
Chlorostoma funebris (=Tegula funebris)

Phylum: Mollusca

Class: Gastropoda, Prosobranchia

Order: Archeogastropoda

Family: Trochidae, Monodontinae

The black turban or top shell snail (A. Adams, 1855)

Description

Size—to 50 mm or more high (Carlton and Roth 1975), usually less than 25 mm (Keep 1935); this specimen 20 mm diameter, 17 mm high.

Color—exterior purplish-black, not shiny; with white eroded apex. Gray when dry. Interior white with a black margin; a pearly or "rainbow" deep interior patch. White around columella (McLean 1969) (fig. 1)

Shell Shape—strong; 4 inflated whorls; rather top-shaped, (conical) with a flat base; round aperture, nearly round, horny operculum: family Trochidae (Griffith 1975). Small snails are about as high as wide (figs. 1, 2); older ones become higher than wide (Frank 1965b).

Sculpture—below the suture is an impressed line (Oldroyd 1924), or a scaly band (Carlton and Roth 1975): "foliaceous incremental lamellae" (Oldroyd 1924) (figs. 1, 2). Whorls "spirally lirated," i.e. having up to 17 thread-like spiral lines (figs. 1, 2); sometimes smooth except for base, or strongly sculptured above (fig. 2).

Umbilicus—covered by a callus, nearly always closed (Carlton and Roth 1975) (fig. 3). Specimens with an open umbilicus do not have a flange between umbilicus and aperture.

Columella—spirally twisted (Oldroyd 1924), with 2 denticles (nodes) near base (fig. 3), lower node worn or indistinct.

Aperture—round, complete; no anterior notch or canal (fig. 3): aperture length less than $\frac{3}{4}$ shell length.

Outer Lip—smooth, black-rimmed, without sculpture (fig. 3).

Operculum—thin; round, numerous spiral lines; horny, not calcareous (fig. 4).

Radula—with a single central tooth; 5-7 pointed lateral teeth, 8-10 marginal teeth (fig. 6).

Foot—long, relatively narrow; with epipodal tentacles along sides: family Trochidae (4 on each side: species funebris (fig. 5).

Possible Misidentifications

The Trochidae are herbivorous, conical snails, pearly within, with round, entire apertures and thin horny circular opercula (Griffith 1975). The Turbinidae, a similar family, are also conical, but they have a calcareous operculum, and are represented here only by *Astraea*, a large subtidal and offshore species.

The other common genus of the Trochidae is *Calliostoma*, a conical top shell, which is distinguished from *Chlorostoma* chiefly by its lack of denticles or nodes on the columella. Its whorls are not inflated like *Chlorostoma*'s. *Calliostoma* is found on the outer shores, not in bays; it has many spiral ribs, no umbilicus, and various distinctive colorations.

Snails of the genus *Chlorostoma* have strong columellar nodes, a round, thin, horny operculum with many spiral lines, and a pearly interior. They sometimes have a periostracum. The 3 other species of *Chlorostoma* found on the Pacific coast are not known to be estuarine:

Tegula montereyi probably does not occur above Bolinas Bay, north of San Francisco; it occupies the low intertidal off-shore zone, often in kelp beds. This species is brown, with a strong, open umbilicus and a strictly conical (not inflated) profile.

Tegula pulligo, the dusky turban, occurs in the low intertidal in California; it is the dominant *Tegula* in Puget Sound (Griffith 1975), where it occurs in open coasts and in protected situations (Kozloff 1974a). *T. pulligo* has an open umbilicus with the inner lip produced into a flange (it is closed in *T. funebris*). It has a brown (not purple or black) periostracum; its basic color is brown or gray, sometimes with orange, white or brown spots on the edge. Its habitat is open rocky beaches (Griffith 1975).

Chlorostoma brunnea, the brown turban, is the closest to *C. funebris* in Oregon; it does not seem to occur in Puget Sound (Kozloff 1974a), and is very common on the outer shores in Oregon and around San Francisco (Packard 1918). It has only one node on the

columella, as opposed to *C. funebris*' two; its shell is brown or orange brown, and it lacks the scaly subsutural band of *funebris* (Carlton and Roth 1975). *C. brunnea* is found lower in the intertidal than *funebris*, or in off-shore kelp beds near the surface; probably never in estuaries.

