Macoma nasuta

The bent nosed clam

Taxonomy: Originally described in the genus *Tellina* by Conrad in 1837, additional synonyms include *Tellina tersa*, *Macoma kelseyi*, *M. jacalitosana*. Also subspecific designations (e.g. *Macoma Heteromacoma nasuta,* Kabat and O'Foighil 1987) are sometimes seen. However, *M. nasuta* is the name almost exclusively used in current intertidal guides (e.g. Coan and Valentich-Scott 2007).

Description

Size: Individuals range from 3 to 70 mm (Macginitie and Macginitie 1949; Kozloff 1993) and are seldom larger than 64 mm (Packard 1918). In Coos Bay, the largest individuals are approximately 58 mm, which would classify them as having a medium sized shell (see Keen and Coan 1974).

Color: Shell is white and chalky where eroded (see Fig. 293, Kozloff 1993) and has dark brown parchment periostracum, especially near lower edge and siphons on valves. Shell is often with black markings externally (Brusca and Brusca 1978) but there is no interior shell color (Keen and Coan 1974). Siphons can be orange (Kozloff 1993).

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). Among the bivalves, the Heterodonta are characterized by **ctenidia** (or gills) that are eulamellibranchiate, fused mantle margins and the presence of long **siphons**. Veneroid bivalves have well-developed hinge teeth and members of the family Tellinidae have short lateral hinge teeth (when present – see **Possible Misidentifications**), shells with external striations or ribs, and deep pallial sinuses (Coan and Valentich-Scott 2007). When holding closed shell in both hands with the hinged area up and the ligaments toward you, the right valve is in the right hand (Fig. 4) (Keen and Coan 1974).

Body:

Color:

Interior: Ligament is entirely external and the is not supported by a nymph or projection dorsally (Fig. 5).
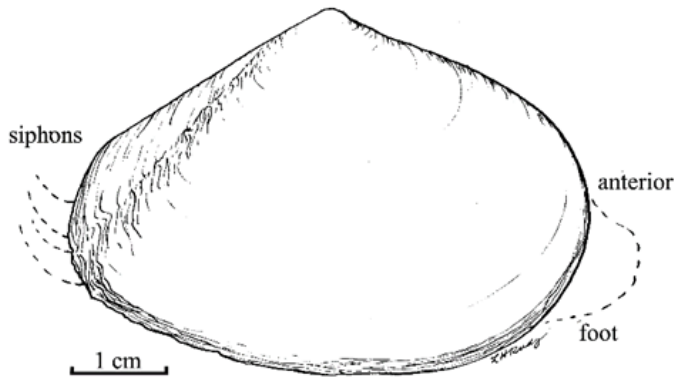
Exterior:

Byssus:

Gills:

Shell: Shells ovate (Fig. 1) and posterior portions of valves are distinctly bent to the right ("bent nose", Kozloff 1993) (Fig. 4). The anterior end is rounded, and the posterior is wedge-shaped, or truncate (i.e. not flanged).

Interior: The pallial sinus of the right valves does not reach the anterior adductor scar (Fig. 3) (see Plate 422, Coan and Valentich-Scott 2007). The adductor and posterior muscle scars are similar in shape in both valves and overlaps, but sinus patterns differ. The pallial sinus of the left valve reaches the anterior adductor muscle scar, fuses and overlaps with it (Fig. 2) (Coan and Valentich-Scott 2007).

Exterior: Valve exterior is thin and smooth, but not polished. The shells are sometimes blackish and are thin, with fine radial lines.

