Americorophium salmonis

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Amphipoda, Gammaridea
Family: Corophiidae

Taxonomy: *Corophium salmonis* was among the first corophiid amphipods described in North America (Stimpson 1857). It was transferred to the genus *Americorophium* in 1997 based on morphological characters (Bousfield and Hoover 1997) (see **Possible Misidentifications**). Researchers have not always followed this transition in other *Americorophium* species (e.g. *A. spinicorne*, Lester and Clark 2002; Sakamaki and Richardson 2009), but we follow the nomenclature used in other current local intertidal guides (Chapman 2007).

Description

Size: Largest males are 6 mm in length, from rostrum to end of uropods and the average size range is 4–6 mm (Coos Bay) and 7.5 mm (Siuslaw Estuary). Females are approximately 7 mm in length (Shoemaker 1949). The illustrated specimen (from Coos Bay) is 6 mm.

Color: Males are transparent, with brown mottling, especially on large second antenna (Fig. 3). Females, like other *Americorophium* species, are clear, with brown mottling, especially on the second antennae.

General Morphology: The body of amphipod crustaceans can be divided into three major regions. The **cephalon** (head) includes antennules, antennae, mandibles, maxillae and maxillipeds (collectively the **mouthparts**). Posterior to the cephalon is the **pereon** (thorax) with seven pairs of pereopods attached to pereonites followed by the **pleon** (abdomen) with six segments comprising three **pleonites** (together the pleosome), three **urosomites** (together the urosome), and finally a **telson** at the animal posterior (see Plate 254, Chapman 2007). In members of the genus *Americorophium*, the body is flattened dorso-ventrally and rarely exceeds 1 cm in total length (including antennae) in local specimens (see Fig 46, Kozloff 1993).

Cephalon:

Rostrum: The male rostrum is straight, slightly convex or with low central projection (Fig. 1) (Shoemaker 1949). The female rostrum, on the other hand, is a broad and low triangle (Fig. 7).

Eyes:

Antenna 1: Reaches to middle of article four of second antenna in males. Their flagellum comprises 14–16 articles (occasionally 11–12) and the first article of the peduncle is flat and greatly expanded laterally (Fig. 1) (Shoemaker 1949). First antenna about as long as the second in females. The female flagellum comprises ten joints (Shoemaker 1949) and the first article is not expanded.

Antenna 2: Much longer than body in mature male specimens. The fourth article has large distal tooth, forming a half-moon, and small tooth within (Fig. 3). The fifth article has two teeth below: one at distal end and one near proximal end (Fig. 3). The proximal tooth lies below the flexed half-moon tooth. The gland cone on second article below, is bi-lobed and elaborate (Fig. 2) (Shoemaker 1949). The second antenna in females is not as massive as in males. The fourth article is without a large half-moon tooth and accessory, but with two single spines on the lower edge and two on the third article (Fig. 4). The gland cone of females is simpler than that of the male and is without lobes (Fig. 8).

Mouthparts:

Pereon:

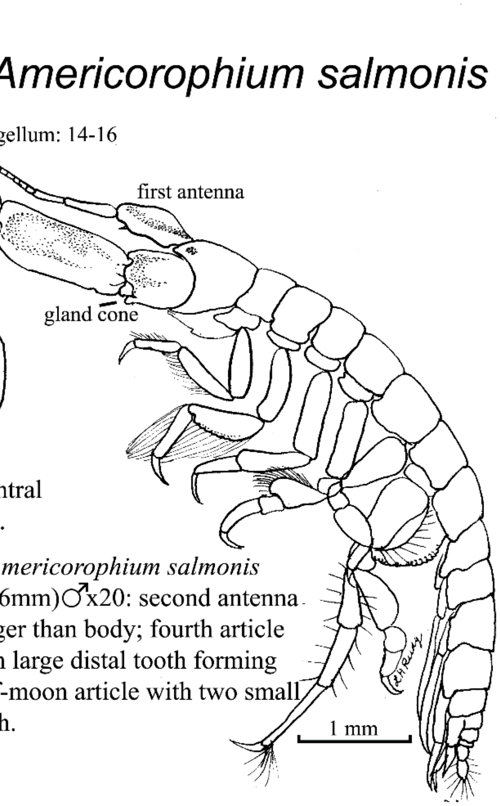
Coxae: Setose lamellae (pairs of brood plates attached to bases of coxae) are present in females only and are used for holding eggs and young. Do not confuse with fleshy gills, which are also attached to coxae.

