
Gnorimosphaeroma insulare

Phylum: Arthropoda, Crustacea

Class: Multicrustacea, Malacostraca, Eumalacostraca

Order: Peracarida, Isopoda, Sphaeromatidea

Family: Sphaeromatoidea, Sphaeromatidae

Taxonomy: The genus *Gnorimosphaeroma* was described in 1954 by Menzies with six species including *G. insulare* as well as *G. lutea*, *G. oregonensis*, each a subspecies of *G. oregonensis*, differentiable by pleotelson morphology. Some authors later elevated these two subspecies to species status based on habitat and physiology (e.g. Riegel 1959). Furthermore, *G. insulare* and *G. lutea* were synonymized by Hoestlandt in 1977 and, although some authors (including those for our current, local intertidal guide, Brusca et al. 2007) also consider *G. oregonensis* a synonym of *G. insulare*, others differentiate the two based on habitat: *G. oregonensis* is strictly marine while *G. insulare* is estuarine (Stanhope et al. 1987).

Description

Size: Males up to 8 mm in length (Miller 1975) and almost twice as long as wide.

Color: White with small black chromatophores.

General Morphology: Isopod bodies are dorso-ventrally flattened and can be divided into a compact **cephalon**, with eyes, two **antennae** and **mouthparts**, and a **pereon** (thorax) with eight segments, each bearing similar **pereopods** (hence the name “isopod”). Posterior to the pereon is the **pleon**, or abdomen, with six segments, the last of which is fused with the telson (the **pleotelson**) (see Fig. 1, Harrison and Ellis 1991; Plate 231, Brusca et al. 2007). The Isopoda can be divided into two groups: ancestral (“short-tailed”) groups (i.e. suborders) that have short telsons and derived (“long-tailed”) groups with long telsons. Members of the Flabellifera, to which *G. insulare* be-

longs, fall into the long-tailed variety. Body surface in *Gnorimosphaeroma insulare* is smooth and with eight segments from cephalon to pereon. Individuals able to roll into a ball (Sphaeromatidae).

Cephalon: Frontal border smooth (Fig. 3).

Eyes:

Antenna 1: First antenna longer than second and basal articles are separated by the rostrum (Fig. 3) (see Fig. 4 Hoestlandt, 1977).

Antenna 2: Shorter than first antenna (see Fig. 4 Hoestlandt, 1977).

Mouthparts: Mandible with a palp and maxilliped with four articles. Hairs present on antero-lateral edge of articles 2–4 are less than ½ the length of the article (see Figs. 5–8, Hoestlandt 1977).

Rostrum:

Pereon:

Pereonites: Seven free pereonites total.

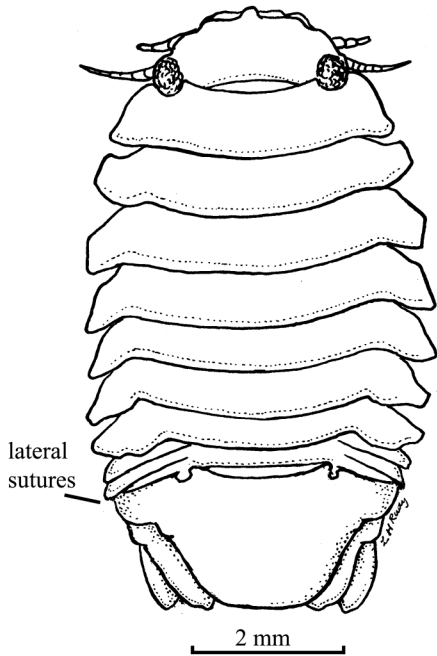
Pereopods: Seven pereopod pairs. The basis of the first pereopod is hairless and distal extremity with one hair or hairless (Fig. 6).

Pleon: Pleon consists of three parts. The first is concealed under the last pereonite, the second consists of several coalesced pleonites often with partial sutures (Fig. 1), and the third part is the large **pleotelson**.

