Tresus capax

Phylum: Mollusca
Class: Bivalvia, Heterodonta
Order: Veneroida
Family: Mactridae

The gaper clam, horseneck clam, or fat gaper

Taxonomy: Originally described as *Lutraria capax* (in 1850 by Gould), few synonyms are known and are rarely used (e.g., *L. maxima* and *Schizothaerus capax*).

Description

Size: Individuals up to 20 cm in length, with average size 10–12 cm. *Tresus capax* are some of the largest northwest clams (Kozloff 1993), some specimens weigh up to 1.8 kg (Ricketts and Calvin 1971).

Color: Shell chalky white and occasionally with patches of black due to the presence of sulfides (Kozloff 1993). The periostracum is dull brown in color, and often flaking.

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 family Mactridae are characterized by a A-shaped cardinal tooth (see Plate 396F, Coan and Valentich-Scott 2007; Fig. 2a).

Body: (Fig. 295, Kozloff 1993).

Color:

Interior: Biphasic action of the heart is facilitated by acetylcholine in *Mytilus planulatus*, *M. edulis*, *Spisula solidissima*, and *T. capax* (Greenberg 1970). Stomach described as Type V (for definition, see Reid 1977). A visceral "skirt", or a fold along the edge of the mantle tissue, often gives a home to commensal pea crabs in the genus *Pinnixa.* Maximal systolic pressure was recorded for *T. capax* to be 13 cm H_20, which is higher than the 11 cm H_20 recorded for *Saxidomus giganteus* (Florey and Cahill 1977) (see description in this guide).

Exterior:

Byssus:

Gills:

Shell: Overall shell shape is oval, with larger specimens quadrate (Fig. 1). The posterior end is truncate, and gapes widely (Figs. 1–2). Individuals 1.5 times long as tall (Kozloff 1993).

Interior: Porcelaneous and white, with two adductor muscle scars of similar shape, and a long pallial sinus (Fig. 2).

Exterior: Right and left valves are similar and with smooth sculpture, with only concentric rings. Some periostracum, but not necessarily covering the entire shell. Beaks are one third from anterior end.

Hinge: One small cardinal tooth on each valve, and a J-shaped, socket-like chondrophore (Fig. 2). The left valve is with A-shaped tooth (Fig. 2a).

Eyes:

Foot:

Siphons: Large, fused siphons are retractible (almost completely), and with rather leathery tips, and small, inconspicuous, leathery plates at the tip (Kozloff 1993).

Burrow: Burrow depth ranges from 30–50 cm and depends on substrate type (e.g., those in stiff clay have more shallow burrows than those in soft mud) (Kozloff 1993). *Tresus capax* individuals apparently lose the ability to re-burrow themselves once they reach 60–75 mm in length (Pohlo 1964 in Zhang and Campbell 2002).

Possible Misidentifications

The bivalve family Mactridae is monophyletic based on both molecular and morphological characters and appears in the fossil record beginning in the Cretaceous (Rice and Roddick 1993); there are seven species reported locally. This heterodont family is characterized by an internal ligament, large shells (greater than 25 mm in length) that are internally porcelaneaus and a pallial line with conspicuous sinus (Coan and Valentich-Scott 2007). The anterior cardinal tooth on the left valve has an inverted A-

