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# *Hiatella arctica*

A gammarid amphipod

Phylum: Mollusca

Class: Bivalvia, Heterodonta, Eugeterodonta

Order: Imparidentia, Adapedonta

Family: Hiatelloidea, Hiatellidae

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**Taxonomy:** There are many synonyms for *H. arctica* due to the potentially cosmopolitan distribution of this species. Research by Strauch (1968) and Beu (1969) synonymized all *Hiatella* species worldwide (except *H. australis* from southern Australia) as *H. arctica* (Beu 1969). Commonly seen synonyms include *Saxicava arctica*, *H. pholadis*, and *H. solida*. Due to the extensive synonymizations, it is possible that there are actually two species currently under the name *H. arctica*, locally (Coan and Valentich-Scott 2007).

## Description

**Size:** Individuals to 50–76 mm in length (Kozloff 1993). The illustrated specimen (from Coos Bay) is 38 mm in length (Quayle 1970).

**Color:** Exterior is white, chalky, granular, and with tan, thin, and ragged periostracum (*Hiatella*, Keen and Coan 1974). The interior is porcelain-like and white (*Hiatellidae*, Hunter 1949). Periostracum is light brown or tan.

**General Morphology:** Bivalve mollusks are bilaterally symmetrical with two lateral valves or **shells** that are hinged dorsally and surround a mantle, head, **foot** and viscera (see Plate 393B, Coan and Valentich-Scott 2007). The Veneroida is a large and diverse bivalve heterodont order that is characterized by well-developed hinge teeth. There are 22 local families, and members of the Hiatellidae are characterized by a pallial line that is divided into patches (see Plate 395D, Coan and Valentich-Scott 2007) (Fig. 3).

**Body:** A nestling species with a thin shell (see Fig. 257, Kozloff 1993).

## Color:

**Interior:** Ligament is external (Figs. 2–3) in members of the family *Hiatellidae* (Coan and Carlton 1975). This primary ligament initially forms at the shell posterior in newly metamorphosed juveniles before moving to the middle of the shell (Flyachinskaya and Lezin 2008).

## Exterior:

**Byssus:** These attachment threads are present in nestling specimens, but not in boring ones (e.g., *H. pholadis*). Adult attach with byssal threads and can also bore into rock (Coan and Valentich-Scott 2007). A single, long byssal thread produced by post-larval clams allows them to be moved by weak water currents (see **Juvenile**) (Haderlie 1980), in a process called thread drifting (see *Macoma balthica*, *Nutricola tantilla*, descriptions in this guide).

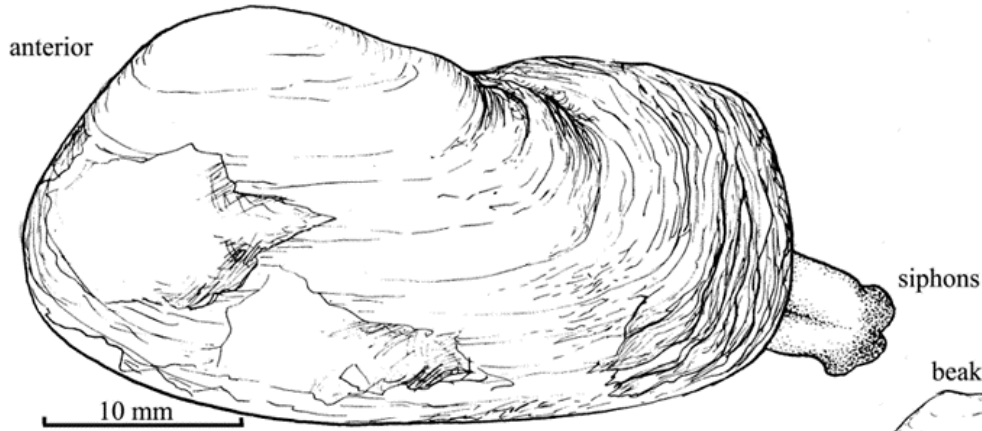
## Gills:

**Shell:** (For amino acid shell composition see Brigham 1983.) Right valve slightly larger than the left (Khalaman 2005) (Fig. 2).

