
Nereis vexillosa

The large mussel worm

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

Taxonomy: One may find several subjective synonyms for *Nereis vexillosa*, but none are widely used currently.

Description

Size: Individuals living in gravel are larger than those on pilings and sizes range from 150–300 mm in length (Johnson 1943; Ricketts and Calvin 1971; Kozloff 1993) and up to 12 mm in width (Hartman 1968). Epitokous adults are much larger than sexually immature individuals. For example, one year old heteronereids were at least 560 mm in length (Johnson 1943).

Color: Body color grey and iridescent green, blue and red body color. Females have more a reddish posterior than males (Kozloff 1993).

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

Body: More than 100 body segments are normal for this species (Hartman 1968), the illustrated specimen has 105 segments (Fig. 1). Nereids are recognizable by their anterior appendages including two prostomial palps and four peristomial tentacular cirri (see **Anterior appendages**) (Fig. 2) (Blake and Ruff 2007).

Anterior: Prostomium pyriform and widest posteriorly (Fig 2).

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

Posterior: Pygidium bears a posterior cirrus with four, fine, accessory lobes (Fig. 1) that are often broken during collection.

Parapodia: Parapodia are of typical nereid biramous structure (Figs. 5, 6, 7) from the third setiger (Hilbig 1997). Posterior notopodial lobes gradually change into long strap-like ligules (Fig. 6), with dorsal cirrus inserted terminally (most important species characteristic). The parapodia of epitokous

individuals are modified for swimming and are wide and plate-like (Kozloff 1993).

Setae (chaetae): Notopodia bear homogomph spinigers anteriorly (Fig. 8d) that gradually transition to few short homogomph falcigers posteriorly (Fig. 8a). Both anterior and posterior neuropodia have homo- and heterogomph spinigers (Fig. 8c, d) and heterogomph falcigers (Fig. 8b) (*Nereis*, Hilbig 1997). Acicula, or heavy internal black spines, are found on all noto- and neuropodia (Figs. 6).

Eyes/Eyespots: Two pairs of small ocelli are present on the prostomium (Fig. 2).

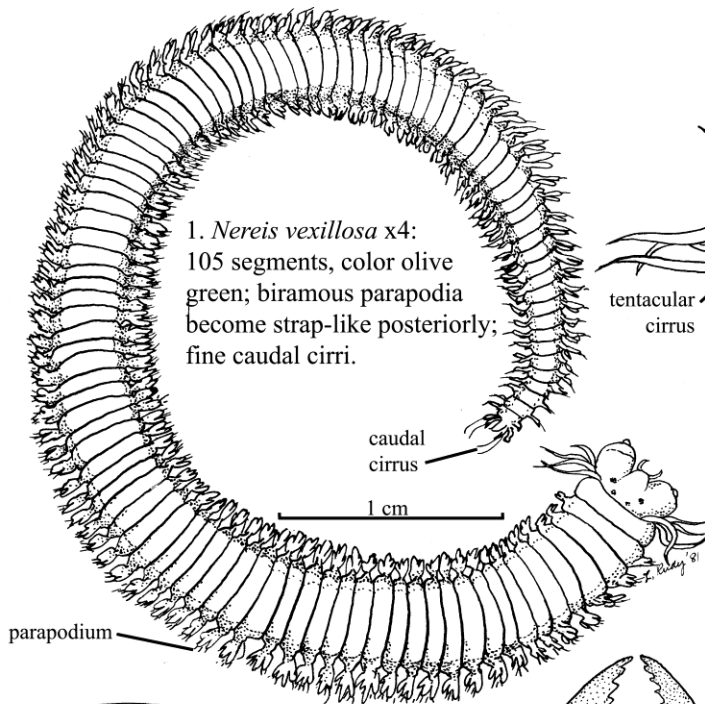
Anterior Appendages: Prostomium bears two small antennae and two massive palps each with small styles. Four pairs of tentacular cirri are also present and the two dorsal pairs are longest (Fig. 2).

Branchiae: Absent (Blake and Ruff 2007).

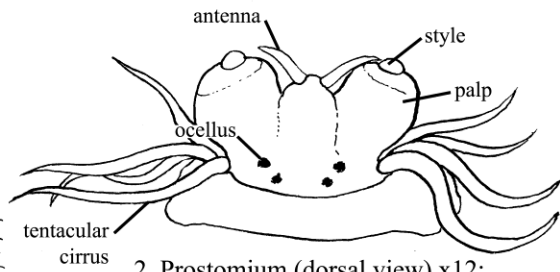
Burrow/Tube: Newly hatched animals build flimsy mucus and sand tubes (Johnson 1943). Adult worm to tube length ratio is 1.65:1 (Roe 1975).