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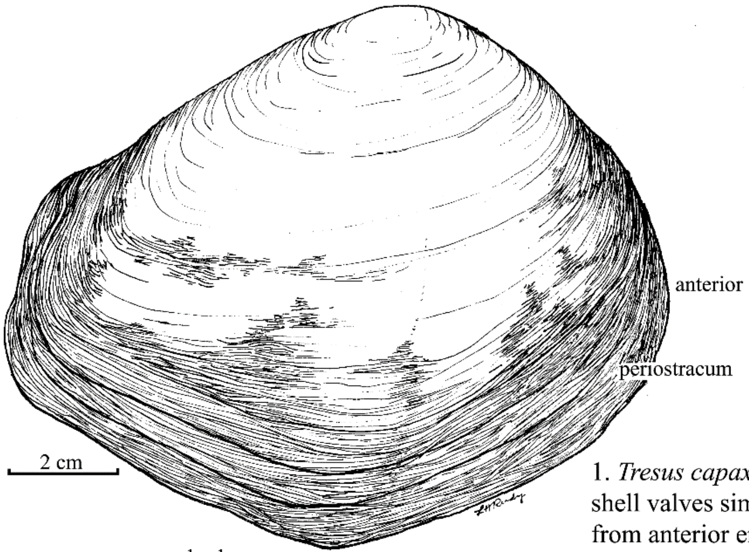
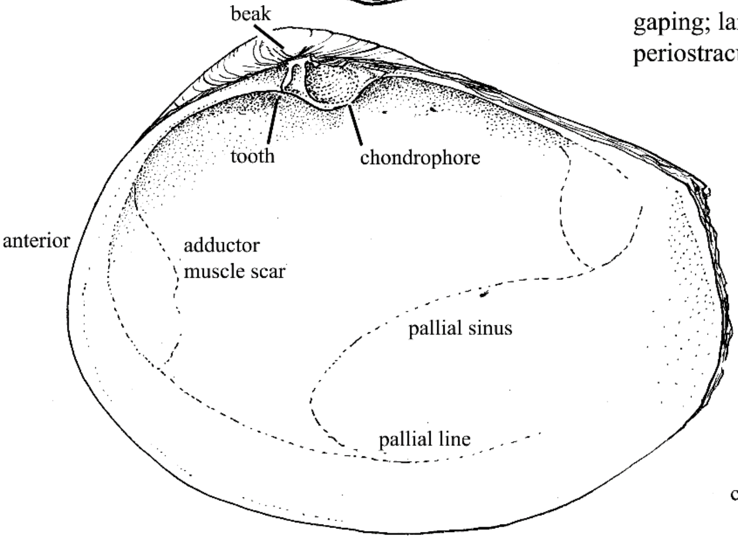
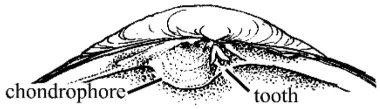
Tresus capax



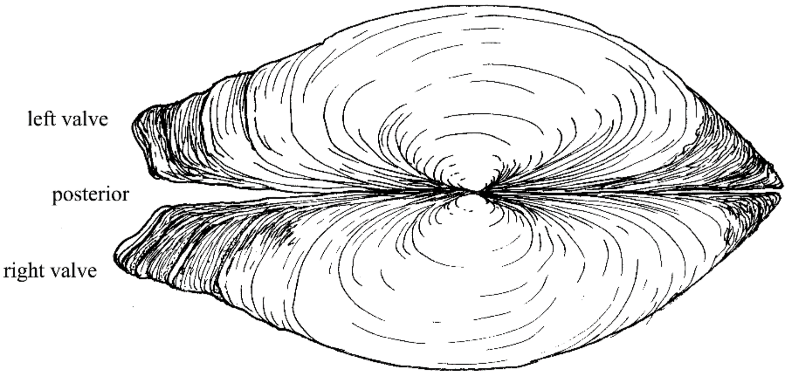
1. *Tresus capax*, exterior, right valve x1: shell valves similar, oval-quadrate; beaks 1/3 from anterior end; posterior end truncate, gaping; large, fused, leathery siphons; some periostracum.



2. Interior, right valve: muscle scars similar; deep pallial sinus; small, J-shaped tooth; socket-like chondrophore containing ligament.



2a. Hinge area, left valve: chondrophore and A-shaped tooth.



3. (Dorsal view).

shape in mactrids (see Fig. 2a), unlike the family Semelidae. Only those in the genus *Tresus* have a shell with a conspicuous gape posteriorly (Fig. 3). In *T. nuttallii*, the shells are ovate or elongate with a posterior end that is longer than the anterior. Sometimes called the southern or Pacific gaper clam, *Tresus nuttallii* occasionally occurs in our area, but is common only from Tomales Bay, California south. It is more elongate than *T. capax*, and has prominent horny plates on its siphon, not just leathery tips. Its periostracum is more extensive and its beaks closer to the anterior end than those of *T. capax*. The shell of *T. capax* the shell is ovate to rhombiodal in shape (Coan and Valentich-Scott 2007). *Tresus nuttallii* also lacks the visceral “skirt" of mantle tissue found in *T. capax (*Coan and Valentich-Scott 2007). This skirt is an elongated inner lamellar palp that hangs dorsally and covers a portion of the posterior visceral mass. *Tresus capax* also hosts up to three species of pea crabs (see **Associates**), which are not found in *T. nuttallii*. Young individuals of both *Tresus* species can be easily confused with *Mya arenaria,* the softshell clam. *Mya arenaria,* however, has a chondrophore on only one valve, its posterior is rounded, not truncate and its siphons lack the leather-like flaps found in *Tresus* local species*.* *Tresus allomyax,* an offshore species, is also reported from central California to Oregon (Coan and Valentich-Scott 2007).

