

# *Archaeomysis grebnitzkii*

A mysid or opossum shrimp

Phylum: Arthropoda  
Subphylum: Crustacea  
Class: Malacostraca  
Order: Mysida  
Family: Mysidae

**Taxonomy:** *Archaeomysis grebnitzkii* was described from a specimen collected from cod gut contents by Czerniavsky in 1882. Later, Holmes described the same species under a different name, *Callomysis maculata*, which was collected from a sandy beach (Holmquist 1975). In 1932, Tattersall transferred *C. maculata* to *A. maculata* and Holmquist (1975) synonymized *Archaeomysis maculata* and *Callomysis maculata* as *A. grebnitzkii*, a species which exhibited a wide North Pacific range (Hanamura 1997; Moldin 2007). These species were previously differentiated by subtle variation in morphological characters that were deemed to be intraspecific (e.g. rostrum shape, third pleopod exopod segments, telson length, Hanamura 1997).

## Description

**Size:** Male body length ranges from 9–15 mm, and females 13–22 mm (Holmquist 1975; Hanamura 1997). The illustrated specimens (from Columbia River) are 4.5 mm (male, Fig. 1a) and 17 mm (female, Fig. 1).

**Color:** Transparent, with stellar melanophores (“maculate”) (see Fig. 265, Kozloff 1993). Some mysids can change color to blend with their background (Tattersall and Tattersall 1951).

**General Morphology:** Mysids are shrimp-like crustaceans that are occasionally called opossum shrimp due to the female marsupium or brood pouch, which is composed of oostegites. Like other Peracarida (e.g. cumaceans, isopods, amphipods, tanaids), their bodies are elongated and composed of an anterior **cephalon** and **pereon** (thorax, covered by a **carapace**), and a **pleon** (abdomen). At the posterior end, they have a **telson** and **uropods**. Among the Mysidacea specifically, the carapace is attached to the thorax by anterior segments only and the posterior dorsal edge is free (Banner 1948) (Fig. 1). Mysid eyes are stalked, antennules are

biramous, antennae have a long scale (or **squama**), pleopods are often reduced, thoracic legs bear swimming exopodites and uropods are lamellar and form tail fan. Mysids are easily distinguished from other Peracardia by the presence of a statocyst on the uropod endopods (see Plate 220, Moldin 2007; Vicente et al. 2014; Fig. 1, Meland et al. 2015).