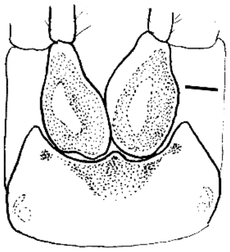
Gnathopod 1:

Gnathopod 2: Filtering type, with fine long setae, present in both sexes, morphology as in other *Americorophium* species (see Fig. 3, *A. brevis* in this guide).

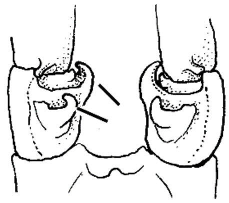
Hiebert, T.C. 2015. *Americorophium salmonsis. In:* Oregon Estuarine Invertebrates: Rudys' Illustrated Guide to Common Species, 3rd ed. T.C. Hiebert, B.A. Butler and A.L. Shanks (eds.). University of Oregon Libraries and Oregon Institute of Marine Biology, Charleston, OR.

Americorophium salmonis



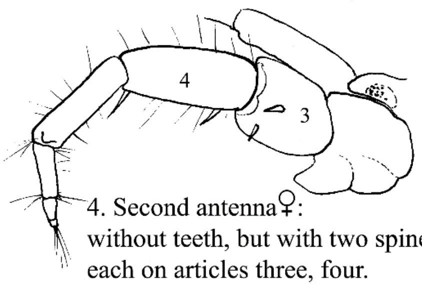


1. Head (dorsal view)♂: rostrum with low projection or straight; first articles, expanded.

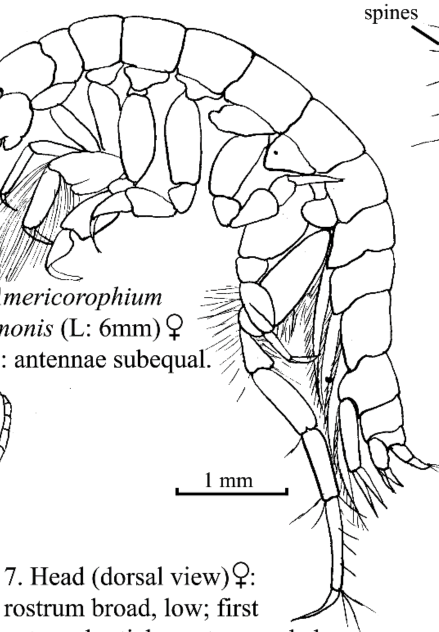


2. Gland cones (ventral view)♂: two lobes.

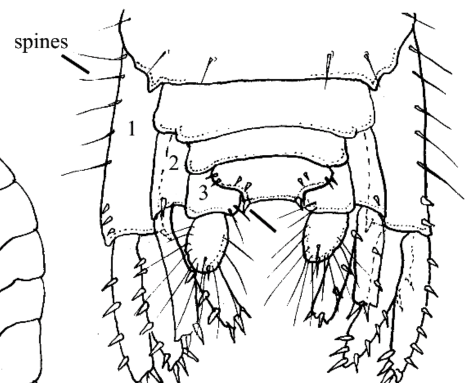
3. *Americorophium salmonis* (L: 6mm)♂x20: second antenna longer than body; fourth article with large distal tooth forming half-moon article with two small teeth.



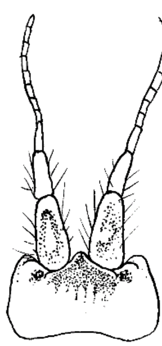
4. Second antenna♀: without teeth, but with two spines each on articles three, four.



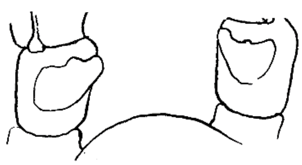
5. *Americorophium salmonis* (L: 6mm)♀ x20: antennae subequal.