All other mactrid species have shells with a narrowly gaping or completely closed posterior (Coan and Valentich-Scott 2007). *Mactromeris* species have a chondrophore that projects ventrally. *Mactromeris catilliformis* has a shorter anterior end than posterior, and the opposite is true for *M. hemphillii*. *Mactromeris californica* and *Simomactra* species lack a chondrophore and only members of the latter genus have a beak without undulations. In *S. planulata*, the shell valves are subequilateral however the shell in *S. falcata* is longer anteriorly.

Ecological Information

Range: Type locality is Puget Sound, Washington (Orr et al. 2013). Known eastern Pacific range from Kodiak, Alaska, to San Francisco. Populations uncommon south of Humboldt Bay, where the congener *Tresus nuttallii* becomes the more common species (Coan and Valentich-Scott 2007).

Local Distribution: Local distribution in many of Oregon's larger estuaries (e.g., Coos, Netarts, Tillamook, Yaquina). However, this species is not yet found in Siletz, or Nestucca, which is potentially due to the stronger currents in the latter estuaries.

Habitat: Occurs in sheltered intertidal flats, e.g., in sand, mud, mud with gravel and shell hash. Individuals also occur in stiff clay down to 30 cm. Occurs in eelgrass (e.g., *Zostera marina*) beds, where digging for their harvest (see **Predators**) does not seem to effect eelgrass production (Yaquina Bay, Oregon, Boese 2002), as well as non-native seaweed species (e.g., *Sargassum muticum*, White and Orr 2011). However, they are rarely found within mudflats dominated by ghost shrimp, *N. californiensis* (see description in this guide), presumably because of the unstable substrate these create (Hancock 1979). *Tresus capax* is occasionally used as a bioindicator species in toxicity testing (e.g., tributyltin, Horiguchi et al. 2003).

Salinity:

Temperature: A temperate northwest species, where temperatures range 9–15° (Matchell et al. 1971).

Tidal Level: Occurs from 25–60 cm below the surface and mid- to subtidal to 50-meter depths (Zhang and Campbell 2002).

Associates: Hosts at least three pea crab species within the mantle cavity (Pearce 1965; Campos-Gonzalez 1986) including *Pinnixa faba* (see Fig. 296, Kozloff 1993; description in this guide), *P. littoralis*, *Fabia subquadrata* (Kozloff 1993). They ingest material (e.g., diatoms) brought in by the clam and their presence make the mantle tissue irritated or blistered (Kozloff 1993). Only one adult pair is found per clam, however, several juveniles can be present (Kozloff 1993). Occasionally inhabited by nemertean worm *Malacobdella grossa* (Haderlie 1980). Coexists with the congener, *T. nutallii*, in Humbolt Bay and occasionally in Oregon and Washington and British Columbia, Canada (Zhang and Campbell 2002). However, *T. capax* is much more commonly found (Kozloff 1993).

Abundance: Very abundant and commonly dug in local estuaries. Constituted nearly all of Coos Bay's commercial clam catch, and up to 60% of Oregon's total commercial catch (Hancock et al. 1979). Individuals can be found at densities of over 108 individuals/m^2 (Yaquina Bay, Hancock et al. 1979). However, *T. capax* is less common south of Humboldt Bay (see **Range**); high mean densities of 24.8 individuals/m^2 were reported for populations in Humboldt Bay, California (Wendell 1976). Individuals more abundant in shallow than deeper water (Campbell and Bourne 2000).

Life-History Information

Reproduction: Dioecious. Individuals free-spawn in Jan–March (northern California, Oregon, Washington) and mid February–May (Strait of Georgia, Bourne and Smith 1972b; Brusa et al. 1978; Kabat and O'Foighil 1987). In Humboldt Bay, California, gametes were most abundant from August to October, when water temperatures were high, and spawning coincides with a drop in water temperatures (January to March) and salinity; sex ratios where approximately 1:1 (Machell and De Martini 1971). Spawning in late winter with peaks in March to April have also been reported for Yaquina Bay, Oregon and the periodicity may be influenced by lunar cycles (Hancock et al. 1979; Breed-Willeke and Hancock 1980). Oocytes are 60–70 µm in diameter and sperm heads 3.2 µm in length with tails 30 µm long. Development proceeds as follows at 13˚C (Kabat and O'Foighil 1987; Bourne and Smith 1972a, 1972b): first polar body at 40 min, first cleavage at 90 min, trochophore larva at 24 hr, and straight hinge veligers at 48 hrs (Kabat and O'Foighil 1987).