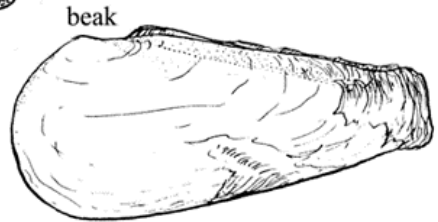
**Interior:** Pallial line is faint and broken into discontinuous scars (Fig. 3) (*Hiatellidae*, Coan and Valentich-Scott 2007), unlike *Entodesma navicula* (see description in this guide). Adductor muscle scars are approximately equal in size, but not shape. There is no pallial sinus (Kozloff 1974).

**Exterior:** The shape is highly variable due to their nestling habit. Right and left valves are equal, oblong, and gaping. The posterior is broader and more square than the anterior end, which is broadly truncated (Fig. 1). Elongate, boring specimens have been reported as *H. pholadis* (Coan and Carlton

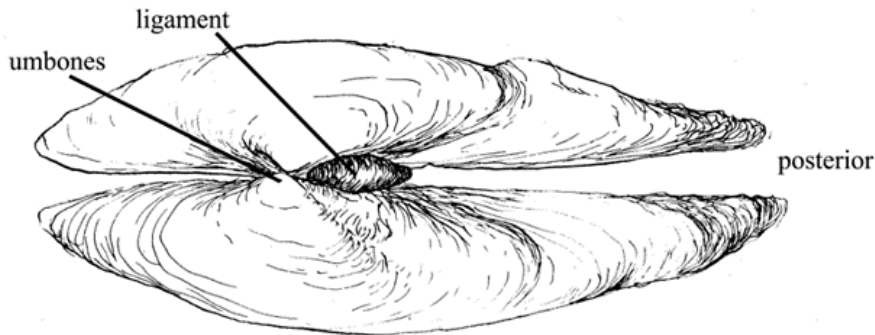
# *Hiatella arctica*



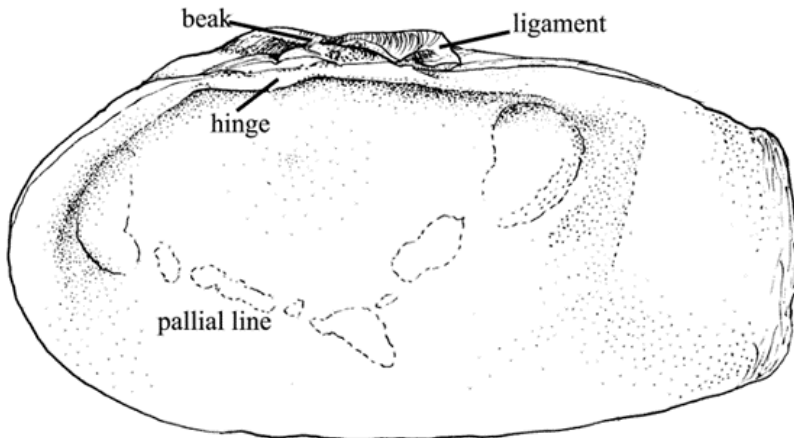
1. *Hiatella arctica*, exterior, left valve (L:38mm) x3:  
shell oblong, distorted; posterior truncate, beaks nearer  
anterior end than middle; concentric striations on rough,  
white surface, thin tan periostracum.



- 1a. *H. pholadis*, left valve x2:  
elongate; beaks near anterior end.



2. (Dorsal view): umbones depressed, not touching; ligament  
external, posterior gaping.



3. Interior, right valve: white, porcelain-like; hinge without  
teeth; ligament external; pallial line broken into scars.