**Cephalon:** (see also Figs. 3–4, Hanamura 1997).

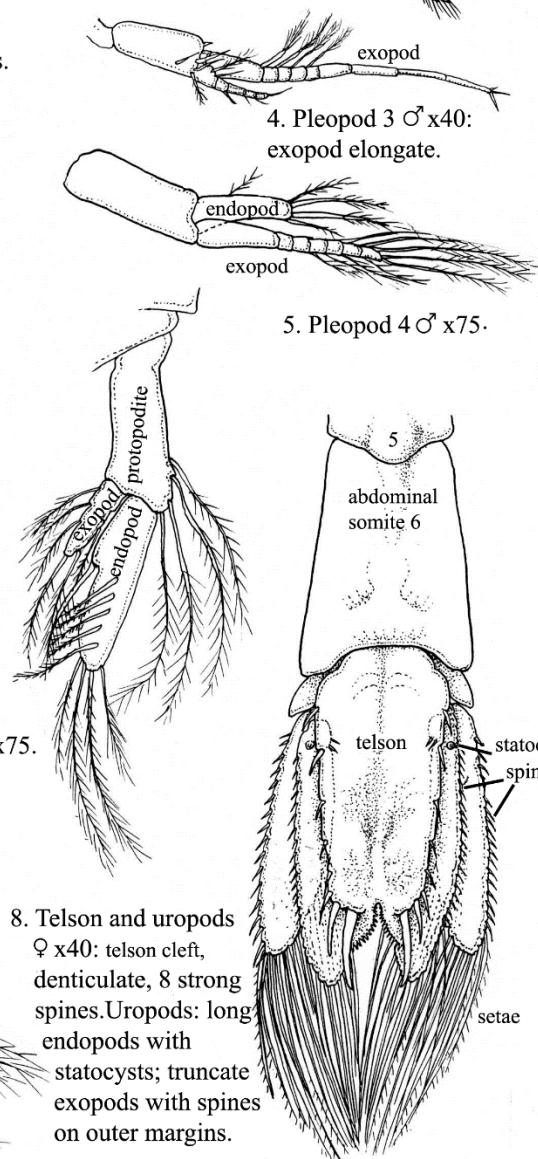
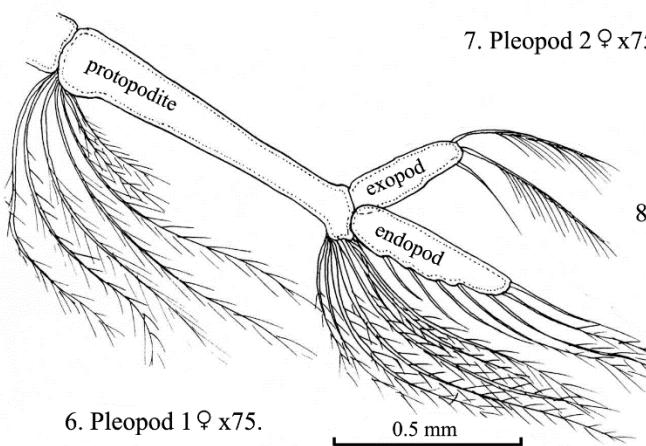
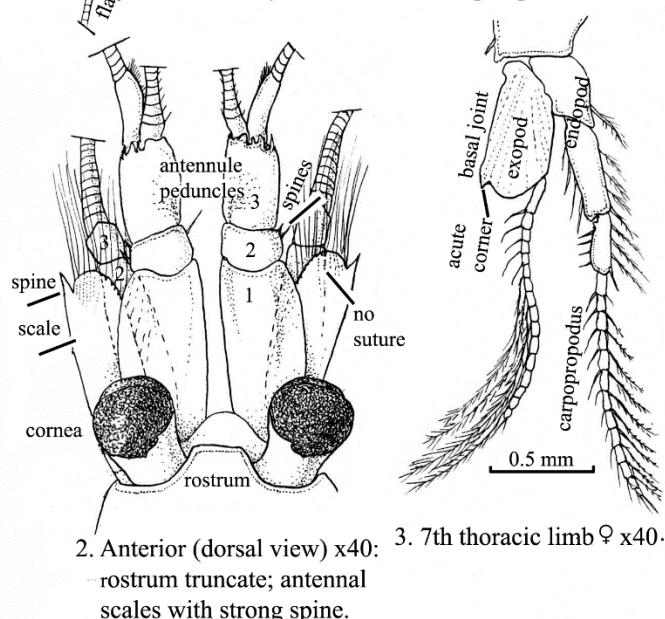
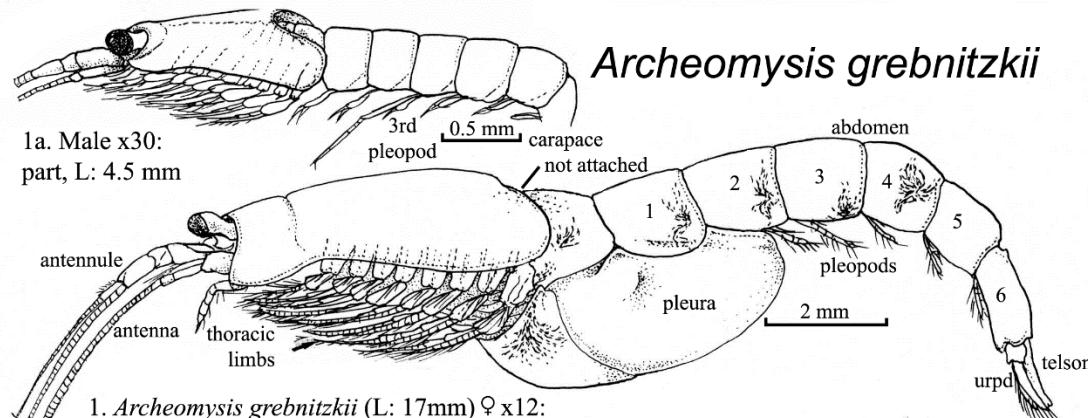
**Carapace:** Attached to first two or three thoracic segments and free dorsally at posterior edge (Banner 1948) (Figs. 1, 1a). Posterior margin with rounded lateral lobes (*Archaeomysis*, Banner 1948) and no fringe or ornamentation. Carapace pronounced anteriorly into a short rostrum (Fig. 2).