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). The straight-hinge veliger larvae of *T. capax* are 75–80 x 60 µm, when umbones are present they are 140–150 µm, pediveligers are 230–250 µm and at settlement individuals are 250 x 240 µm. Straight hinge veligers have an anterior end that is longer and more pointed than the posterior (see Fig. 4, Brink 2001) and the bottom half of the anterior end slopes dramatically ventrally (Brink 2001). Eventually, the umbo becomes more angled, the posterior end becomes blunt, and the anterior end pointed. The anterior shoulder is longer than the posterior and metamorphosis occurs when individuals are 260–280 µm (Bourne and Smith 1972a; Brink 2001), after 34 days (5˚C), 26 days (10˚C), or 24 days (15˚C) (Bourne and Smith 1972a; Kabat and O'Foighil 1987). Larvae do not develop at temperatures of 20˚C and higher (Bourne and Smith 1972a). Larval recruitment was variable from 1969–1973 throughout 16 sites in Humboldt Bay, California (from 6.7 to 100 recruits/0.25 m^2, see Wendell 1976).

Juvenile: Sexual maturity is reached after 3–4 years, when individuals are at least 70 mm in length (Bourne and Smith 1972b; Kabat and O'Foighil 1987).

Longevity: Four to 29 years (Tofino, British Columbia, Canada, Campbell et al. 2009). The best aging technique is counting the annuli (see **Growth**) on chondrophore (Hancock et al. 1979). Individuals that are commercially and recreationally harvested are approximately five years old (Hancock et al. 1979). The mean age of individuals collected from Ritchie Bay in southern British Columbia, Canada were 10.8 years old (and 148 mm in length Campbell and Bourne 2000). Wendell (1976) estimated the longevity to be 15–20 years in *T. capax* populations from Humboldt Bay, California (Wendell 1976).

Growth Rate: Subtidal individuals that are over four years old are larger and grow faster than intertidal specimens (Hancock 1979; Breed-Willeke and Hancock 1980); growth rates from low intertidal and subtidal zones were greater than those for intertidal zones in southern British Columbia, Canada (Campbell and Bourne 2000). Most growth occurs in late spring and summer when planktonic food is most plentiful. Individuals then store fat and glycogen throughout the remainder of the year (Kozloff 1974). Individuals are 110 mm in length when 15–16 years old (Kabat and O'Foighil 1987). Growth rates are estimated by counting growth zones on the chondrophore, as shell growth alternates between narrow conchoilin (transparent) and wide aragonite (opaque) zones (Gaumer 1977; Campbell et al. 2009). Growth rates measured at two locations in southern British Columbia, Canada were 98 and 84 mm at 5 years, 132 and 123 mm at 10 years, and 149 and 145 mm at 15 yrs in Seal and Doyle Islands, respectively (Bourne and Smith 1972b).

Food: A suspension feeder (Reid 1977) that eats planktonic organisms and detritus particles. Interestingly, *Saxidomus* spp. (*S. giganteus*, *S. nuttallii*) are more resistant to toxic (saxitoxin) dinoflagellates than other co-occurring bivalves, like *T. capax* (Kvitek and Beitler 1991).

Predators: Known predators include birds (e.g., glaucous-winged gull, Kvitek 1991), human harvest (e.g., Cannon and Burchell 2009), the snail *Polinices,* crab (*Cancer magister*)*,* and sea stars in the genus *Pisaster.* Haplosporidian parasitic infestation was recorded in 89% of clams from Oregon estuaries (Gaumer 1977). Occasionally sea otters, but *T. capax* likely avoids otter predation in its deep burrow (Kvitek and Oliver 1992; Kvitek et al. 1992). As larvae, *T. capax* veligers are preyed upon by planktonic predators and suspension feeders. A commercial fishery was developed in British Columbia, Canada (Zhang and Campbell 2002), and the fishery in Coos Bay produced over 25,166 kg (Gaumer 1977).

Behavior: A weak burrower, *T. capax* individuals can still be found rather deep (e.g., 50 cm, see **Burrow**) in the substrate.

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