Ampithoe valida

A gammarid amphipod

Phylum: Arthropoda, Crustacea

Class: Multicrustacea, Malacostraca, Eumalacostraca

Order: Peracarida, Amphipoda, Senticaudata, Corophiida, Corophiidira
Family: Corophioidea, Ampithoidae

Description

Size: Both illustrated specimens (from Coos Bay), a male and female, were 10 mm in length. Size range up to 12.5 mm (Chapman 2007).

Color: Green with black chromatophores and red eyes.

General Morphology: The body of amphipod crustaceans can be divided into three major regions. The **cephalon** (head) or cephalothorax 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 pairs of pleopods. The first three sets of pleopods are generally used for swimming, while the last three are simpler and surround the telson at the animal posterior. Ampithoid amphipods are in the suborder gammaridea, one of the largest groups of amphipods in marine and estuarine habitats. They have smooth bodies that are only slightly compressed (Conlan and Bousfield 1982). Keys to the Ampithoidae generally refer to male specimens, although sexual dimorphism may be weaker in this group than others (Chapman 2007).

Cephalon:

Rostrum:

Eyes:

Antenna 1: The first and second antennae are of equal length in males (Fig. 1), but the first antenna is slightly longer in females. Both first and second antennae bear a few setae, but no spines (Barnard 1965). No accessory flagellae are present.

Antenna 2:

Mouthparts: Lower lip with a notch between the sublobes and outer lobes (Fig. 5) (Ampithoidae, Barnard 1965) and sublobes are compressed. Mandible is with a large palp and an obvious rasping surface (Fig. 2).

Pereon:

Coxae: Coxa one extended anteriorly, particularly coxal plate one (Fig. 1) (Barnard 1965).

Gnathopod 1: Male gnathopod article five has a distal projection and is slightly longer than article six. Article two is very setose and article six has an oblique angle to the palm (Fig. 3). The gnathopod palm in females is also oblique (not figured).

Gnathopod 2: Male gnathopod articles two and three have large rounded lobes. Article five is with a narrow hind lobe, article six is elongate, rectangular, with a transverse palm and a quadrate middle bump and dactyl (article seven) is curved (Fig. 4). Female gnathopod two is like female gnathopod one (palm oblique), but stouter.

Pereopods 3 through 7:

Pleon:

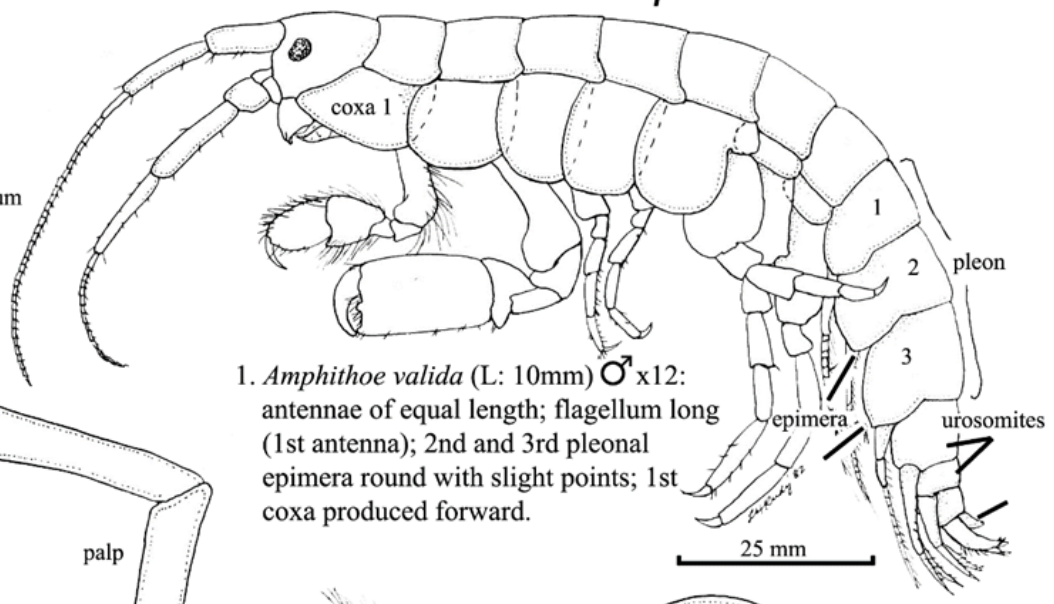
Pleonites:

Urosomites: All three urosomites short and the first two have spines (Fig. 1). Uropod one is with a vestigial peduncular process. Third uropods are with two hooks on the stout outer ramus (Barnard 1965) and the inner ramus is flattened, with bristles (Kozloff 1974) (Fig. 6).

