
Nephtys caecoides

A sand worm

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

Description

Size: Individuals up to 100 mm in length and 5–8 mm in width, with up to 129 segments (Hartman 1968; Hilbig 1997). The illustrated specimen has 115 segments (Fig. 1).

Color: A strong pigment pattern on prostomium and first few segments (Fig. 2) persists through preservation. Body usually steel to dark grey (Hartman 1938).

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

Body: Trim, stiff and slender in appearance (Hartman 1938), rectangular in cross section (Hartman and Reish 1950). Anterior third is stout and wide, while the middle and posterior regions become slender and more flexible (Hilbig 1997). First segment is incomplete dorsally (Hartman 1968) (Fig. 2).

Anterior: Prostomium is trapezoidal or rounded and changes shape when proboscis is everted (Fig. 2) (Hilbig 1997).

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

Posterior: Pygidium bears long caudal cirrus that is sometimes lost during collection or preservation.

Parapodia: Parapodia are biramous and rami are widely separated, densely packed and their setae are fan-shaped (Nephtyidae, Blake and Ruff 2007). Both noto- and neuropodia are rounded in the worm posterior (Fig. 5b) and the acicular lobes are incised in the middle of the worm (Fig. 5a). First parapodial pair pointed anterior (Hilbig 1997). Another defining characteristic of the Nephtyidae are the interrampal cirri that are inserted just beneath dorsal cirri, which are small, in anterior setigers (Blake and Ruff 2007) (Fig. 5). Beginning with the fourth setiger, and continuing to within 10–20

setigers from worm posterior, there is a recurved cirrus between the parapodial lobes (Fig. 5) (Lovell 1997). In juvenile specimens, this can be nearly straight (Fauchald 1977). The interrampal cirrus is larger than the dorsal cirrus, except in the last nine segments (Hartman 1968).

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 caecoides* exhibits three setal types; 1) a bunch of short, stiff and slender barred setae (pre-acicular) (Fig. 4a, b); 2) post-acicular setae with upper fascicle of spinulose capillaries and large middle fascicle with wide spinose setae (Fig. 4c); 3) neurosetae with upper smooth capillaries and spinose setae in middle fascicle and spinulose capillaries in lower fascicle. Setae of first parapodium are pointed anteriorly and the remainder are lateral (Fig. 2) (Hilbig 1997). A single acicula is present in each ramus, and is transparent or yellow and tapers to a fine tip (Hilbig 1997).

Eyes/Eyespots: Absent in adults (Hilbig 1997).

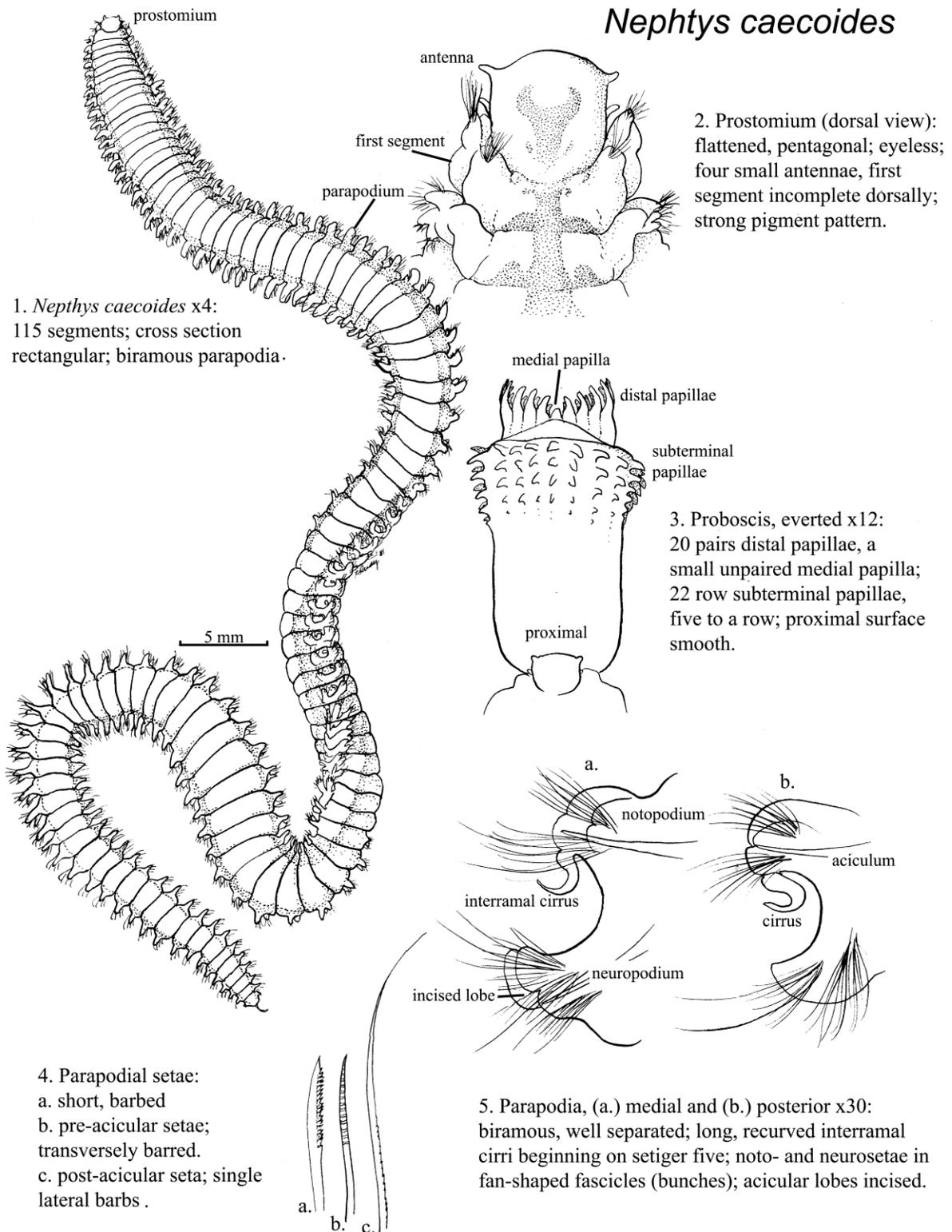
Anterior Appendages: Prostomium bears four small simple antennae, in two pairs which are widely separated. One pair of nuchal organs present (Hilbig 1997).