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, with 6–8 teeth (Fig. 3, 4). 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. Paragnaths (conical teeth) on both oral and maxillary rings are arranged as follows: Area I has several small cones in tandem; Area II has an oblique, small transverse patch (Fig. 3); Area III has a circular patch; Area IV (paired) with an oblique patch of several rows, both are ventral; Area V has no paragnaths; Area VI with a mass of 6–9 or more and both are dorsal (Fig. 3); Areas VII and VIII both

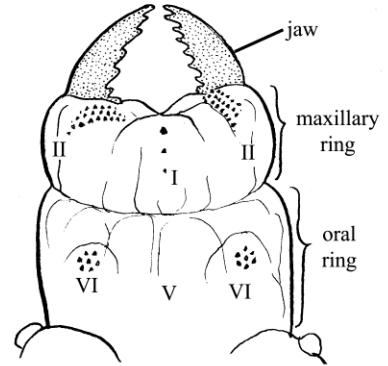
Nereis vexillosa



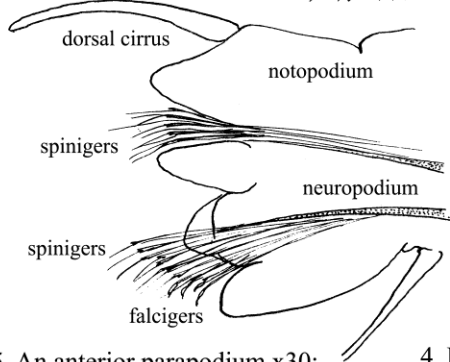
1. *Nereis vexillosa* x4:
105 segments, color olive green; biramous parapodia become strap-like posteriorly; fine caudal cirri.



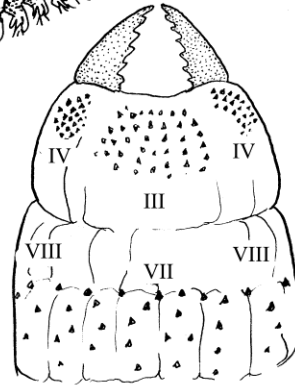
2. Prostomium (dorsal view) x12:
four small ocelli; one pair antennae; massive palps, small styles; four pairs tentacular cirri.



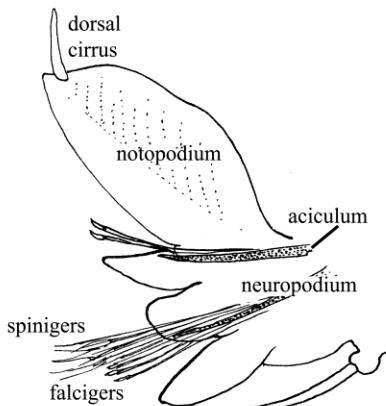
3. Everted proboscis (dorsal view) x12:
conical paragnaths, oral and maxillary rings; jaws 6-8 teeth; paragnaths area - I: several small cones in tandem, II: an oblique, small transverse patch, V: none, VI: 6-9 or more in a mass.



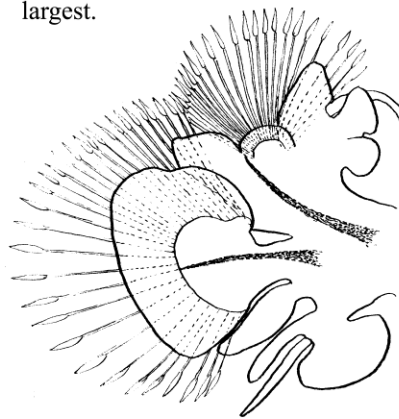
5. An anterior parapodium x30:
biramous; notopodial and neuropodial lobes 'normal', not strap-like.



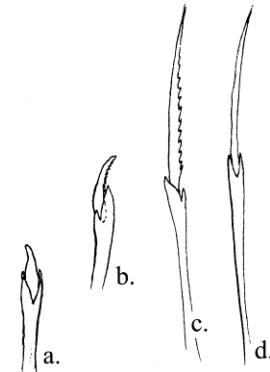
4. Everted proboscis (ventral view) x12:
paragnaths area - III: circular patch, IV: oblique patch, several rows, VII: many, continuous band, VIII: anterior cones largest.