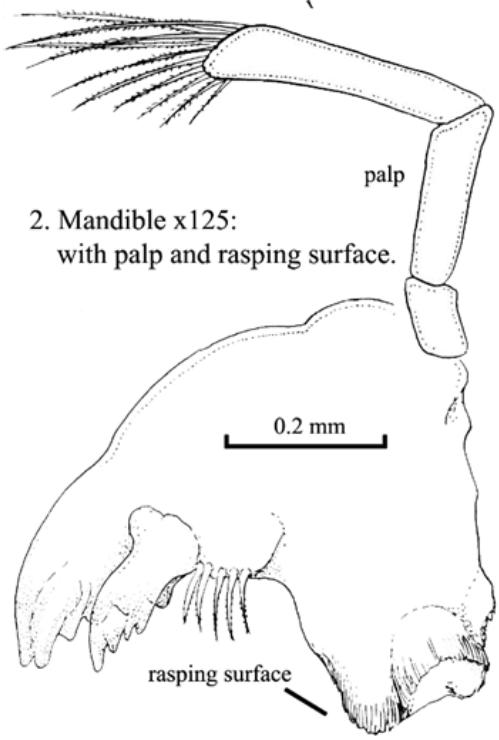
Epimera: The second and third epimera are rounded, with very slight points (Barnard 1965) (Fig. 1).

Telson: Telson is blunt and with small knobs

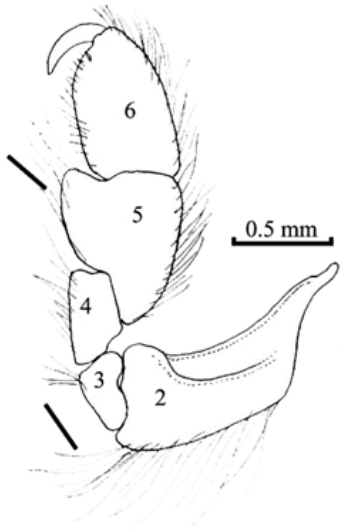
Amphithoe valida



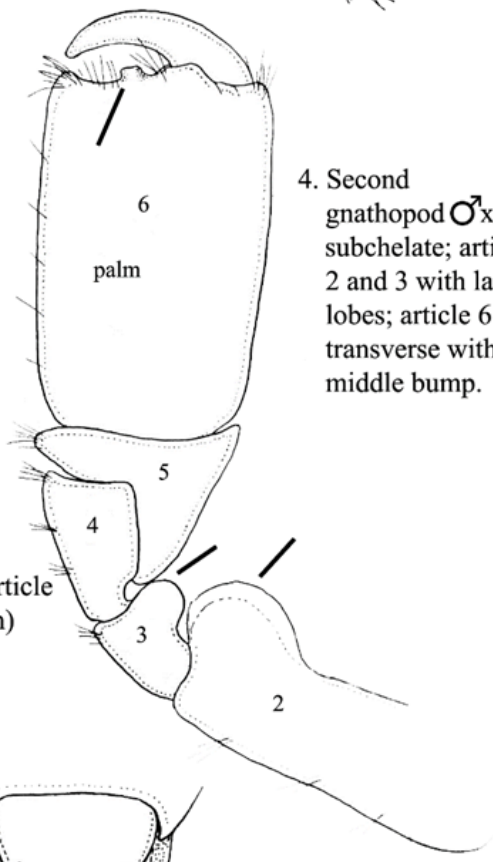
1. *Amphithoe valida* (L: 10mm) ♂x12: antennae of equal length; flagellum long (1st antenna); 2nd and 3rd pleonal epimera round with slight points; 1st coxa produced forward.



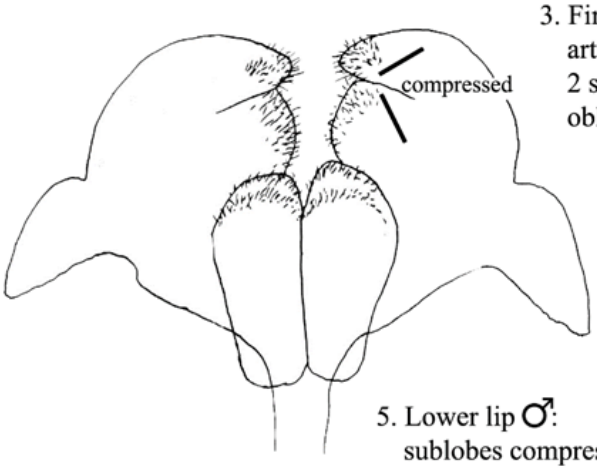
2. Mandible x125: with palp and rasping surface.



