
Nephtys caeca

A sand worm

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

Taxonomy: *Nephtys caeca* is the name used in current local intertidal guides (e.g., Blake and Ruff 2007). One can find several synonyms, however, including variants of the generic spelling (*Nephtys*), subjective synonyms (e.g., *N. margaritacea*, *N. oerstedii* and *N. bononensis*) and species described and later determined to be an earlier developmental stage of *N. caeca* (e.g., *Nephtys nudipes*) (Rainer 1991).

Description

Size: Individuals to 20 cm in length and 10–15 mm in width (Hartman 1968). 90–150 total body segments.

Color: Body color is pale pink and can be light to dark green or brown. No prominent external pigment patterns. The proboscis is iridescent.

General Morphology: Anterior cylindrical in cross-section and becomes slender and rectangular posteriorly (Nephtyidae, Blake and Ruff 2007).

Body: Individuals long, slender and quadrangular in cross-section (Hartman 1968).

Anterior: Prostomium pentagonal, flattened and no pigment pattern (Fig. 2).

Trunk: Thick with widely separated parapodial rami (Fig. 1, 5).

Posterior: Pygidium with very small and hairlike posterior cirrus (Fig. 1).

Parapodia: Fleshy flaps extending laterally from each segment, are biramous and rami are widely separated, densely packed and their setae are fan-shaped (Nephtyidae, Blake and Ruff 2007). Each lobe with a broad and rounded notopodium and a neuropodium. Post-acicular lobes become foliaceous posteriorly (Hartman 1968) (Fig. 5). Bears interramal cirri that are long and recurved between the two parapodial lobes (Figs. 3, 5).

Setae (chaetae): All nephtyid setae are simple and the setae of both rami are of similar morphology. Overall, there are four main types of nephtyid setae including capillary (e.g., spinose), barred (which are pre-acicular), lyrate and setae with spines (Dnestrovskaya and Jirkov 2011). *Nephtys caeca* has fan-like bunches of neuro- and notosetae on the parapodial lobes. Post-acicular setae (Fig. 5) are long and fine, with single lateral barbs (Fig. 4a) and pre-acicular setae short and with transverse bars (Figs. 4b, 5).

Eyes/Eyespots: None (Fig. 2).

Anterior Appendages: Four small, simple (unforked) antennae (Fig. 2).

Branchiae: The interramal cirri, which are inserted just beneath each dorsal cirrus, are sometimes called branchiae (Blake and Ruff 2007).

Burrow/Tube: *Nephtys caeca* can move rapidly through loose sand and makes temporary burrows (MacGinitie 1935).

Pharynx: Bears short and wide proboscis with a variety of papillae, their number and arrangement is of taxonomic significance (Blake and Ruff 2007). The proboscis in *Nephtys* species can be divided into three distinct regions including the proximal, sub distal and distal (Lovell 1997) (Fig. 1). The proboscis, when fully everted, is globular, with 22 rows of paired distal papillae forming a crown-like structure. Twenty-two rows of sub distal papillae with five small papillae in each row (Fig. 1). The proximal surface of the proboscis is rough and covered with minute wart-like papillae (Fig. 1).

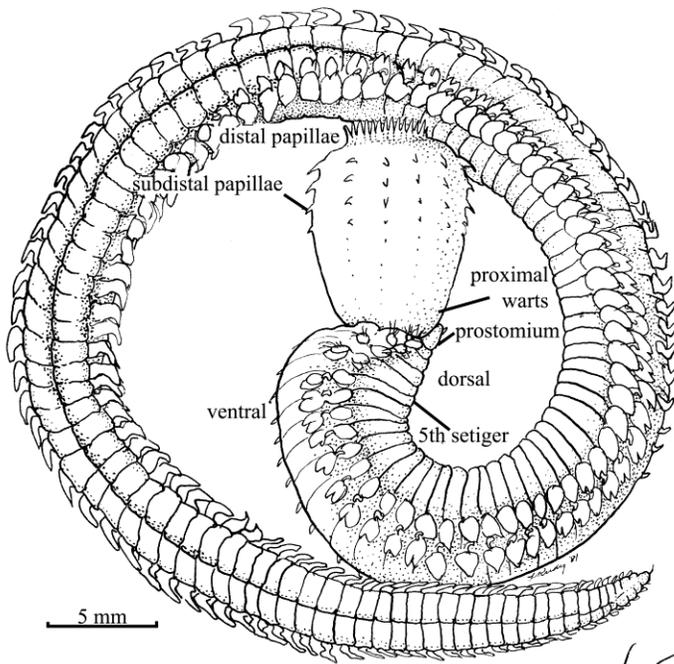
Genitalia:

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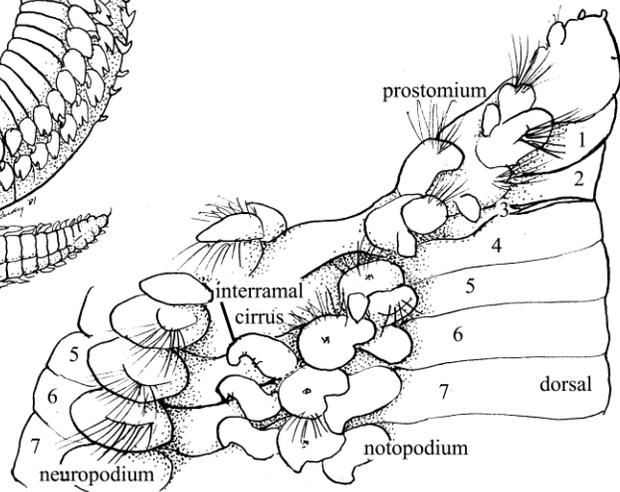
Possible Misidentifications

Worms of the family Nephtyidae can be distinguished by their anteriorly cylindrical

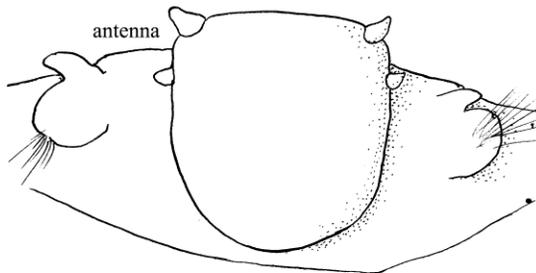
Nephtys caeca



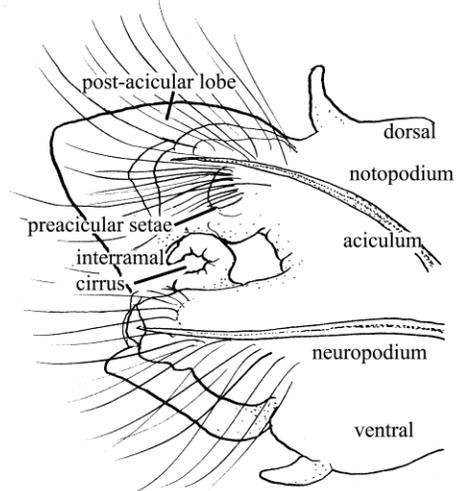
1. *Nephtys caeca* (lateral view) x4: to 150 segments; everted proboscis with 22 rows of distal papillae; subdistal papillae 22 rows of 5; proximal proboscis surface rough; body cross section rectangular.



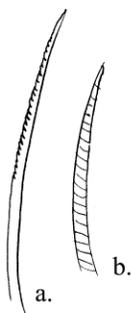
3. Anterior parapodia (lateral view) x30: interrampal cirri begin on 5th cirri; parapodia bilobed neuro- and notopodia.



2. Prostomium (dorsal view) x30: pentagonal, eyeless; four small antennae.



5. 90th parapodium x30: biramous; post-acicular lobes large, foliaceous; recurved interrampal cirrus beginning on fifth segment; long, fine noto- and neurosetae; shorter, barred pre-acicular notosetae.