1975) (Fig. 1a). Shell sculpture is concentric only and the periostracum is light tan and thin (Figs. 1, 2) (*Hiatella*, Keen and Coan 1974).

**Hinge:** Adult specimens are without (or very worn) hinge teeth (Fig. 3). However, young clams have 1–2 weak, peg-like cardinal teeth. Umbones are depressed, nearer anterior end than middle and do not touch one other (Fig. 2).

**Eyes:**

**Foot:**

**Siphons:** Siphons are fused and with crimson siphon tips (Fig. 1) (Kozloff 1993).

**Burrow:**

### Possible Misidentifications

Three bivalve families including the Lyonisiidae, Hiatellidae, and Thraciidae are characterized by their lack of dorsal margin ears or projecting teeth or chondrophores, and two adductor muscles. In thraciids, the ligament can be both internal and external and the pallial line is continuous; in hiatellids the ligament is always external and the pallial line is broken into patches (see below). On the other hand, in the lyonisiids (e.g., see *Entodesma navicula* in this guide) the pallial line is continuous, as in thraciids, but the ligament is always internal, unlike thraciid species (Coan and Valentich-Scott 2007).

Burrowing and nestling clams, of which there are many genera, can be difficult to separate by shell shape as their nestling habits tend to produce a varied shell shape. Useful characteristics for differentiating species include the hinge teeth, pallial line, and siphons. Most Pholadidae can be distinguished by their two distinct shell sections (see *Penitella penita*, *Zirfaea pilsbryi* in this guide). All pholads have file-like denticulations and (except for *Netastoma*) an internal myophore.

There are only two local species reported in the family Hiatellidae: *Panopea*

*abrupta* and *Hiatella arctica*. *Panopea abrupta* tends to be larger (up to 200 mm in length) than *H. arctica* and have a continuous pallial line, not broken into patches like in *H. arctica*. *Panopea abrupta*, also known as the geoduck, is a very deep burrower with long siphons (up to several feet) in soft sediments. It has one cardinal tooth in either hinge and is rarely found in Oregon. Also, *Saxicavella pacifica*, a small offshore species in soft sediments is reported (Coan and Valentich-Scott 2007).

*Entodesma navicula* is probably most likely to be confused with *H. arctica*, as it is of a comparable size, shape, and habitat. *Entodesma navicula* has a dark, rough periostracum, not a pale, thin one, an external ligament (like *H. arctica*), and short, fused siphons, but without red tips. Inside the shell is very pink and pearly. *Entodesma navicula* has no hinge teeth, but does have a large internal ligament and its pallial line is continuous.

Other bivalves that can be easily confused with *H. arctica* include *Protothaca staminea*, *Petricola carditoides*, *Platyodon cancellatus*, and *Cryptomya californica*. The venerid clam *Protothaca staminea*, like *H. arctica*, is white with an external ligament, and can be found nestling in old pholad burrows. It has radial as well as concentric striations, however, and interiorly has three cardinal hinge teeth and a strong pallial line and sinus. *Petricola carditoides* is a nestling clam which has an external ligament and a chalky white shell, as in *H. arctica*. It has 2–3 hinge teeth in the adult, not just in the juveniles. *Petricola carditoides* also has purple-tipped siphons, not crimson, and its shell has some radial sculpture. The myid clam *Platyodon cancellatus* is a white borer with a heavy shell with fine, almost lamellar concentric exterior sculpture. Inside it has a chondrophore and tooth in its hinges, and a well-developed, deep pallial sinus. *Cryptomya californica*, also a myid

clam, can nestle among rocks, although its usual habitat is sand or mud. It is small (to 30 mm), thin-shelled and has a chondrophore. Interiorly it has an entire pallial line, and an inconspicuous pallial sinus (Coan and Carlton 1975).