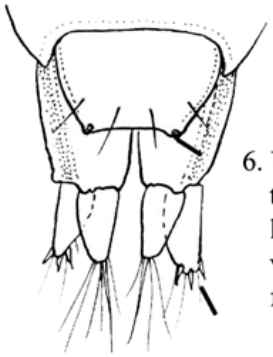
3. First gnathopod ♂x30: article 5 pronounced; article 2 setose; article 6 (palm) oblique.



4. Second gnathopod ♂x30: subchelate; articles 2 and 3 with large lobes; article 6 transverse with middle bump.



5. Lower lip ♂: sublobes compressed (from Barnard 1965, fig. 23).



6. Urosome: telson with small knobs; laminar, thickened only ventrally; third uropods flat, outer rami with hooks.

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at posterior corners (Fig. 6).

Sexual Dimorphism: Among amphipods, males generally have larger eyes, antennae and gnathopods (Straude 1987). Sexual dimorphism in *A. valida* is pronounced in the **antennae** and **gnathopods**, particularly the second gnathopods (Alonso et al. 1995), and species determination must be made from male specimen.

Possible Misidentifications

The Ampithoidae are a family of gammarid amphipods characterized by short third uropods and rami that possess 1 -2 distinctive and stout hooks on the outer ramus (Myers and Lowry 2003). They are usually sexually dimorphic and males are easier to identify than females. They are herbivorous and live in nests they create amongst algal blades or within algae stipes. There are 10–11 local species in the genus *Ampithoe* (*A. corallina* is currently a questionable species, Chapman 2007), which are generally larger than other amphipod genera (Kozloff 1993). See Conlan and Bousfield (1982) for detailed account of *Ampithoe* characters.

Ampithoe simulans is also found in marine intertidal habitats of Coos Bay (Barnard 1965). This species has an oblique and concave article on the second gnathopod, not a transverse one. This article has a large sinus, and a small process on its inner margin (Barnard 1954). This species is primarily found on the open coast and lives within *Phyllospadix* spp. and other types of algae (Chapman 2007). *Ampithoe plumulosa,* as its name suggests, has a very setose second antenna and the first antenna is very long. The lower lips gape and are not compressed as they are in *A. valida.* This likely introduced species and is often found in mussel beds (Chapman 2007). *Ampithoe pollex* does have compressed lower lips and its name comes from its large pointed process or thumb which meets the dactyl (the sixth article of the second gnathopod in males). *Ampithoe aptos* has two enlarged lobes on the apex of the teslon and the fifth article of pereopod five is less than half as long as the sixth. On the other hand, *Ampithoe sectimanus* has a telson with small knobs and the fifth article of pereopod five is more than half as long as the sixth. *Ampithoe dalli* has plumose setae on the anterior edge of the second article of gnathopod one (in males). *Ampithoe longimana* is North Atlantic species, introduced to southern California, and *A. ramondi* is a cosmopolitan species that is currently not reported farther north than Point Conception, California. Neither of these species are found in current local intertidal keys (Chapman 2007).

Ampithoe lacertosa, another common local species found in estuaries, is very similar in appearance to *A. valida.* It differs chiefly in its lower lip, which gapes. The antennae are unequal in *A. lacertosa*, the first being longer than the second. The sixth article of the second gnathopod is transverse and sinous, but lacks the central bump present in *A. valida.* The fifth article of gnathopod one also lacks the distal projection present in *A. valda.*

Ecological Information

Range: Type locality is Long Island Sound in the North Atlantic (Alonso et al. 1995). Known Pacific range includes British Columbia to southern California and also Japan (Carlton 1979) and Korea (Alonso et al. 1995). Range on Atlantic coast extends from New Hampshire to Chesapeake Bay (Carlton 1979). This species is native to the Atlantic coast and was introduced to the western coast (Chapman 2007). The range of this species was recently extended as far south as Quequen and Chubut Argentina (Alonso et al. 1995). Recent genetic analysis of northeast

Pacific *A. valida* populations suggests three distinct lineages that may represent three cryptic species. Furthermore, these lineages suggest three separate introductions to the western coast of the United States (see Figs. 4–5, Pilgrim and Darling 2010).

Local Distribution: Coos Bay sites in South Slough (Barnard 1954), especially in the Metcalf Preserve.

Habitat: Tube dweller amongst eelgrass (Barnard 1975) and green and red algae (Alonso et al. 1995), especially *Enteromorpha* and *Ulva* spp. habitats. (This specimen built a tube in lab petri dish.) *Ampithoe valida* is a biofouling organism, and is often found on floats, pilings and docks (Chapman 2007; Pilgrim and Darling 2010).

Salinity: Collected at salinities as low as 5 and occurs in brackish waters.

Temperature:

Tidal Level: Collected at + 0.15 m MLLW and found subtidally at depths up to 30 m (Chapman 2007).

