Ruff 2007)
Temperature: From cool and temperate waters and, although warmth (30°C) negatively affects reproduction, it does not cause fatalities (Smith 1953).
Tidal Level: Shallow intertidal.
Associates: In the Salinas River, associates include the isopod *Gnorimosphaeroma oregonensis*, and amphipods *Corophium spinicorne*, *Anisogammarus contervicolus* (Smith 1953). *N. limnicola* does not overlap with *Nereis vexillosa* or *Neanthes brandti* (Coos Bay, 1970 unpublished student report).
Abundance: Abundant at Coos bay, especially the east side of Coos Bay (L.C. Oglesby, pers. com.). Populations are irregularly distributed and tend to occur in isolation in shallow water in Salinas River, California (Smith 1950, 1958).

Life-History Information

Reproduction: The reproduction and development of *Neanthes limnicola* (=*Neanthes lighti*) was described by Smith (1950). *N. limnicola* is a unique nereid in that individuals are viviparous, hermaphroditic and self-fertile. Although individuals are self-fertile, genetic evidence suggests that they are capable of outcrossing to maintain genetic diversity (Fong and Garthwaite 1994). Oocytes are approximately 120–170 µm in diameter (Sato 1999; Fernald et a. 1987) and develop within the adult coelom, by typical spiral cleavage, until they are 4–8 mm in length (20 setiger stage). Adults have been found with larvae within their coelom in July–August (Washington, Fernald et al. 1987). Breeding occurs in late winter through spring and summer, when high temperatures and salinity suppress sexual activity (Salinas River Estuary, CA, Smith 1953).
Larva: Larvae grow rapidly into ciliated trochophores. At the 20-setiger stage, larvae hatch by rupturing of the body wall of the parent (Smith 1950). Total development time ranges from 21–28 days. Newly hatched young immediately build protective tubes of sand grains and mucus.
Juvenile:
Longevity:
Growth Rate:
Food: Nereids use their jaws to tear apart and eat pieces of algae and diatomaceous detritus from the surface of the bottom (Smith 1950; Kozloff 1993).
Predators:
Behavior: Free-living and constructs a mucus-lined burrow, which is somewhat Y-shaped and deep (Kozloff 1993). Worm exists above the fork of the "Y" and can escape down into the burrow during dry periods. *N. limnicola* individuals can swim well.

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