**Rostrum:** Rostrum length shorter than eyestalk (Fig. 2) and can be grooved, bent down slightly, or rounded (Holmquist 1975). “Shortly produced”, according to original genus description (*Archaeomysis*, Holmquist 1975).

**Eyes:** Large, movable, stalked, with black corneas and somewhat pear shaped. Eye and eyestalk less than twice as long as broad (Fig. 2). Visual pigment absorbances were measured for *A. grebnitzkii* at 496 nm, which phylogenetically placed this species within a shorter-wavelength spectral sensitivities species clade (Porter et al. 2007).

**Antennae:** Almost as long as body and with slender multi-articulate flagellum (Fig. 1). The peduncle has three joints and is longer than its antennal scale, but shorter than the antennular peduncle (Fig. 2). Antennule peduncle with first joint about equal in length to remaining joints combined. The second joint is with two spines on the outer margin (Tattersall 1951) (Fig. 2).

**Antennae Scale:** (= **squama**) Extends to distal end of second penducular joint and is 3½ times as long as broad. Sclae with straight outer margin, without setae



(*Archaeomysis*, Banner 1948), with strong terminal spine, and weak or absent distal suture. On anterior and inner margins, scale is setose only (no spines) (Kozloff 1974) (Fig. 2).

**Mouthparts:** For general mouthpart morphology for the Mysida see Fig. 3, Meland et al. 2015. Labrum longer than broad (Tattersall and Tattersall 1951) and with strong frontal spiniform process (*Archaeomysis*, Banner 1948).

**Pereon:**

**Pereopods:** Pereopods without well-developed gills (Mysida, Banner 1948). First leg with exopodite, second leg without a lobe-like process on merus. Pereopod 3–8 with carpopropodus (carpus and propodus fused) of endopod that is divided into many subjoints: 9–11 in females (Fig. 3), 7–9 in males (not figured). Exopods in both male and female legs 3–8 has a basal joint with an acute outer distal corner (Fig. 3). No branchiae are present on thoracic legs (Mauchline 1980).

**Pleon:** Fifth pleonite with a small medial projection and sixth with corresponding ridge (Fig. 5). In females, the lateral pleura on the first somites help form the brood pouch (Fig. 1). Inconspicuous pleura are present on somites 3–5, none on six (Banner 1948).

**Pleopods:** Male pleopods variable (Mysida, Mauchline 1980) and all are biramous. The first is with a uniarticulate endopod and multi-articulate exopod (Banner 1948) of 7–9 articles (Holmquist 1975) and the third is with elongate exopod (*Archaeomysis*, Banner 1948) (Fig. 1a, 4). The second pleopod with endopod of 4–7 articles, exopod of 8–9 articles, the third is with elongate copulatory exopod of 8–10 articles, endopod of 5 articles (Holmquist 1975) (Fig. 4), and the fourth is with exopod of 5–9 articles (Holmquist 1975). The illustrated fourth male pleopod has 7 articles (Fig. 5), endopod a simple plate, the fifth pleopod is like the fourth, but shorter, and with 4–8 exopod articles (Holmquist 1975) (see also Fig. 4, Hanamura 1997).

Female pleopods are "usually degenerate" (i.e. reduced) (Mysida, Mauchline 1980) and all are biramous (*Archaeomysis*, Mauchline 1980) with each ramus of one small article (see also Fig. 3,

Hanamura 1997). The first pleopod is with an elongate protopodite, with basal and distal tufts of long setae, the endopod is longer than the exopod, and more than  $\frac{1}{2}$  as long as protopodite (Fig. 6). The second pleopods are with short protopodite and exopod, and a longer endopod (Fig. 7). The third, fourth and fifth female pleopods are like the second, but with shorter endopods.

**Telson:** Telson with distinct apical cleft (Mauchline 1980) and margins of cleft are denticulate (Banner 1948) (Fig. 8). Total length is  $2\frac{1}{2}$  times as long as broad (at base). Eight to nine spines are present on each margin, the last two spines are long, strong, and close together (Fig. 8) (See Fig. 7, Meland et al. 2015; see Fig. 5, Hanamura 1997).