Hinge: Hinge with ligament is entirely external and no lateral teeth (Fig. 5) (*Macoma,* Coan and Valentich-Scott 2007). Two cardinal hinge teeth are present on the
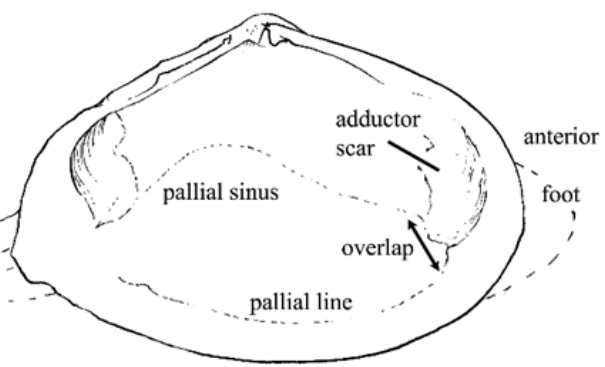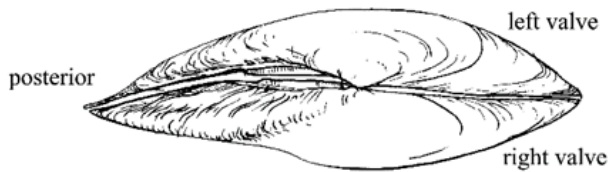
Macoma nasuta

1. *Macoma nasuta*, external, right valve x1.63:
thin, white shell; bent right posteriorly; fine, radial
lines; anterior rounded; posterior truncate.
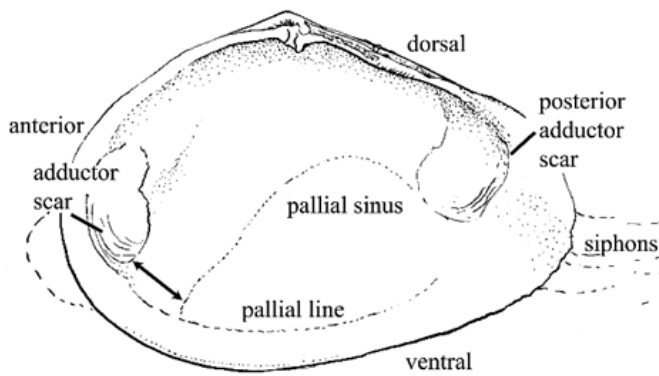
2. Interior, right valve:
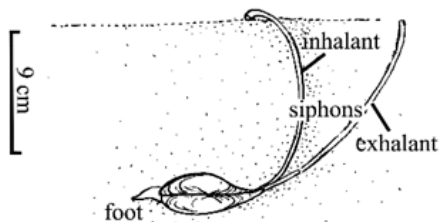pallial sinus doesn't reach anterior adductor scar;
muscle scars similar.

3. Interior, left valve:
pallial sinus overlaps anterior adductor scar.

4. Exterior (dorsal view):
posterior valves bent right.
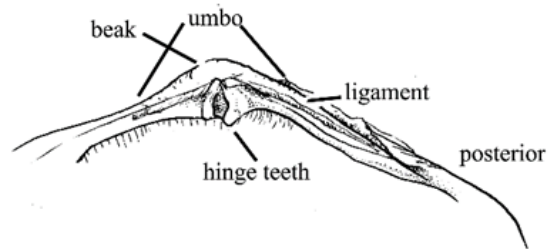
5. Dorsal region, right valve:
two cardinal hinge teeth; hinge
external; no lateral teeth; ligament
dorsal, external, not on nymph; back
central, slightly prominent.

6. Clam burrowing x0.33
(MacGinitie, 1949).

right valve (Fig. 5) and one on the left valve (Fig. 2). The beak is central and slightly prominent (Fig. 5) (Packard 1918).

Eyes:

Foot:

Siphons: The inhalant and exhalant siphons are completely separate and distinctly orange in color (Fig. 6) (Kozloff 1993).

Burrow: Clams burrow 10–20 cm within fine sediment, but these burrows are not permanent (Alexander et al. 1993; Volkenborn et al. 2012). For burrow schematic, see Fig. 8.10B, Zonneveld et al. 2014.