6. A posterior parapodium x30:
notopodial lobe long, strap-like; dorsal cirrus attached terminally.



7. Heteronereia parapodium, female (Johnson, 1943).



8. Setae:
a. homogomph falciger (notopodial)
b. heterogomph falciger (neuropodial)
c. heterogomph spiniger
d. homogomph spiniger

have continuous bands of many paragnaths, those anterior being largest and both are ventral (Fig. 4).

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. Common local nereids are those in the genera *Neanthes* and *Nereis*. *Neanthes* species have only homogomph spinigerous setae in the posterior notopodia. 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* 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 (Smith 1959; Pettibone 1963).

Common local *Nereis* species include 6–7 species (Blake and Ruff 2007). *Nereis eakini*, from rocky habitats, that 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). *Nereis latescens* is common amongst algal holdfasts and their dorsum bears transverse lines of brown pigment (Blake and Ruff 2007). *Nereis pelagica* is an intertidal to subtidal species with dark parapodial lobes. The common and abundant *Nereis vexillosa*, can be differentiated from the above species by its olive green to brown color where it is found in many diverse marine environments, especially in mussel beds. Furthermore, it has distinct greatly elongated, strap-like notopodial lobes in the posterior parapodia.

Other morphologically similar species include those in the genus *Neanthes*. *Neanthes limnicola* individuals are usually pale and translucent, not distinctly green as in *N. vexillosa*. *Neanthes brandti* has been at times considered a subspecies or a synonym of *N. virens*, (Breton et al. 2004) and is large, sand-dwelling and green in color like *N. vexillosa*. However, *N. brandti* is usually paler

ventrally and, in contrast to *N. vexillosa*, it has many teeth on all areas of the proboscis, its posterior parapodial lobes are leaf-like, not long and strap-like. *N. brandti* also has no falcigers in the posterior notopodia and its ecological niche is different, it does not live in mussel beds or on pilings. *Neanthes succinea* is one of the most common nereids in the Northeast Pacific and has a very enlarged posterior notopodial lobes, with a small distal dorsal cirrus attached at the end of the lobe (Blake and Ruff 2007). *N. succinea* is thought to be a more southern form (although it has been reported from Netarts Bay).

Ecological Information

Range: Type localities are Alaska and Siberia. Known range includes eastern Siberia to Alaska and south to central California (Hartman 1968).

Local Distribution: Coos Bay distribution includes many sites and, within Oregon, *N. vexillosa* has also been found in Yaquina Bay.

Habitat: Individuals occur among heavy algae cover, eelgrass, bark, and under rocks or cobblestones. Their preferred substrate is sand or mud mixed with sand. *N. vexillosa* also occurs in mussel beds and barnacle clusters on intertidal pilings along the open coast (Blake and Ruff 2007).

Salinity: *Nereis vexillosa* is strictly a marine species.

Temperature: Cold water to temperate (Johnson 1943).

Tidal Level: Intertidal and shallow water (Johnson 1943).

Associates: Occurs with *Neanthes virens*, in mussel beds and with the scaleworm

Halosydna, porcelain crab *Petrolisthes*, and isopod *Cirolana*.

Abundance: Ubiquitous (Ricketts and Calvin 1971). The most abundant large annelid of the Pacific Northwest (Johnson 1943), but varies in abundance throughout wide geographical range (Ricketts and Calvin 1971). About 22 individuals/m² were reported in Mitchell Bay, Washington (Roe 1975).

Life-History Information

Reproduction: *Nereis vexillosa* has heteronereid a form (called an epitoke) characterized by modified parapodia (Fig. 7). These epitokes swarm at night in summer months (June in Coos Bay and March-August in Washington, Fernald et al. 1987). Males appear first near water's surface, then females. Large (200–250 µm in diameter) oocytes are released from the females in a gelatinous mass and both female and egg mass sink to the benthos. Both adults usually die shortly thereafter (Fernald et al. 1987). Eggs are found in a firm, irregular, gelatinous mass, 2.5–7.5 cm in diameter, translucent and blue green, green or brown when freshly laid. Eggs can withstand strong wave action. *N. vexillosa* is the only nereid with a solid egg mass.

Larva: Larval development was described by Johnson (1943). Pelagic and lecithotrophic larvae hatch from the gelatinous egg mass between 3–5 setiger stages. Survivorship of larvae is reduced due to ingestion by the co-occurring terebellid polychaete *Eupolyornia heterobranchia* (Wilson 1980). When larvae are 1–2 weeks old (4–6 setiger stages), they build mucus tubes and begin to feed (Roe 1975; Fernald et al. 1987).