**Uropods:** Uropods biramous, with neither branch articulate (Banner 1948). Both rami with setae on the distal margin (*Archaeomysis*, Banner 1948). The endopod is longer than the exopod, with statocyst near base, and two basal spines (Fig. 8). Six spines are present on the inner edge in males, seven in females (Banner 1948). The exopod is truncate, without suture (Mauchline 1980), with 14 (male) to 17 (female) lateral spines on outer margin (more than 10, *Archaeomysis*). No setae on the outer exopod margin (Banner 1948).

**Statocyst:** Light and balance organ on endopod of uropod (Fig. 8). It is found in all neritic and in common oceanic mysids (Banner 1948) and distinguishes mysids from larval decapods (Green 1968).

**Sexual Dimorphism:** Pleopod morphology varies between males and females. Mature females are also recognizable by the presence of oostegites that form a thoracic brood pouch with two pairs of lamellae (Mauchline 1980). These oostegites arise from the seventh and eighth pereopods (Mauchline 1980) to form marsupium (Fig. 1).

## Possible Misidentifications

Mysidacea and Euphausiacea, being superficially similar in appearance, are often treated together (e.g. Banner 1948; Mauchline 1980). (They were formerly combined as the Schizopoda.) Both are orders of the class Malacostraca, but euphausiids are in the group (i.e.

superorder) Eucarida with the Decapoda (Martin 2007). Like the mysids, euphausiids differ from decapods in having biramous thoracic legs (Kasaoka 1974). Unlike the mysids, euphausiids have a carapace that is fused dorsally with all the thoracic segments. The mysid carapace is attached only to the first two or three thoracic segments. Furthermore, mysid females have oostegites, but euphausiids do not.

Other orders of Peracarida include Isopoda, Tanaidacea, and Amphipoda, which are all fairly easily distinguished from Mysidacea. One order that might be confused is Cumacea, small crustaceans of up to  $\frac{1}{2}$  inch long, with an inflated, shrimp-like carapace (see *Cumella vulgaris*, this guide), a single compound recessed eye (except for some eyeless females of some species), and a flexible, tubular abdomen. Mysids characteristically have large, stalked, movable eyes, and well developed exopodites on their thoracic legs. Mature females have oostegites forming a marsupium. Additionally, northeast Pacific mysids lack thoracic gills, have reduced pleopods in females (and sometimes in males). They also have a statocyst on the inner ramus of the uropod.

Mysicadea is divided into two suborders, the Mysida and Lophogastrida. The former suborder comprises coastal and intertidal species while the latter includes mostly large, pelagic and deep sea mysids. These suborders are easily differentiable by the presence of branchial gills, biramous pleopods and the lack of statocysts in Lophogastrida (branchia are absent, pleopods are reduced and statocysts are conspicuous in the Mysida) (Moldin 2007). *Archaeomysis grebnitzkii* belongs to the Mysida, lacking gills or branchiae on the thoracic legs (Fig. 3) and having rather reduced female pleopods.

Within the Mysicadea locally, there are 15 species comprising the following genera: *Acanthomysis* and *Neomysis* (comprising three species and four species, respectively), and *Hyperacanthomysis*, *Alienacanthomysis*, *Columbiaemysis*, *Deltamysis*, *Exacanthomysis*, *Hippacanthomysis*, *Holmesimysis*, and

*Archaeomysis* (each with a single species represented locally) (Moldin 2007).

*Alienacanthomysis macropsis* is recognizable by elongated eyestalks and *Deltamysis holmquistae* has spines on the lateral telson margins, but only distally, where other species have spines all over the telson margins or in proximal groups. *Alienacanthomysis macropsis*, has a broadly triangular rostrum with long acute lateral carapace spines and its telson has a fringe of small spines. It is abundant in San Francisco Bay and becomes rarer farther north (Holmquist 1979). It has been reported from Yaquina Bay to lower Columbia River and in Puget Sound in bays amongst *Ulva* and in plankton (Kozloff 1974a).

*Archaeomysis japonica* was described in 1996 by Hanamura et al. and was previously considered *A. grebnitzkii*. However, the two species differ in the endopod of the third pleopod, which is segmented in *A. japonica* (males, Hanamura et al. 1996).