Tegula gallina, the speckled tegula, is gray to green, lacks the scaly subsutural band, and is found south of Santa Barbara. It is closely related to *C. funebris*; the radulae are quite similar (Merriman 1967).

Ecological Information

Range—Vancouver, B.C., to central Baja California (McLean 1969).

Local Distribution—marine portions of large Oregon estuaries; Coos Bay: Pigeon Point.

Habitat—avoids exposed outer coast situations although it is found in rocky protected outer tidepools (Carlton and Roth 1975); marine portions of estuaries in rocky situations amongst seaweed (Griffith 1975). Strongly built: can withstand surf. Females found in more exposed places than males at low tide (Frank 1975). Species is negatively phototactic: seeks the light (Morris et al 1980).

Salinity—collected at 30 ‰ salt. Cannot withstand continued exposure to low salinity.

Temperature—found in temperate waters only. With black color can get quite warm during exposure to sun at low tides.

Tidal Level—on outer shores, most common at high inter-tidal (2-0 m) (Frank 1975); found in midintertidal as well. In estuary found at 0-+1 ft. Small snails settle high, live there 5-6 years, then migrate to lower levels (to +0.6- -0.2 m) (Paine 1979).

Associates—on outer coast: slipper shell *Crepidula* and several limpets (*Collisella*), which can be predatory. Empty shells used by hermit crabs.

Quantitative Information

Weight—this specimen 4g wet, with shell.

Abundance—most abundant mid-intertidal grazer (Frank 1975).

Life History Information

Reproduction—dioecious; eggs and sperm exuded into water. Sexes can be determined by color of foot sole: males are light, females darker; female gonad bright green from egg yolk. Egg masses gelatinous, about 3 mm diameter; several hundred eggs, about 0.19

mm diameter. Breeding probably once a year (Paine 1979); reproductive size of snails 14 mm (Paine 1971). Planktonic veliger larvae emerge on 7th day, settle 12th day. Long life of *T. funebris* ensures increased lifetime reproductive effort (Frank 1975).

Longevity—lives up to 30 years; average age may be 10 years (Frank 1975).

Growth Rate—young snails grow rapidly: from 4-5.6 mm and 27 mg average weight (June) to 5.6-9.8 mm. 177.3 mg (following March) (Morris et al 1980). California snails do not show growth rings of Oregon snails, which in older animals reveal an annual winter cessation of growth (Frank 1975).

Food—"a catholic feeder" (Frank 1975): almost any common alga. Prefers *Macrocystis integrifolia*, *Nereocystis luetkeana*, *Rhodoglossum affine*, *Gigartina canaliculata*: i.e. fleshy forms. If not available, will eat encrusting green alga, *Ralfsia pacifica*, detritus (Abbott et al 1964).

Predators—*Pisaster ochraceus* in low intertidal. Although *Chlorostoma* is not its preferred prey, *Pisaster* can consume over ¼ the available snails (Frank 1965b). Possibly limpet *Collisella*; carnivorous snail *Nucella*; crab *Cancer antennarius*.

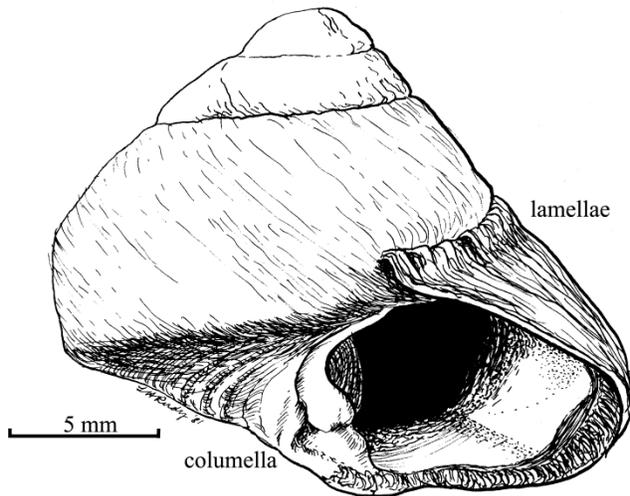
Behavior—larger animals migrate to lower intertidal. Species is sedentary, aggregates at low tide, moves up to rock tops at nighttime high tides (not diurnal ones) (Morris et al 1980). Territory: tends to live in a radius of about 1.5 m for months; a daily movement of about 1m (Frank 1975). Snails move well on rocks, are clumsy on sand. They place pebbles on the foot to alter balance (Morris et al 1980). Escape predators by sensory perception (seastars), or by crawling onto top of predator's shell (carnivorous snails).