6. Urosome and telson: first uropods with slender, blunt spines; telson margin straight, two spines.



7. Head (dorsal view)♀: rostrum broad, low; first antennal articles not expanded.



8. Gland cones (ventral view)♀: simple, lobeless.

Perepods 3 through 7:

Pleon:

Pleonites:

Urosomites: Urosome with posterior margin straight, slightly concave and with a spine in each corner as well as two spines on each lateral edge and two on the inside edge (Fig. 6). First uropods with three to six slender spines along outside edge of peduncle. Two to three small, blunt spines present at distal corner (Fig. 6). Third uropods have many slender setae on all edges (Fig. 6).

Epimera:

Telson:

Sexual Dimorphism: Males and females exhibit differing morphology in characters of the rostrum, Antenna 1 and 2, as well as overall body size and color.

Possible Misidentifications

The gammarid family Corophiidae is characterized by individuals that build U-shaped tubes in both soft sediments and on hard surfaces, sometimes forming dense aggregations. Species can be dramatically sexually dimorphic. Although males may be easier to identify with taxonomically relevant characters including the rostrum and peduncle of second antennae, most females can be reliably identified to species as well (Chapman 2007). Five corophiid genera occur locally: *Americorophium*, *Corophium*, *Crassicorophium*, *Laticorophium* and *Monocorophium*. The three common estuarine species in this guide (*A. brevis, A. salmonis,* and *A. spinicorne*) were previously members of the genus *Corophium* (see Shoemaker 1949), but were transferred to the genus *Americorophium* in 1997 (Bousfield and Hoover 1997).

All *Americorophium* species have filtering-type second gnathopods and long setae on the third uropods. Of the four local *Americorophium* species, sexual dimorphism is strong in the three species *A. brevis*, *A. salmonis*, and *A. stimpsoni*. In particular, the second antenna and fourth segment differ between males and females (Shoemaker 1949). This is not the case, however, for the fourth *Americorophium* species, *A. spinicorne,* where male and female morphologies are similar. Additional characteristics that differ between species (particularly *A. brevis* and *A. salmonis*) include first antenna, telson, first uropods and third uropods.

Americorophium stimpsoni, principally a northern California species, does not seem to occur in Oregon. Its chief key characteristic is a prominent male rostrum, almost as long as the ocular lobes. The females are much like those of *A. salmonis*.

Americorophium spinicorne, another prominent northwest species, has less sexual dimorphism than other *Americorophium* species. Both males and females have a half-moon tooth on the fourth article of the second antenna, but without the small accessory tooth. *Americorophium spinicorne* is also strongly euryhaline and often found in fresh-water habitats. Segments of urosome are separate and not fused in *A. spinicorne* and males and females can be distinguished by the second antennal features and by the presence of lamellae and/or eggs in females.

Males: Of the *Americorophium* species in which males have urosome segments dissimilar to females, *A. stimpsoni*, *A. brevis*, and *A. salmonis* all have a half-moon and accessory tooth on the fourth article of the second antenna. *Americorophium brevis* and *A. salmonis* often have similar rostrums, but that of *A. stimpsoni* has a prominent central lobe nearly as long as the ocular lobes. In *A. salmonis* the first antenna reaches only to the middle of the fourth article. *Americorophium brevis* does not have flat expanded first articles of the first antenna and *A. salmonis* usually has 14–16 articles in the flagellum, (though occasional specimens will have 11–12). In *A. brevis,* the males have about 11 articles in the flagellum of the first antenna. The uropods of *A. salmonis* and *A. brevis* are quite dissimilar. In *A. salmonis*, the peduncle of the first uropod is armed on the outside edge with three to six long, slender spines and at the distal edge with two to three short, blunt spines. *Americorophium brevis* has instead only eight short, blunt spines. The third uropods of *A. salmonis* have many more and longer setae than those of *A. brevis*. The telson shape and spination of the two species are also quite different (compare Figs. 4, *A. brevis*, and Fig. 5, *A. salmonis* in this guide).

Females: *A. salmonis* and *A. stimpsoni* females are very much alike, with no strong distinguishing characteristics, so the species should not be differentiated solely by female specimens. The only *Americorophium* female of this group to have the half-moon hook is *A. spinicorne*, so this species is easily distinguished from others. *Americorophium brevis* has three pairs of spines, as well as a spine on the gland cone, instead of having two single spines on the underside of the fourth article of the second antenna. The first antenna has eight joints in the flagellum, while that of *A. salmonis* has ten.

Ecological Information

Range: Type locality is Puget Sound, Washington (Bousfield and Hoover 1997). Known range along the west coast of North America includes Coos Bay to Puget Sound and Alaska (Barnard 1954).