*Archaeomysis grebnitzkii* has spines along the lateral margins of uropod exopods, which is not seen in other species. Of the species without lateral exopod spines, *Hippacanthomysis platypoda* has a flattened exopod of fourth pleopod (males). *Holmesimysis costata* and *E. davisi* have distinctly segmented pleonites, the former has a broadly triangular telson while the latter has a telson that is sharply triangular. *Holmesimysis* was extracted from *Acanthomysis* (Holmquist 1979). Its members have fourth male pleopods with only two segments and on the tip are two spiny peg-like structures (Mauchline 1980). *Holmesimysis costata*, the type species for the genus, has a short, bluntly rounded antennal scale.

*Columbiaemysis*, *Acanthomysis*, *Neomysis* and *Hyperacanthomysis* species have pleonites that are smooth and without distinct folds or segments. *Neomysis* species have a pointed distal tip of the antennal scale (see Fig. 3, *Neomysis mercedis*, this guide) and members of the remaining genera have a distal antennal scale tip that is rounded. There are several Pacific species of the genus *Neomysis* (all

with pointed apex on the antennal scale, two pairs of female oostegites, statocyst on the uropod endopod, and male fourth pleopods biramous). For differentiating *Neomysis* species, see *N. mercedis* (this guide). *Columbiaemysis ignota* has been described from female specimens only, and only from British Columbia. Its antennal scale is long, setose all around, and has a suture. Its telson is tongue shaped, with spines becoming dense at the tip, and two long spines at the rounded apex. There are four spines on the lower edge of the statocyst.

### Ecological Information

**Range:** Type locality is Bering and Commander Islands in the Bering Sea (Hanamura 1997). Known range in northern Pacific (Holmquist 1975) from Urup Island and northern Sakhalin to southwest Alaska and the Bering Sea, to Washington, Oregon, and northern California (see Fig. 25, Hanamura 1997).

**Local Distribution:** Locally present in estuaries of Coos Bay, Yaquina Bay, lower-Columbia River and also along the open coast.

**Habitat:** Primarily littoral, buried in sand with a mixture of pebbles and boulders on both open ocean coast and in inland waters. In mud and with the alga *Zostera* as well as with *Phyllospadix* and kelp intermixed (Holmquist 1975). Burrows in bottom substratum, and rises to surface of water at night, especially during the breeding season (Mauchline 1980; Tattersall and Tattersall 1951). Individuals very sensitive to oxygen reduction (Green 1968; Jawed 1973).

**Salinity:** Quite variable, from fresh water to salinities of 34 (Holmquist 1975). However, salinity figures could refer to surface, and the species is an inhabitant of the saltier, bottom water (Holmquist 1975).

**Temperature:** A wide temperature tolerance, ranging from 8.5 °C or lower to 24 °C. (Holmquist 1975).

**Tidal Level:** Predominantly intertidal and also found in shallow waters close to shore (Holmquist 1975). Moves up and down with the rising and falling tide. Occurs at extreme low tide level (Puget Sound, Washington, Banner 1948) and subtidal (Coos Bay,

Oregon) as well as intertidally and at low water on ocean beaches. Juveniles may be more common higher in the intertidal, while larger individuals (i.e. adults) can be found in deeper habitats, offshore (Llewellyn et al. 1981; Takahashi and Kawaguchi 1995).

### Associates:

**Abundance:** The most common mysid of the northeastern Pacific, followed by *Neomysis mercedis* (see this guide) (Holmquist 1975). The most abundant and common species collected in hyperbenthic sledge samples at Bastendorff Beach, Charlston, Oregon with approximately 3200 individuals per square meter (Marin Jarrin and Shanks 2011).

### Life-History Information

**Reproduction:** All development takes place within the female marsupium and is lecithotrophic and proceeds through three distinct stages: 1) the embryonic stage; 2) the first nauplioid stage (eyeless larva); and 3) the post-nauplioid (eyed larva) stage to a juvenile (see Figs. 38.1–38.2, Vicente et al. 2014). Copulation in *A. grebnitzkii* occurs at night and lasts only a few seconds (Mauchline 1980). Sperm is shed into female brood pouch and the female then lays eggs, which are immediately fertilized (Mauchline 1980) and 510 x 480 µm (a 13 mm long female, Hanamura 1997). Early embryos are spherical or sub-spherical. Young develop to a subadult stage in the brood pouch, and emerge from external genital openings of oviducts near the bases of the sixth thoracic legs (Mauchline 1980). The number of eggs depends on size of female and embryos and in temperate and high latitudes on season, but not on temperature (Mauchline 1980). Brood size in the closely related genus *Gastrosaccus*, can vary seasonally, with largest broods produced in early summer and a female *G. vulgaris*, of similar in size to *A. grebnitzkii* (17 mm long), had 100 embryos per brood (Mauchline 1980). Numbers of broods/year is not definitely known for *A. grebnitzkii*, but the most shallow-living neritic and littoral mysid species usually have three broods/year, including the closely related *Gastrosaccus* at a comparable latitude (Japan, Mauchline 1980). Chromosome counts for *A. grebnitzkii* were 2n=10, plus an extra small chromosome (Holmquist 1975).