Possible Misidentifications

Tellinids can be distinguished from other small or young bay clams (i.e. Mactridae: *Tresus*; Veneridae: *Protothaca*, *Saxidomus*; Myidae: *Mya, Cryptomya*) an external ligament, an ovate shell, an inconspicuous nymph (or supporting projection for the external ligament), sometimes reddish hue and lateral teeth as well as a shell with ribs or striations (no radial pattern) and shells that never gape. Lateral teeth may or may not be present in the Tellinidae (Coan 1971). Myids have a hinge with a spoon-shaped chondrophore (left valve) and a projecting tooth (right valve) (see *Mya arenaria*, this guide). Venerids have three cardinal teeth in each valve. Mactrids have an internal ligament, A-shaped cardinal teeth, and gaping valves (Coan and Valentich-Scott 2007). The Tellinidae has around 16 species distributed between two genera locally – *Tellina* and *Macoma*. These genera can be differentiated by the hinge teeth, *Tellina* species have a hinge with lateral teeth, while *Macoma* species do not. *Macoma* species have shells that are also more rounded and inflated than *Tellina*, and are smooth, white, often chalky. They are characterized by having a ovate shell consisting of two equal valves, a dark and deciduous periostracum, two cardinal teeth, the absence of lateral

teeth and a pallial sinus that is deeper on the left valve (Scott and Blake 1998; Arruda and Domaneschi 2005). *Macoma* species may also have a more northern geographic distribution while *Tellina* are elongate, relatively compressed, conspicuously sculptured, brightly colored, and usually warm water dwellers (Coan 1971). Eleven species in the infaunal genus *Macoma* (Luttikhuizen et al. 2012) are reported locally (although 30 have been identified in the northeastern Pacific, Dunnill and Ellis 1969), but only seven are described in local keys (e.g. Coan and Valentich-Scott 2007), the four most common species of *Macoma* in our area are *M. balthica*, *M. nasuta, M. inquinata,* and *M. secta* (Kabat and O'Foighil 1987).

Two species, *M. secta* and *M. indentata* have a posterior dorsal flange extending from posterior end to the external ligament, this is absent in other *Macoma* species. The former species is called the the sand clam and has a quadrate and truncate posterior. The latter is elongate, has a pointed posterior, unique muscle scars, is relatively rare and small (to 2.5 cm) and occurs from Trinidad, California southward. *Macoma secta*, also has a white shell, with a yellowish epidermis. Its right valve is more inflated than the left, and it can be large (to 120 mm) and is more common in clean sand, not in estuarine mud.

The morphology of the pallial sinus differentiates the other species. In species without a posterior dorsal flange, *M. acolasta* and *M. yoldiformis*, the anterior ventral edge of the pallial sinus is detached for a portion of the distance to the posterior adductor muscle scar. *Macoma acolasta* also has a rounded posterior, rather than pointed as in *M. yoldiformis* and is rare, sand-dwelling, and occurs from Bodega Bay, California, southward. *Macoma yoldiformis* is elongate, inflated, and thin, with the pallial sinus detached from the pallial line. Although the range of this clam is from Vancouver south to Baja California, it is

not included in Puget Sound or British Columbia work (Dunnill and Ellis 1969). It can be found in silt in low intertidal of protected bays (Coan and Valentich-Scott 2007).