Associates: Associates in South Slough include the introduced corophiid amphipod, *Grandidierella japonica,* and the sacoglossan, *Aplysiopsis enteromorphae (=smithi).*

Abundance: Locally common and abundant in South Slough. In Argentina, abundance of *A. valida* was highest in the summer months with 727 individuals per 0.125 square meter (Alonso et al. 1995). In Portugal, *A. valida* densities showed a direct and positive correlation with areas of nutrient enrichment, where abundances were up to 2026 individuals per square meter in areas of high eutrophication (Pardal et al. 2000).

Life-History Information

Reproduction: Most amphipods have separate sexes with some sex determination correlated with environmental conditions (Straude 1987). Females brood embryos in an external thoracic brood chamber and irrigate embryos with water flow produced by pleopod movement. Development within this brood chamber is direct and individuals hatch as juveniles that resemble small adults, with no larval stage. The embryos of *A. valida* are oval in shape, white to yellow in color, females produce 2–3 broods each year and the number of embryos per brood may (Alonso et al. 1995) or may not be (Pardal et al. 2000) positively correlated with adult female body size. Although many amphipod species exhibit an extended coupling period (e.g. *Hyale pugettensis*, Straude 1987), where males and females are physically coupled for several days prior to copulation, there is no such period in *A. valida* individuals. Instead, males and females inhabit the same nest, although males may visit the nests of many different females (“cruising males”, Borowsky 1983). Aspects of the developmental biology of *A. valida*, were described by Barrett (1966). Female broods range in number from 3–60 (average 22) eggs which are 460 µm in diameter. At 8–10˚C, individuals hatch at 10 days post fertilization, but remain in the female brood pouch for another 4 days. This timeline increases at warmer temperatures (e.g. 7 and 4 days at 12–15˚C) (Heller 1968; Barrett 1966). Barrett (1966) found that brood size more accurately correlates to pereon length (not total body length). Reproductive characters of the congener, *A. longimana,* include an average brood size of only nine individuals and egg size of 420 µm (Nelson 1980) and *A. lacertosa* have broods with 10–155 (average 64) embryos that are elliptical in shape and approximately 450–560 µm in diameter. At 8 –10˚C, individuals hatch at 22 days post fertilization, but remain in the female brood pouch for another 19 days size (Heller 1968).

Larva: Since most amphipods are direct developing, they lack a definite larval stage. Instead this young developmental stage resembles small adults (e.g. Fig. 39.1, Wolff 2014).

Juvenile: Immature females can be differenti-

ated from mature females by the presence of a brood pouch and associated setae for securing embryos (Alonso et al. 1995). Males reach sexual maturity earlier than females (compare 24–44 days with 28–61 days, Pardal et al. 2000).

Longevity: Range from 191–242 days (Pardal et al. 2000).

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).

Ampithoe valida grows at a rate of 1 mm per week to a maximum size of 18 mm (Nicotri 1980).

Food: The Ampithoidae are notable for their specialized feeding on algae (Myers and Lowry 2003). Grazing by *Ampithoe* amphipods (e.g. *A. longimana*) can have a significant impact on the structure of algal communities (Duffy and Hay 2000) and experimentally adjusting feeding diversity (rather than phylogenetic diversity) leads to a community with a larger number of species (Best et al. 2013). Grazing studies have shown that *A. lacertosa* grazes macroalgae (e.g. *Ulva* spp.) faster than eelgrasses, while the opposite is true for the grazing habits of the congener, *A. valida,* that consumes eelgrasses more readily than it does macroalgae (Best and Stachowicz 2012) where it is often found on the flowering structures of eelgrasses (Reynolds et al. 2012). However, other researchers have shown that *A. valida* prefers soft, filamentous or bladed algae including *Enteromorpha*, *Ulva*, *Ceramium*, *Gracilaria* and *Porphyra* spp (Nicotri 1980; Cruz-Rivera and Hay 2003; Zheng et al. 2013) and populations decline when no such algae is available (Grilo et al. 2009). Chemically defended algae (e.g. *Dictyota menstrualis*) are eaten by *A. longimana*, but are avoided by *A. valida* (Duffy and Hay 1994; Kubanek et al. 2004).

Predators: The *Ampithoe* congener, *A. longimana*, is preyed upon by the pinfish, *Lagodon rhomboides,* and the grass shrimp, *Palaemonetes vulgaris* (Nelson 1979). *Ampithoe longimana* may reduce predation from these omnivores by ingesting and conentrating the toxins of the chemically defended brown alga *Dictyota menstrualis* (Duffy and Hay 1994).

Behavior: A tube-dweller that rarely leaves the tube, *A. valida* can swim rapidly for short periods if needed (Nicotri 1980).

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