Sex ratios vary within populations, but females frequently outnumber males (Mauchline 1980).

**Larva:** The first nauplioid stage has appendages that resemble the typical nauplius larva (see *Balanus glandula*, this guide), but lacks an eye or swimming setae. The next post-nauplioid stage has all adult appendages, carapace and eyes. Both stages are non-motile and lecithotrophic. Ultimately, the post-nauplioid molts into a free-living juvenile (Vicente et al. 2014). Larval development time depends on temperature. In *G. vulgaris*, developmental duration is 10.9–25 days (Matsudaira et al. in Mauchline 1980).

**Juvenile:** Juveniles are simply miniature adults at post-emergence molt, when they are usually 1.5–3.0 mm long (Mauchline 1980).

**Longevity:** Mysids will probably live 12–18 months in temperate water and over two years in the Arctic (Tattersall and Tattersall 1951). No longevity rates known for *A. grebnitzkii*. In overwintering generations, most individuals are born in autumn, a few in summer, and fewer in winter. Spring breeding is intensive and females may produce two broods. Spring generations reproduce in the summer (possibly twice), and usually die by autumn (Mauchline 1980).

**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). Mysids generally take about one year to attain full growth and are sexually mature in considerably less time (Tattersall and Tattersall 1951). Females usually grow larger than males (Mauchline 1980) and the number of instars is fewer than for most crustaceans. The first and second occur in the marsupium, and 10 or more occur after the release of young (Mauchline 1980).

**Food:** Feeds either on living or dead material that is picked up by thoracic endopods, or (more commonly) on fine suspended matter filtered by thoracic exopods. Danish *Gastrosaccus* species, also bottom dwellers, eat detritus, algae, copepods and amphipods (Tattersall and Tattersall 1951). To stir up

food for filtering, mysids will balance, head down, on antennal scales and inner flagella of antennulae, and create currents with thoracic exopods. They can also "plow" the bottom with their scales and flagellae (Cannon and Manton 1927 in Mauchline 1980). South African *Gastrosaccus* species feeds most often at night (Mauchline 1980).

**Predators:** Fish are the most common and most important predators (Tattersall and Tattersall 1951; Haertel and Osterberg 1967) as well birds (e.g. eider duck in Aleutians), shrimp, ctenophores, squid, and possibly cetaceans and seals. This species is also eaten by humans or used as fish bait in some parts of the world (e.g. India, Tattersall and Tattersall 1951). *Archaeomysis grebnitzkii* was the dominant prey of the bay shrimp, *Lissocrangon stylirostris* (see description in this guide) at night (Marin Jarrin and Shanks 2008, 2011).

**Behavior:** Locomotion is by exopods of thoracic legs as pleopods are often reduced, and not locomotory. Motion is rotary and unceasing. An "escape mechanism" is also observed in *A. grebnitzkii*, where a sudden downward flex of abdomen and tail fan causes the individual to spring backward and even leap out of water (Tattersall and Tattersall 1951) or through mud (Mauchline 1980). While this has not been shown in *A. grebnitzkii*, females of some mysid species will recapture escaped larvae and return them to their marsupium (Mauchline 1980). Larvae can belong to other individuals or to other species. Males will eat escaped larvae (Mauchline 1980). Mysids avoid bright light (Tattersall and Tattersall 1951), but are attracted to weak light sources and fishing lures (Mauchline 1980). *Archaeomysis grebnitzkii* did not respond to atmospheric pressure changes of 0.1 atm (Mauchline 1980). Other burrowers (e.g. *Gastrosaccus*) have pronounced diel vertical migration where individuals remain within the substrate during the day and are pelagic at night. Burrowing mysids are reotactic and face into water current. They may move offshore to avoid breaking waves and waves can also wash them out of their burrows (Mauchline 1980).

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