Macoma inquinata, M. nasuta and M. balthica (see descriptions in this guide) are all species with an anterior ventral edge of pallial sinus that is not detached and they tend to be larger (up to 110 mm) than M. acolasta or M. yoldiformis (less than 30 mm). Macoma balthica has a pinkish hue and a pallial sinus that ends ¾ of the way to anterior adductor muscle scar and is generally more oval than M. nasuta or M. inquinata (Kozloff 1993). Macoma inquinata is a common mud clam, with slightly inflated but not dramatically bent valves. In M. inquinata, the pallial sinus does not reach the ventral end of the anterior adductor muscle and the shell is chalky white with a fibrous olive green periostracum. Macoma nasuta, on the other hand, is not as round and heavy as M. inquinata and its pallial sinus reaches and joins the anterior adductor scar above its base (left valve). (Its right valve may be more like M. inquinata's). Furthermore, its siphons are orange and its shell posterior is bent to the right (Fig. 4). Macoma inquinata can also bend slightly posteriorly, and may be confused with the thinner M. nasuta, without investigations of the other aforementioned features. In M. balthica, the pallial sinus that reaches to 1/4 the anterior adductor muscle scar and the shell has a pinkish hue. (see Plate 422 for diagrams of these distinguishing characteristics in Macoma). Macoma balthica and M. inquinata are generally smaller than M. nasuta (up to 5 cm) and the shell of M. nasuta is white in-side and out, with some dark periostracum.

(The following species may be present locally, but are not included in local dichotomous keys). Macoma expansa, is a rare, usually offshore species (to 50 mm) whose pallial sinuses are perpendicular to the pallial line. Macoma elimata is found only in 15–476 meters of water. Macoma incongrua is a generally northern species which can be found to 33°N latitude, intertidally to 36 meters. It has somewhat inflated valves, is usually 30–40 mm long, and almost round in outline (Dunnill and Ellis 1969). Macoma calcarea is found from 35 meters and lower, from 37° north. Other northern subtidal species include the large M. brota and M. lipara (Dunnill and Ellis 1969).

Ecological Information

Range: Type locality is Astoria, OR. Known range from Kodiak, Alaska to Baja California (Ricketts and Calvin 1971). Kodiak Island, Alaska to Cabo San Lucas, Baja California (Coan 1971; Rae 1978).

Local Distribution: Occurs locally, in bays as well as offshore below the surf zone (Coan and Valentich-Scott 2007).

Habitat: Preferred substrates include mud and muddy sand (Kabat and O'Foighil 1987), about 10–15 cm below the surface (Kozloff 1993). Macoma nasuta is very adaptable and can live in finer mud than other Macoma species, often in the extremely stale waters of small lagoons (Ricketts and Calvin 1971). Individuals also found in eelgrass beds (Kozloff 1974). A common deposit feeder is often used in sediment toxicity testing and biomarker responses (e.g., Boese et al. 1995; Werner et al. 2004; Cho et al. 2007; Amirbahman et al. 2013). Can burrow within muddy and silty sediment (i.e., a wide range of grain sizes, Alexander et al. 1993) up to 40 cm (Rae 1978). Macoma nasuta was the oldest intertidal species present at Queen Charlotte Islands in the fossil record (~13,210 C^{14} years) and was possibly the first species to colonize this area following the last glacial maximum. This early colonization was likely

due to the tolerance of *M. nasuta* for low water temperature, high turbidity, low primary productivity and low salinity. Following initial colonization, congeneric species, *M. calcarea* and *M. inquinata*, began to appear in the fossil record (Hetherington and Reid 2003).

Salinity: Adapted to a wide range of conditions and salinities.

Temperature: Temperate and cold waters. *Macoma nasuta* is not found in the Panamic province to the south.

Tidal Level: Intertidal and subtidal (Kabat and O'Foighil 1987). Most common in bays at mid-tide line (Coan and Valentich-Scott 2007). Also reported from low tide horizon to 137 meters, with decreasing numbers with depth (Rae 1978).

Associates: Occasionally infested with encysted larvae of the tapeworm *Anthobothrium* sp. (MacGinitie and MacGinitie 1949). Juvenile pea crabs, *Pinnixia littoralis,* can occur within the mantle cavity of *M. inquinata* and *M. nasuta* in Puget Sound, Washington (Haderlie and Abbott 1980). Also host to the commensal nemertean *Malacobdella macomae* (Haderlie and Abbott 1980; Kozloff 1991; Roe et al. 2007). Individuals also host the turbellarian, *Graffilla pugetensis* in the pericardial cavity (Schell 1989). While other bivalve species exhibited declined numbers associated with the exotic mussel, *Musculista senhousia*, *M. nasuta* populations were not negatively affected and, instead, increased in number (Mission Bay, San Diego, California, Crooks 2001). *Macoma nasuta* co-occurs with the congener, *M. inquinata*.