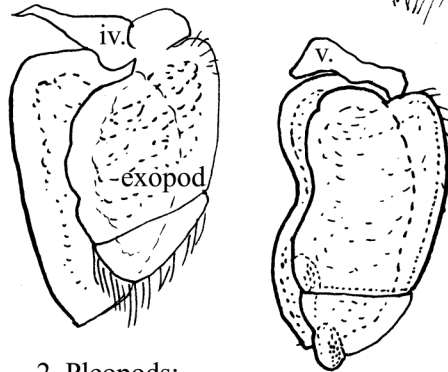
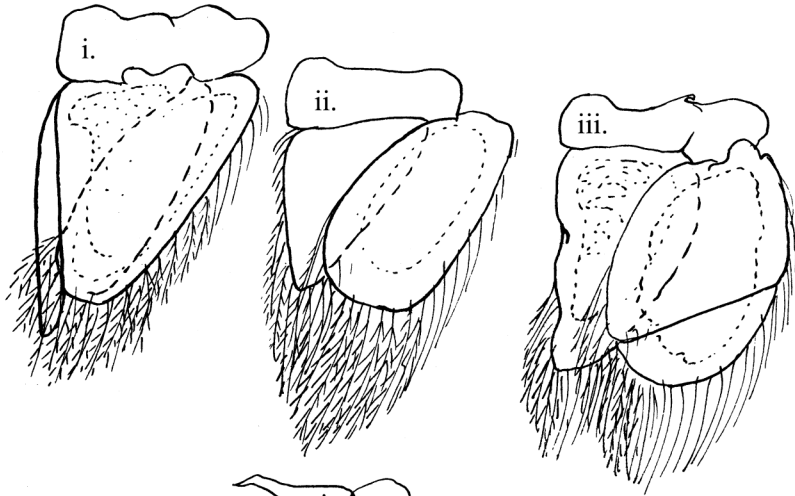
Pleonites: Only two of three reach the lateral margin, third pleonite is under the second (Figs. 1, 4).

Pleopods: Five pleopod pairs. The first pair is not widely separated at the base, and is similar in size to the second. The first three pairs are with marginal plumose setae.

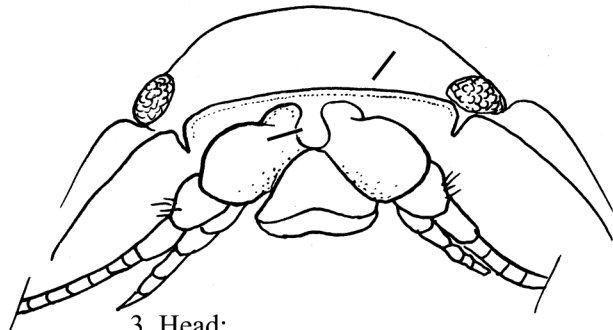
Gnorimosphaeroma insulare



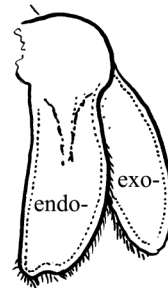
1. *Gnorimosphaeroma insulare* x12.5.



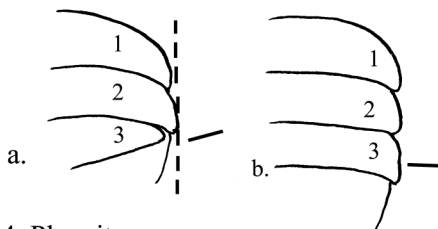
2. Pleopods:
 i, ii similar in size, i not separated at base.
 i, ii, iii with marginal plumose setae.
 iv bent; iv, v fleshy, without transverse folds.



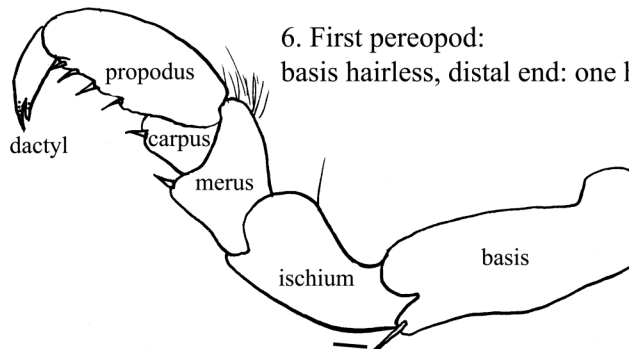
3. Head:
 antennal bases separated by rostrum,
 frontal border smooth.



5. Right uropod:
 biramous,
 endopod rigid,
 exopod movable.



4. Pleonites:
 a. two pleonites reach margin, third visible
 beneath: *G. insulare*.
 b. three pleonites reach lateral margin:
G. oregonense, *G. rayi*.



6. First pereopod:
 basis hairless, distal end: one hair.

The fourth and fifth pairs are fleshy and without transverse folds, and the fourth is with a bent exopod (Fig. 2, 1-v). The number and arrangement of these folds of the endopods and exopods is considered an important taxonomic character by some authors (e.g. Cassidinidae, Fig. 2, Iverson 1982; Fig. 1, Harrison and Ellis 1991).