4. Setae, tips:
a. long, barbed postacicular seta
b. transversely barred preacicular seta (notopodial).

and posteriorly rectangular bodies (in cross section), well-developed bi-lobed parapodia, interramal cirri, four small prostomial antennae, and eversible globular proboscis with terminal rows of papillae. They are strong and muscular worms that can be good burrowers and strong swimmers (Blake and Ruff 2007). Nephtyids superficially resemble the genus *Nereis*, however, they have no long anterior appendages (tentacular cirri) and their proboscis armature is quite different (Kozloff 1993). The distinctive taxonomic characters of *N. caeca* include 22 distal paired papillae, 22 rows of sub distal papillae with five papillae per row, no unpaired mid dorsal papilla and interramal cirri beginning on setigers five or six (Blake and Ruff 2007).

Some *Nephtys* species are distinguished from each other by very fine morphological details. The species most closely related to and difficult to differentiate from *N. caeca* include *N. caecoides* and *N. californiensis*. *N. caecoides*, is slightly smaller (on average) than *N. caeca*, with dark bands of color on its anterior end, and a smooth proboscis, not a rough one. *N. caecoides* also has an unpaired medial papilla (not present in *N. caeca*) and interramal cirri beginning on the fourth setigers (rather than the fifth or sixth in *N. caeca*). It is probably the closest species, morphologically, to *N. caeca*, and their two distributions overlap in Coos Bay (Porch 1970). *N. californiensis* is found mostly on the outer coast, or if in bays, only in very clean coarse sand. It has a distinctive V-shaped pigment pattern (sometimes with red spot at center) of pigmentation on the lower end of the prostomium, a smooth proboscis without medial papilla, soft silky flowing setae and interramal cirri beginning on the third setiger.

Three other *Nephtys* species are not so easily confused with *N. caeca*. *N. cornuta*, a small species (less than 15 mm in length) that can be identified by its distinctive bifid ventral and posterior antennae. This species often retains larval eyes on the third setiger, a feature which is usually lost in other closely related species

(Blake and Ruff 2007). *N. cornuta* can also be differentiated because it has 18 distal paired papillae (instead of 22 in *N. caeca*) (Lovell 1997). *N. punctata* is much like *N. caeca* in size and form (Hartman 1938), but with interramal cirri beginning on setiger 8–10, and with incised acicular lobes in the anterior parapodia. This species is large and muscular with wide body and short parapodia and is currently only reported in southern California (Hilbig 1997; Blake and Ruff 2007)

N. parva, colorless except for a dark spot in the middle of its prostomium (Hartman 1968), a smooth proboscis proximally, no medial papilla, eyespots on its third setiger and interramal cirri beginning on the fourth setiger. The type material from this species is suspected to have been miscurated and the holotype appears to be that of *N. cornuta*, while the species description and paratypes match *N. caecoides* more closely. Thus, this species is not a currently valid taxon (Lovell 1997; Blake and Ruff 2007).

N. ferruginea has the same number of paired distal and sub distal papillae, however, the interramal cirri in this species begin on setiger three, rather than four in *N. caecoides* (Lovell 1997). *N. ferruginea* individuals have a distinct rust colored pigment in a V-shape pattern on prostomium in addition to transverse bars mid dorsally on the first 20 setigers and oblique stripes dorsolaterally (Hilbig 1997).

Ecological Information

Range: Type localities include Greenland and the Arctic (Hartman 1968). Known distribution is Alaska to northern California and circumboreal. Possibly introduced from the eastern United States (Blake and Ruff 2007).

Local Distribution: Coos Bay distribution includes many stations, especially those within South Slough. The distribution of *N. caeca* is much like that of the polychaete *Scoleteoma zonata*.

Habitat: Sand, mud or mixed sediments. Individuals also occur with eelgrass and

prefer more mud than *Scoleteoma zonata* (Porch 1970).