### Ecological Information

**Range:** Type region is the Arctic coast of Norway (Keen 1971) A circumpolar species with known range from Arctic Ocean to Panama (Oldroyd 1924). Range is certainly influenced by many human introductions (Beu 1971; Narchi 1973; Russell-Hunter 1949; Yonge 197), and potentially includes two species as a result (Coan and Valentich-Scott 2007) (see **Taxonomy**). In Cow Head, Newfoundland, radiocarbon age of *H. arctica* fossils embedded in rock were approximately 8,250 years BP (Brookes and Stevens 1984). The genus *Hiatella* is widespread in polar latitudes dating to 150 million years ago (Laakkonen et al. 2015). A recent molecular analysis of over 350 specimens using three gene regions suggests cryptic speciation rather than widespread distribution, including at least 13 different putative species, several of them living sympatrically (Laakkonen et al. 2015). These authors found several distinct lineages within the northeast Pacific (see Laakkonen et al. 2015).

**Local Distribution:** Local distribution in Coos Bay including Pigeon Point.

**Habitat:** Individuals nestle in old pholad burrows or bore into smooth, soft, homogenous rocks. They are also found in mussel (e.g., *Mytilus*) clumps, on pilings, and on open coasts within algal holdfasts. On hard surfaces and within crevices, individuals attach byssally (Hunter 1949). Prefers sheltered locations or being covered by other organisms (Khalaman 2005).

**Salinity:** Occurs in Coos Bay as well as more saline parts of estuary, and individuals

have been collected at salinities of 30. Heart rates 10 to 16 beats per minute at normal salinities but drops dramatically in response to a change in salinity, returning to normal after 2–7 days (Bakhmet et al. 2012).

**Temperature:** Temperature may affect shell growth and structure (see **Larva**) leading Lezin et al. (2015) to question the relevance of shell structure as taxonomic characters and for estimation of sea surface temperature (but see Strauch 1968, 1971). Shell shape is also certainly affected by the nestling habits of individuals (see Rowland and Hopkins 1971).

**Tidal Level:** Intertidal to 120 m deep, but also low or subtidal when attached (with byssus) under rocks, on floats or pilings (Morgan and Allen 1976; Morton 1987; Yonge 1952, 1976; Coan and Valentich-Scott 2007). The highest abundance of individuals (57 per square meter) was observed at 20-meter depths in the Young Sound, northeast Greenland (Sejr et al. 2002).

**Associates:** Associates include other nestling and boring molluscs (e.g., *Entodesma navicula*, *Penitella penita*, *Zirfaea pilsbryi*). A potential competitor affecting settlement of *Pecten maximus*, the great scallop in the Bay of Brest in France (Chauvard et al. 1996). *Hiatella arctica* is a facultative epibionts of the crab *Hemigrapsus sanguineus* in Japan (Isaeva et al. 2001). Competes with and often associated with *Mytilus edulis* fouling communities (Khalaman 2005). Also co-occurs with the solitary ascidian *Styela rustica*, in the White Sea (Khalaman 2007).

**Abundance:** Not common locally, however, *H. arctica* is the dominant byssal bivalve in the arctic and boreal regions (Coan and Valentich-Scott 2007). Along with *Mytilus edulis*, *H. arctica* was the most abundant bivalves in Eyjafjordur, North Iceland, with newly metamorphosed spat observed on settlement plates throughout the year (Garcia et al. 2008). Density reached approximately 815 individuals per meter in the White Sea

(Khalaman 2005).

## Life-History Information

**Reproduction:** Spawning occurs from mid June through September and veliger larvae are present through November (White Sea, Russia, Flyachinskaya and Lesin 2006).

The early development is apparently very similar to *Mytilus edulis* (see description in this guide), which was described by Malakhov and Medvedeva (1985).