Uropods: Two branched uropods visible dorsally, with rigid endopod and flexible exopod (Fig. 5) (see Fig. 9, Hoestlandt 1977).

Pleotelson: Rounded and convex (Fig. 1).

Sexual Dimorphism: Conspicuous sexual dimorphism is rare among isopods, however, mature females are often broader and bear a thoracic marsupium while males have modified first pleopods, called gonopods (Sadro 2001; Boyko and Wolff 2014). Protogyny has been observed (see **Reproduction**) in *G. insulare* and females can have rudimentary penes after brood release (Brook et al. 1994).

Possible Misidentifications

The order Isopoda contains 10,000 species, 1/2 of which are marine and comprise 10 suborders, with eight present from central California to Oregon (see Brusca et al. 2007). Among isopods with elongated telsons (with anuses and uropods that are subterminal), there are several groups (i.e. suborders) including Valvifera, Anthuridea, Gnathiidea, Epicaridea and Flabellifera.

The Flabellifera is a large assemblage contains 3,000 species with seven families occurring locally, three of which are not present north of Point Conception, California (Brusca et al. 2007). The Flabellifera are characterized by body length that is rarely less than 3 mm and a pleon with less than three free pleonites (plus the pleotelson). The family Sphaeromatidae is almost certainly paraphyletic (Brandt and Poore 2003) and includes 37

species in 11 genera in the western coast of North America (Wall et al. 2015) and has a pleon with 1–2 free pleonites, a convex body that is not depressed, antennae that are widely separated, indistinct frontal lamina and subequal pleopods, where pleopods 4–5 are ovate in shape (see also Iverson 1982). There are 17–24 species in this family from central California to Oregon (Brusca et al. 2007). These species belong to the following genera: *Ancinus*, *Clianella*, *Dynamene*, *Paradella*, *Pseudosphaeroma*, *Tecticeps* (all with one species), *Paracereis*, *Sphaeroma* (each with two species), *Dynamenella*, *Exosphaeroma* (each with 4–5 species) (for detailed key of *Exosphaeroma* see Wall et al. 2015) and *Gnorimosphaeroma* has two to four species locally.

The fourth and fifth pleopods in *Gnorimosphaeroma* lack pleats (see Cassidinidae, Fig. 2, Iverson 1982; Fig. 1, Harrison and Ellis 1991), the first pereopod is ambulatory and the uropod is with an exopod. In *G. noblei* the first article of the left and right antennae peduncles are touching while they are not in *G. oregonense*. *Gnorimosphaeroma rayi*, so far found only in Tomales Bay, California and in Japan, is an estuarine species found also above the mid-tide line, and also under stones. In this species, the basis of the first pereopod has a tuft of 7–9 setae and 2–3 setae are present on the sternal crest of the ischium. *Gnorimosphaeroma oregonense*, is found above the mid-tide line, usually under stones. *Gnorimosphaeroma oregonense* is stouter than *G. insulare*, being 1.5 to 1.75 times longer than wide and all three pleonites reach the lateral margin and the frontal border of its head has several curves (compare Plate 243C to 252C1, Brusca et al. 2007). The exopod of the uropod is only $\frac{2}{3}$ as long as the endopod (Richardson 1905). *Gnorimosphaeroma rayi* also has three pleonites reaching the lateral margin (Fig. 4b) and the

basis of the first pereopod is setose. It is stout like *G. oregonense*, and has longer antennae than either *G. oregonense* or *G. insulare*.

Ecological Information

Range: Type locality is San Nicolas Island, California (Menzies 1954). Known range from Alaska to California (Menzies 1954a), where it is most common north of Point Conception (Miller 1968).

Local Distribution: Oregon distribution in the Siuslaw estuary and Cox Island as well as the Metcalf Preserve (South Slough of Coos Bay) and Carter Lake (Wones and Larson 1991).

Habitat: Estuarine intertidal, among *Fucus* and under logs in *Salicornia* marshes and in mud or drainage channels (e.g. Metcalf Preserve) as well as sedge marshes, amongst wood debris and within algal beds and banks (Stanhope et al. 1987). Benthic in Tomales Bay.

Salinity: Euryhaline (Wones and Larson 1991). Estuarine to fresh water and can tolerate salinities from 6–35 (Welton and Miller 1980).

Temperature:

Tidal Level: -1.4 meters to subtidal (Metcalf Preserve, Hoestlandt 1969a).

Associates: Alga *Fucus*, amphipod *Orchestia*, littorine snail *Ovatella* (Metcalf Preserve) and amphipod *Anisogammarus* (Siuslaw estuary). Co-occurs, but is not negatively affected by the non-native mud snail, *Potamopyrgus antipodarum* (Brenneis et al. 2010).