Abundance: On "every possible mud flat" (Ricketts and Calvin 1971) where it is often the most common clam (e.g., in Elkhorn Slough). Individuals are more abundant in habitats with more mud than sand (San Francisco Bay, California, Alexander et al. 1993). The most abundant bivalve collected in box cores (25 x 25 x 50 cm) from a coastal lagoon in Bodega Harbor, California (Everett 1994).

Life-History Information

Reproduction: Separate sexes, gametes are discharged into the water through excurrent siphon. Oregon spawning reportedly spring, early summer (Haderlie and Abbott 1980). Nuclear protein composition of sperm is described by Ausio (1988). Gametogenesis for *M. nasuta* and *M. secta* is described by Rae (1978) and reproduction and development has been described for the common congener, *M. balthica* (Caddy 1967, 1969; Lammens 1967). Unspawned oocytes of *M. nasuta* were 48–57 μm in diameter. Individuals were observed to spawn most months of the year, with peak spawning from August to November (14°C, Rae 1978). Spawning occurs in a a brief period of two days and sex ratios were 1:1, with no hermaphrodites seen in the populations (Tamales Bay, California, Rae 1978).

Larva: Bivalve development generally proceeds from external fertilization via broadcast spawning through a ciliate 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 (e.g. see *M. balthica*, 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 (Kabat and O'Foighil 1987; Brink 2001). (For generalized life cycle see Fig. 1, Brink 2001). *Macoma nasuta* and *M. secta* are known to have free swimming veliger larvae (MacGinitie and MacGinitie 1949; Marriage 1954; Rae 1978, 1979; Brink 2001).

Juvenile:

Longevity:

Growth Rate:

Food: Primarily a suspension feeder that also ingests detritus from mud surface with siphon, while discarding coarse, inedible material (MacGinitie and MacGinitie 1949; Kabat and O'Foighil 1987). In a comparison of individual growth on a diet of surface sediment versus detritus, the former supported better growth (Hylleberg and Gallucci 1975). When deposit feeding, *M. nasuta* sucks the top 1 mm of sediment by boring or rotating with the siphon tip (Fig. 6) and exhibits some selectivity in feeding (Hylleberg and Gallucci 1975; Gallucci and Hylleberg 1976). Interstitial water amounted to only 4% of the total water ventilated (~0.2 ml per hour). Instead, the overlying water is primarily ventilated (~7.3 ml per hour, Winsor 1990). The average ventilation rate for *M. nasuta* was found to be lower than that of other filtering bivalves, suggesting that deposit feeding may be their dominant feeding mode (Specht and Lee 1989). *Macoma nasuta* was found to be actively deposit feeding 83% of the time (Volkenborng et al. 2012). (For irrigation patterns see Table 1, Volkenborn et al. 2012). The deposit feeding behavior of both *M. nasuta* and *M. inquinata* showed variation in response to water flow. Their inhalant siphons extended farther, allowing for deposit feeding over a larger area, when water flow was lower (Levinton 1991).

Predators: Small clams are fed upon by crabs (e.g., *Cancer productus*), seastars (e.g., *Pisaster* spp.), as well as the snail *Polinices lewisii* (Haderlie and Abbott 1980; Kozloff 1993) and shore birds.

Behavior: Usually situated within the mud with left valve down (MacGinitie and MacGinitie 1949; Kozloff 1993) and burrows 10–20 cm deep into the sediment (Volkenborn et al. 2012) with a burrowing rate that is highest in fine sand and muddy silt (Alexander et al. 1993).

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