Juvenile: In the field, juveniles have 8–25 setigers from 3–5 weeks, are one half adult size after one year and are fully grown and sexually mature the following year (Roe 1975). Juveniles can grow quickly in the lab, on a diet of other polychaetes (Johnson 1943). In the field, they can be territorial two weeks after hatching (Roe 1975). Researchers have shown that *N. vexillosa* is less likely to burrow into sediment that has been recently disturbed (e.g., by erosion, mixing, fresh feces, burrow trails and feeding tracks) (Woodin et al. 1995).

Longevity: Two-year life-span (Roe 1975).

Growth Rate: Varies greatly. At 4–12 months and 60 segments, adult species characteristics are conspicuous, including strap-like parapodial lobes (Johnson 1943).

Food: *N. vexillosa* is omnivorous and prefers fresh animal food, and will reject dead food. This species is not a scavenger by preference (Johnson 1943). Nereids use their jaws to tear apart and eat pieces of algae (Kozloff 1993). Young build flimsy mucus and sand tubes, and rarely leave them completely to feed.

Predators: Sometimes preyed upon by nemertean *Paranemertes peregrina* (Roe 1970). Widely used by man for fish bait.

Behavior: Very active worm that can bite human collector.

Bibliography

1. BARNES, R. S. K., and S. M. HEAD. 1977. Variation in paragnath number in some British populations of estuarine polychaete *Nereis diversicolor*. *Estuarine and Coastal Marine Science*. 5:771-781.
2. BLAKE, J. A., and R. E. RUFF. 2007. Polychaeta, p. 309-410. *In: The Light and Smith manual: intertidal invertebrates from central California to Oregon*. J. T. Carlton (ed.). University of California Press, Berkeley, CA.
3. BRETON, S., F. DUFRESNE, G. DESROSIERS, and P. BLIER. 2004. Morphological variation in *Nereis (Neanthes) virens* (Polychaeta : Nereididae) populations. *Journal of the Marine Biological Association of the United Kingdom*. 84:983-985.
4. FERNALD, R. L., C. O. HERMANS, T. C. LACALLI, W. H. WILSON, JR, and S. A. WOODIN. 1987. Phylum Annelida, Class Polychaeta, p. 138-195. *In: Reproduction and development of marine invertebrates of the northern Pacific coast*. M. F. Strathmann (ed.). University of Washington Press, Seattle, WA.
5. HARTMAN, O. 1968. Atlas of the errantiate polychaetous annelids from California. Allan Hancock Foundation,

- University of Southern California, Los Angeles.
6. HARTMAN, O., and D. J. REISH. 1950. The Marine annelids of Oregon. Oregon State College, Corvallis, Oregon.
 7. HILBIG, B. 1997. Family Nereididae, p. 291-316. *In*: Taxonomic atlas of the benthic fauna of the Santa Maria Basin and Western Santa Barbara Channel. Vol. 4. J. A. Blake, B. Hilbig, and P. H. Scott (eds.). Santa Barbara Museum of Natural History, Santa Barbara, CA.
 8. JOHNSON, M. W. 1943. Studies on the life history of the marine annelid *Nereis vexillosa*. *Biological Bulletin*. 84:106-14.
 9. 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, WA.
 10. PETTIBONE, M. 1963. Aphroditidae through Trochochaetidae. *In*: Marine polychaete worms of the New England Region. Vol. 1. Smithsonian Institution, Washington, D.C.
 11. RICKETTS, E. F., and J. CALVIN. 1971. *Between Pacific tides*. Stanford University Press, Stanford, California.
 12. ROE, P. 1975. Aspects of life-history and of territorial behavior in young individuals of *Platynereis bicanaliculata* and *Nereis vexillosa* (Annelida: Polychaeta). *Pacific Science*. 29:341-348.
 13. ROE, P., and R. GIBSON. 1970. The Nutrition of *Paranemertes peregrina* (Rhynchocoela: Hoplonemertea). *Biological Bulletin*. 139:80-91.
 14. SMITH, R. I. 1959. The synonymy of the viviparous polychaete *Neanthes lighti* Hartman (1938) with *Nereis limnicola* Johnson (1903). *Pacific Science*. 13:349-350.
 15. WILSON, W. H. 1980. A Laboratory investigation of the effect of a terebellid polychaete on the survivorship of nereid polychaete larvae. *Journal of Experimental Marine Biology and Ecology*. 46:73-80.
 16. WOODIN, S. A., S. M. LINDSAY, and D. S. WETHEY. 1995. Process-specific recruitment cues in marine sedimentary systems. *Biological Bulletin*. 189:49-58.