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

Burrow/Tube:

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

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distinct regions including the proximal, sub-distal and distal (Lovell 1997) (Fig. 3). In *N. caecoides* there are 20 pairs of distal papillae, an unpaired mid-dorsal papilla and 22 rows of sub-terminal papillae with 3–6 papillae per row (five per row in the illustrated specimen). Mid-dorsal and mid-ventral distal areas of the proboscis are without papillae and smooth (Lovell 1997; Hilbig 1997) (Fig. 3).

Genitalia:

Nephridia:

Possible Misidentifications

Worms of the family Nephtyidae can be distinguished by their anteriorly cylindrical 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. caecoides* include 20 distal paired papillae, 22 rows of sub-distal papillae with 3–6 papillae per row, an unpaired mid-dorsal papilla and interramal cirri beginning on setiger four (Lovell 1997).

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. caecoides* include *N. caeca* and *N. californiensis*. *N. caeca* is slightly larger, iridescent, with no prostomial pigmentation and a rough proboscis with no unpaired medial papilla. Furthermore, this species has interramal cirri beginning on the fifth or sixth setiger, not the fourth (as in *N. caecoides*). This is a northern species, which is locally rare, and likely introduced from the eastern United States (Blake and Ruff 2007). *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 that are not so easily confused with *N. caecoides*. *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 20 in *N. caecoides*) and interramal cirri that begin on setiger five (rather than four in *N. caecoides*) (Lovell 1997). *N. punctata* is much like *N. caeca* in size and form (Hartman 1938), but has 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 a 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 locality is Tomales Bay, California (Hartman 1968). Known range includes western Canada to southern California.

Local Distribution: Coos Bay distribution includes many stations, especially those within the South Slough. The distribution of *N. caecoides* is very close to *Scoletoma zonata* but occurs in sandier mud (Porch 1970).

Habitat: Mud, sand and mixed sediments of bays and lagoons. *N. caecoides* also occurs in eelgrass flats (Hartman 1938) but is not found in areas with large amounts of silt (Clark and Haderlie 1962). Instead this species prefers fine, stable substrate.

Salinity: Can tolerate low salinities, (i.e. freshwater stream beds) (Porch 1970).

Temperature:

Tidal Level: Intertidal to littoral depths (one specimen from 46–106 meters) (Hartman and Reish 1950). Densest populations at Bodega Bay at + 0.32 meters and at -0.52 meters MLLW (Clark and Haderlie 1962). Individuals observed from 0.0 m to +1.2 m, with 15 specimens collected at 0.0 m, 7 specimens at +0.9 m and 1 specimen at +1.2 m (Johnson 1970).

Associates: *Nephtys caeca* has much the same habitat (Porch 1970).

Abundance: One of the most common nephtyids in California where San Francisco Bay densities were recorded at 130 individuals/m² (Jones 1961) and Bodega Bay densities were 32 individuals/m² (Clark and Haderlie 1962). The most commonly found nephtyid in Coos Bay and distribution is a function of protection from exposure, rather than other physical factors (e.g. salinity or temperature, Porch 1970).

Life-History Information

Reproduction: The reproduction and larval development of *N. caecoides* is not known. However, *Nephtys* species are usually free-spawning with pelagic development that proceeds via a trochophore larva (e.g. *N. caeca*, Fernald et al. 1987; Crumrine 2001).

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. Nephtyid larvae are common in plankton samples and are recognized by their shape and species-specific bright body colors (Lacalli 1980; Fernald et al. 1987). A locally collected larva identified to the genus *Nephtys* with DNA sequence data had distinct red pigment bands near the prototroch and telotroch and blue pigment within the gut (<http://invert-embryo.blogspot.com/2012/12/confirmed-identity-of-wild-caught.html>). Nephtyid trochophore and metatrochophore larvae are predatory (Fernald et al. 1987; Crumrine 2001).

Juvenile: The prostomium becomes angular rather than rounded 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 (Hilbig 1997).

Longevity:

Growth Rate:

Food: *Nephtys caecoides* is carnivorous (Clark and Haderlie 1962).

Predators:

Behavior: Individuals are very active, and are good swimmers and burrowers.

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