Salinity: Collected at salinities of 30, but can tolerate lower salinities (i.e., freshwater of stream beds) (Porch 1970).

Temperature: A cold water species, *N. caeca* does not extend far southward to California.

Tidal Level: Intertidal (+ 0.15 m) to lower intertidal and depths of 1000 m (Rainer 1991).

Associates: Known associates include barnacles and the large polychaete, *Pista pacifica*.

Abundance: Not common, locally (Blake and Ruff 2007). In the St. Lawrence Estuary (Québec, Canada), most individuals were observed in the lowest sampling sites (specific sampling heights not indicated, Caron et al. 1995).

Life-History Information

Reproduction: *Nephtys caeca*, as is the case for other *Nephtys* species, are free-spawning with pelagic larval development that proceeds via a trochophore larva (Fernald et al. 1987; Crumrine 2001; Pleijel and Rouse 2006). In the St. Lawrence Estuary (Québec, Canada), oocyte maturation occurred in the late summer to autumn, oocyte diameters were approximately 140–160 μm (Caron et al. 1995) and ripe adults spawn into their temporary burrows (Bently et al. 1984). However, in the River Tyne Estuary (United Kingdom), individuals are known to spawn in late spring or early summer (Olive 1977).

Larva: Nephtyid trochophore larvae have a pair of eyes, dome-shaped prostomium and barrel-shaped body. They have well developed prototrochs and telotrochs, with neurotrochs present in young larvae. They are common in plankton samples and are recognized by their shape and species-specific bright body colors (Lacalli 1980; Fernald et al. 1987). Early trochophore larvae of *Nephtys caeca* have been described (Thorson 1946; Lacalli 1980). They have dull red to brown pigmentation on the episphere, prostomium and pygidium. The posterior pigmentation is arranged in two bands, one anterior to and the other posterior to the pygidium (Lacalli 1980). They also have an olive colored gut and no blue pigmentation, a

common characteristic of other nephtyid larvae (e.g., <http://invert-embryo.blogspot.com/2012/12/confirmed-identity-of-wild-caught.html>). Eight-setiger stages measure approximately 670 μm in length and have simple capillary setae (Lacalli 1980). Nephtyid trochophore and metatrochophore larvae are predatory (Fernald et al. 1987; Crumrine 2001).

Juvenile: The prostomium transitions from rounded to angular in newly metamorphosed individuals (Fig. 5, Lacalli 1980). Juveniles may possess eyes on one of the first three setigers that are usually, although not always (e.g. *N. cornuta*), lost in adults (*Nephtys*, Hilbig 1997). Advanced larval or juvenile stages were collected benthically from the River Tyne Estuary and described by Olive in 1977. Unique features included yellow-brown pigmented prostomium with rusty brown pigment granules dorsally, green intestine becoming deep blue posteriorly, spade-shaped pygidium and both smooth and striated setae. The four pairs of anterior antennae only developed in advanced stages (Olive 1977). No larval settlement was observed intertidally in the St. Lawrence Estuary, suggesting sublittoral larval recruitment. Instead, juveniles were seen intertidally in June–July (1986) (Caron et al. 1995).

Longevity: Seven or more year life-span (United Kingdom, Olive 1977).

Growth Rate: Sexual maturity is reached in two years (United Kingdom, Olive 1977).

Food: *Nephtys caeca* adults are carnivorous and predation by them is known to regulate other infaunal populations within a community. They are a primary predator of *Macoma balthica* (St. Lawrence Estuary) and are known to feed on smaller conspecifics (Ambrose 1984; Caron et al. 2004). Juvenile *N. caeca*, however, are herbivores (Caron et al. 2004).

Predators:

Behavior: Individuals are active, and are good swimmers and burrowers (MacGinitie 1935). Bioturbation from *N. caeca* has been shown to homogenize particles in the first few centimeters of sediment while burrowing or moving (Piot et al. 2008).

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