Local Distribution: Local distribution in mudflats of South Slough as well as Cox Island (Siuslaw Estuary), Tillamook Bay, Sixes River, Ten Mile Creek and Columbia River (Forsberg et al. 1977).

Habitat: Members of the Corophiidae inhabit small U-shaped tubes in soft sediments, or on hard surfaces (Chapman 2007). Occurs in muddy habitats and sometimes with algae (e.g. *Ulva*). Especially abundant in brackish estuaries with a high degree of silt and mud (Raymond et al. 1985; Kozloff 1993). Comparisons of macrofaunal communities within and outside of *Dendraster excentricus* beds found *Americorophium* species to be more prevalent where sand dollars were not present (Smith 1981). Corophiid amphipods are frequently used in tests of sediment toxicity and/or water quality (e.g. fluoranthene, Swartz et al. 1990; ivermectin, Davies et al. 1998; sewage outfall, Arvai et al. 2002; and nonylphenol, Hecht et al. 2004).

Salinity:

Temperature:

Tidal Level:

Associates:

Abundance: Populations often very dense and easily observed or collected in the field. The abundance of *Americorophium* species was measured in the Campbell River Estuary and ranged from zero to ~15,000–31,000 per square meter in July (Raymond et al. 1985). Densities of *A. salmonis* in the Copper River Delta, Alaska were as high as 7,000 per square meter in August (Powers et al. 2002).

Life-History Information

Reproduction: Development in most amphipods is direct, lacking a larval stage, and little is known about the reproduction and development in *A. salmonis.* Ovigerous *A. salmonis* females and young have been observed in October (Ten Mile Creek). Ovigerous *A. spinicorne* females have been observed in February, March, May and December (Eriksen 1968). In the European species, *Corophium volulator*, breeding occurs in February (over-wintering population) and again in July–August. Young remain in brood pouch four weeks and females produce up to four broods per year (Green 1968).

Larva: Since most amphipods develop directly, they lack a definite larval stage. Instead the young developmental stage resembles small adults (e.g. Fig. 39.1, Wolff 2014).

Juvenile:

Longevity:

Growth Rate: Amphipod 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. Ruppert et al. 2004).

Food: A detritovore, *A. salmonis* sorts material with filtering gnathopods. Abdominal appendages create a water current that is filtered by the fine hairs on the gnathopods, and the filtrate is then scraped off and ingested (Miller 1984; Taghon 1984; Kozloff 1993).

Predators: Young fish (e.g. Pacific Staghorn Sculpins, Starry Flounders, Threespine Stickleback, Signal Crayfish, Brenneis et al. 2011). *Americorophium salmonis* is a particularly important component of juvenile salmonid diet (e.g. Chinook, Forsberg et al.

1977; Bottom and Jones 1990) and White Sturgeon (*Acipenser transmontanus*, McCabe et al. 1993). Avery and Hawkinson (1992) also found that Gray Whale populations exhibited great feeding activity in areas with high density of corophid tube mats dominated by the species *A. spinicorne,* in northern California.

Behavior:

Bibliography

1. ARVAI, J. L., C. D. LEVINGS, P. J. HARRISON, and W. E. NEILL. 2002. Improvement of the sediment ecosystem following diversion of an intertidal sewage outfall at the Fraser River Estuary, Canada, with emphasis on *Corophium salmonis* (amphipoda). Marine Pollution Bulletin. 44:511-519.
2. AVERY, W. E., and C. HAWKINSON. 1992. Gray whale feeding in a northern California estuary. Northwest Science. 66:199-203.
3. BARNARD, J. L. 1954. Marine amphipoda of Oregon. Oregon State College, Corvallis.
4. BOTTOM, D. L., and K. K. JONES. 1990. Species composition, distribution, and invertebrate pray of fish assemblages in the Columbia River Estuary. Progress in Oceanography. 25:243-270.
5. BOUSFIELD, E. L., and P. M. HOOVER. 1997. The amphipod superfamily Corophioidea on the Pacific Coast of North America. Part 5. Family Corophiidae: Corophiinae, new subfamily. Systematics and distributional ecology. Amphipacifica. 2:67-139.
6. BRENNEIS, V. E. F., A. SIH, and C. E. DE RIVERA. 2011. Integration of an invasive consumer into an estuarine food web: direct and indirect effects of the New Zealand mud snail. Oecologia. 167:169-179.
7. CHAPMAN, J. W. 2007. Amphipoda: Gammaridea, p. 545-556. *In:* The Light and Smith manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley, CA.
8. DAVIES, I. M., P. A. GILLIBRAND, J. G. MCHENERY, and G. H. RAE. 1998. Environmental risk of ivermectin to sediment dwelling organisms. Aquaculture. 163:29-46.
9. ERIKSEN, C. H. 1968. Aspects of the limno-ecology of *Corophium spinicorne* (Stimpson) (Amphipoda) and *Gnorimosphaeroma oregonensis* (Dana) (Isopoda). Crustaceana. 14:1-12.
10. FORSBERG, B. O., J. A. JOHNSON, and S. I. KLUG. 1977. Identification, distribution and notes on food habits of fish and shellfish in Tillamook Bay, Oregon. Oregon Department of Fish and Wildlife, s.l.
11. GREEN, J. 1968. The Biology of estuarine animals. University of Washington Press, Seattle.
12. HECHT, S. A., J. S. GUNNARSSON, B. L. BOESE, J. O. LAMBERSON, C. SCHAFFNER, W. GIGER, and P. C. JEPSON. 2004. Influences of sedimentary organic matter quality on the bioaccumulation of 4-nonylphenol by estuarine amphipods. Environmental Toxicology and Chemistry. 23:865-873.
13. 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.
14. LESTER, G. T., and W. H. CLARK. 2002. Occurrence of *Corophium spinicorne* (Stimpson, 1857) (Amphipoda: Corophiidae) in Idaho, USA. Western North American Naturalist. 62:230-233.
15. MCCABE, G. T., R. L. EMMETT, and S. A. HINTON. 1993. Feeding ecology of juvenile white sturgeon *Nacipenser transmontanus* in the lower Columbia River. Northwest Science. 67:170-180.
16. MILLER, D. C. 1984. Mechanical post-capture particle selection by suspension feeding and deposit feeding corophim. Journal of

Experimental Marine Biology and Ecology. 82:59-76.
17. POWERS, S. P., M. A. BISHOP, J. H. GRABOWSKI, and C. H. PETERSON. 2002. Intertidal benthic resources of the Copper River Delta, Alaska, USA. Journal of Sea Research. 47:13-23.
18. RAYMOND, B. A., M. M. WAYNE, and J. A. MORRISON. 1985. Vegetation, invertebrate distribution, and fish utilization of the Campbell River Estuary, British Columbia, Canada. Canadian Manuscript Report of Fisheries and Aquatic Sciences:1 -33.
19. RUPPERT, E.E., R.S. FOX, and R.D BARNES. 2004. Invertebrate zoology: a functional evolutionary approach, 7th Edition. Thomson Brooks/Cole, Belmont, CA.
20. SAKAMAKI, T., and J. S. RICHARDSON. 2009. Dietary responses of tidal flat macrobenthos to reduction of benthic microalgae: a test for potential use of allochthonous organic matter. Marine Ecology Progress Series. 386:107-113.
21. SHOEMAKER, C. R. 1949. The amphipod genus *Corophium* on the west coast of America. Journal of the Washington Academy of Sciences. 89:66-82.
22. SMITH, A. L. 1981. Comparison of macrofaunal invertebrates in sand dollar (*Dendraster excentricus*) beds and in adjacent areas free of sand dollars. Marine Biology. 65:191-198.
23. SWARTZ, R. C., D. W. SCHULTS, T. H. DEWITT, G. R. DITSWORTH, and J. O. LAMBERSON. 1990. Toxicity of fluoranthene in sediment to marine amphipods: A test of the equilibrium partitioning approach to sediment quality criteria. Environmental Toxicology and Chemistry. 9:1071-1080.
24. TAGHON, G. L. 1982. Optimal foraging by deposit feeding invertebrates: roles of particle size and organic coating. Oecologia. 52:295-304.
25. WOLFF, C. 2014. Amphipoda, p. 206-209. *In:* Atlas of crustacean larvae. J.W. Martin., J. Olesen, and J. T. Høeg (eds.). Johns Hopkins University Press, Baltimore.