**Larva:** Bivalve development generally proceeds from external fertilization via broadcast spawning through a ciliated trochophore stage to a veliger larva. Bivalve veligers are characterized by a ciliated velum that is used for swimming, feeding and respiration. The veliger larva is also found in many gastropod larvae, but the larvae in the two groups can be recognized by shell morphology (i.e. snail-like versus clam-like). In bivalves, the initial shelled-larva is called a D-stage or straight-hinge veliger due to the “D” shaped shell. This initial shell is called a prodissoconch I and is followed by a prodissoconch II, or shell that is subsequently added to the initial shell zone (see Fig. 1, Caddy 1969). Finally, shell secreted following metamorphosis is simply referred to as the dissoconch (see Fig. 2, Brink 2001). Once the larva develops a foot, usually just before metamorphosis and loss of the velum, it is called a pediveliger (see Fig. 1, Caddy 1969; Kabat and O’Foighil 1987; Brink 2001). (For generalized life cycle see Fig. 1, Brink 2001). Larval development was described by Flyachinskaya and Lesin (2006) where straight hinge larvae were 120 µm, umbo were 160 µm, early pediveligers were 220 µm, pediveligers were 310 µm and grew to 400 µm pre-metamorphosis and were 750 µm post-metamorphosis (see Fig. 3, Flyachinskaya and Lesin 2006). The shell is yellowish pink when early in development and changes to a darker (dirtier) yellow with pink

margins. Veliger larvae of *H. arctica* have a distinctly triangular shell and there are two distinct posterior dorsal spines on the dissoconch in newly metamorphosed *H. arctica* (see Fig. 3F, Flyachinskaya and Lezin 2006). These spines are lost in adulthood Flyachinskaya and Lezin 2008). Settlement was observed throughout the year in Eyjafjordur, Iceland with peaks in abundance of primary (<1mm) settlers in September. Lezin et al. (2015) found that larvae and juveniles raised at 12°C formed ridges and spines on the shell posterior. However, they developed fewer or inconspicuous spines at lower temperatures (e.g., 5°C) (Lezin et al. 2015). Wild-caught planktonic larvae measured up to 380 µm in the North Sea and had a tough shell, a conspicuous pallial line, and concentric ridges that become more pronounced and widely spaced with distance from the umbo (Rees 1950).

**Juvenile:** Like other bivalve species (e.g. *Mytilus edulis*, *Macoma balthica*), post-larval (i.e., juvenile) *H. arctica* may exploit two dispersal periods. The initial larval dispersal and settlement into the benthos, is followed by potential dispersal from the benthos by thread drifting on water currents via mucous threads by juveniles (i.e., “thread drifting”, Martel and Chia 1991).

**Longevity:** Age was estimated for individuals in the Young Sound, northeast Greenland by counting growth rings (a method validated by Sejr et al. 200b); the oldest individuals were estimated to be 126 years old (Sejr et al. 2002a).

**Growth Rate:** Mean growth rate was estimated to be 0.14 mm per year in northeast Greenland (Sejr et al. 2002a).

**Food:** A suspension feeder. Filtration rates were 1.4 x 10<sup>-2</sup> liters per hour per gram wet weight (*Phaeodactylum tricorutum*, 15°C) and increases up to temperatures of 17°C before decreasing above 25°C (Ali 1970), at high temperatures *H. arctica* close their valves

completely (Petersen et al. 2003). Clearance rates for individuals at varying temperatures were recorded by Petersen et al. (2003) for individuals collected in the Arctic (Young Sound, northeast Greenland) and temperate waters (Tjarno, Sweden) (see Table 1, Petersen et al. 2003) and averages being approximately 23.4 and 27.4 ml per minute per gram body weight those from the Arctic and Sweden, respectively (Petersen et al. 2003). Clearance rates and assimilation efficiency (how much food is metabolized) of *Rhodomonas baltica* decreases with increasing food concentration (Sejr et al. 2004). Sejr et al. (2004) found that individuals grow to annual observed growth in the wild in three weeks at optimal feeding conditions in the laboratory and suggest that food is limiting in wild populations.

**Predators:** Toothed snails (e.g., *Nucella* spp.) can prey on small nestling clams like *H. arctica*.

**Behavior:** Individuals bore mechanically and without the aid of chemical compounds (Hunter 1949).

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