Abundance: Individuals have a tendency to congregate. Individuals were abundant at some depth in the coastal dune lake, Carter Lake (Oregon National Dunes Recreational Area, Wones and Larson 1991).

Life-History Information

Reproduction: Most isopods have separate sexes (i.e. dioecious, Brusca and Iverson

1985), although protogynous and protandric species are known (Brook et al. 1994; Araujo et al. 2004; Boyko and Wolff 2014). Protogyny has been observed in both *G. insulare* (as *G. luteum*) *G. oregonense*, where females have rudimentary penes and grow to sexually mature males following several molts after brood release (see Table 1, Brook et al. 1994). Reproduction proceeds by copulation and internal fertilization where eggs are deposited within a few hours after copulation and brooded within the female marsupium (Brusca and Iverson 1985). The biphasic molting of isopods allows for copulation; the posterior portion of the body molts and individuals mate, then the anterior portion, which holds the brood pouch, molts (Sadro 2001). Embryonic development proceeds within the brood chamber and is direct with individuals hatching as manca larvae that resemble small adults, with no larval stage (Boyko and Wolff 2014). Little about the reproductive and developmental biology of *G. insulare* is known, but ovigerous females were observed in March, larger females produce larger brood, egg sizes vary from 450–480 μm , and the average developmental time is 120 days (Squamish estuary, British Columbia Canada, Stanhope et al. 1987). *Gnorimosphaeroma rayi* reproduces in spring only, on a one year cycle and *G. oregonensis* has young in spring and fall (Hoestlandt 1969).

Larva: Since most isopods are direct developing, they lack a definite larval stage. Instead this young developmental stage resembles small adults (e.g. Fig. 40.1, Boyko and Wolff 2014). Most isopods develop from embryo to a manca larva, consisting of three stages. Manca larvae are recognizable by lacking the seventh pair of pereopods, but otherwise resemble small adults. They usually hatch from the female marsupium at the second stage and the molt from second to third manca produces the seventh pair of pereopods and sexual characteristics (Boyko

and Wolff 2014). Isopod development and larval morphology can vary between groups (e.g. Gnathiidae, Cryptoniscoidea, Bopyroidae, Cymothoidae, Oniscoidea) (see Boyko and Wolff 2014). Parasitic isopods, for example, have larvae that are morphologically dissimilar from adults (Sadro 2001). Isopod larvae are not common members of the plankton, with parasitic larvae most likely to be observed. Occasionally, suspended benthic juveniles or pelagic species are collected in plankton samples, but these can be differentiated from larvae by their larger size (Sadro 2001). The release of manca larvae in *G. insulare* occurred in July (Stanhope et al. 1987).

Juvenile:

Longevity: The longevity of the congeners *G. rayi* and *G. oregonense* are one year and 2.3 years, respectively (Hoestlandt 1969).

An annual, semelparous species, *Gnorimosphaeroma insulare* males die after mating and females die shortly after larvae hatch (Stanhope et al. 1987).

Growth Rate: Growth among isopods occurs in conjunction with molting where the exoskeleton is shed and replaced. Post-molt individuals will have soft shells as the cuticle gradually hardens. During a molt, arthropods have the ability to regenerate limbs that were previously autonomized (Kuris et al. 2007), however, isopods do not autotomize limbs as readily as other groups (Brusca and Iverson 1985). Compared to other arthropods, isopods exhibit a unique biphasic molting, in which the posterior 1/2 of the body molts before the anterior 1/2 (Brusca et al. 2007). Growth rates in *G. insulare* were faster in males than females (see Fig. 5, Stanhope et al. 1987).

Food: A detritivore and scavenger. The congener, *G. oregonense*, co-occurs with and readily eats egg capsules of the gastropod *Nucella emarginata*. In fact, predation by this isopod may cause *N. emarginata* to

produce egg capsules with thicker walls that are more resistant to predation (Rawlings 1994).

Predators: Isopods play a significant role as intermediate food web links, like amphipods, (e.g. see *Americorophium salmonis*, this guide) that are consumed by more than 20 species of marine fish (Welton and Miller 1980; juvenile salmonids, sculpins, flounder and rockfish, Stanhope et al. 1987; cabezon, Best and Stachowicz 2012) and whales (Brusca et al. 2007). The presence of the non-native mud snail, *Potamopyrgus antipodarum*, increases predation on *G. insulare* as well as the native isopod *Americorophium salmonis* (Brenneis et al. 2011).

Behavior:

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