Bibliography

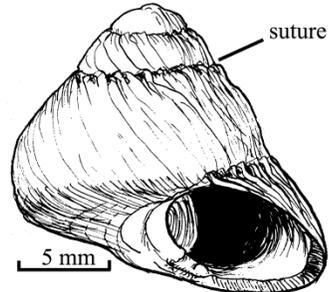
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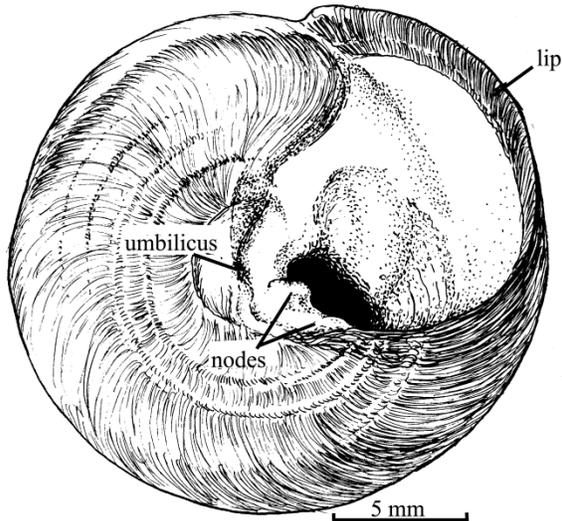
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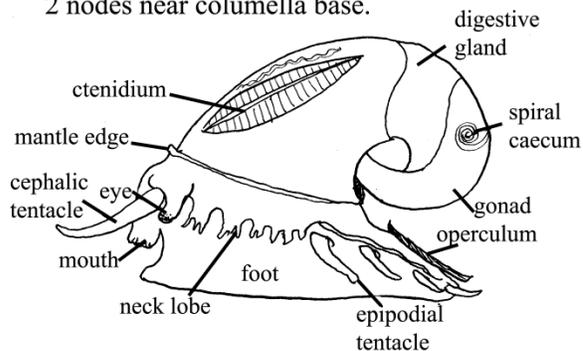
1. *Chlorostoma funebris* (ventral view, H:17mm, D:20mm) x5: four whorls, inflated; eroded spire; elevated lamellae below suture; thread-like spiral sculpture on whorls; base flat.



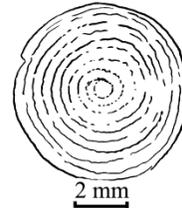
2. Variation x3: strong sculpture on sutures and on whorls.



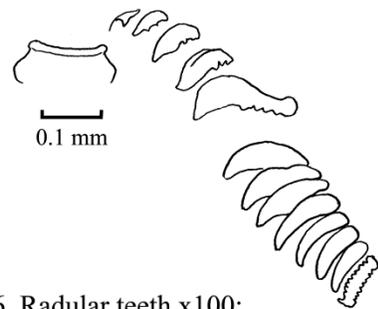
3. (Anterior view) x4.5: aperture rounds, complete; columella white, interior pearly; umbilicus closed; 2 nodes near columella base.



5. Schematic dissection, left side (Abbott et al, 1964).



4. Operculum x4: round, horny, thin; many spiral lines.



6. Radular teeth x100: one large central tooth; 5-7 pointed lateral teeth; 8-10 marginal teeth, last ones serrated (Fritchman, 1965).