Nucella lamellosa

The wrinkled or frilled dogwinkle

Phylum: Mollusca
Class: Gastropoda, Prosobranchia
Order: Neogastropoda
Family: Muricidae

Taxonomy: *Nucella* was previously called *Thais*. *Thais* is now reserved for subtropical and tropical species. For a more detailed review of gastropod taxonomy, see Keen and Coan (1974) and McLean (2007).

Description

Size: To 50 mm in California (Abbott and Haderlie 1980), 100 mm Puget Sound and north (Kozloff 1974); largest specimen illustrated, 54 mm (fig. 1). Largest of the *Nucella* genus.
Color: White to brown, some are pink, lavender or orange tan; not highly polished. Inside whitish, sometimes with color showing through.
Shell Shape: Shell heavy, solid, strong; spirally coiled, fusiform (spindle-shaped). 5-7 whorls; nuclear whorl small, inconspicuous. Spire usually high; siphonal canal relatively long for genus; aperture ovate, almost 1/2 shell length.
Sculpture: Extremely variable. Spire and base have similar sculpture: genus *Nucella* (McLean 2007, Keen and Coan 1974). Axial ribs present (fig. 1). Three chief variations with many gradations: lamellar variety with strong axial ribs, developed in quiet water specimens into frilly ruffles (fig. 4); *Nucella* from rough conditions are smooth, with only faint axial sculpture (figs. 1, 3); and strongly sculptured spirally with one to two strong horizontal ribs at top of each whorl and smaller ribs below; axial sculpture only between ribs. This third variety has flattened and angled whorls (fig. 2) (Kozloff 1974).
Outer Lip: Thickened, smooth, without denticles on posterior portion of aperture (near anal notch) no single strong tooth on edge near anterior canal (see **Possible Misidentifications**). Outer lips rounding smoothly to anterior end of shell. At least one row of denticles within lip (fig. 1).
Columella: Without folds (Kozloff 1974); encrusted, smooth.
Suture: Impressed, distinct, but not a deep groove.
Anterior (Siphonal) Canal: Short, but longer than other *Nucella* species; narrow, slot-like, not spout-like (i.e. with edges touching, making a closed tube: see **Possible Misidentifications**). Not separated from large whorl by revolving groove (fig. 1).
Aperture: Almost 1/2 length shell; ovate to quadrate in outline, with a siphonal notch, but no anal notch (fig. 1). Widest part of aperture (generally near its middle) at least half as wide as shell (Kozloff 1974).
Umbilicus: Small, often closed (fig. 1).
Operculum: Usually large enough to close aperture; conspicuous, with strong spiral lines; with nucleus on one side (fig. la).
Eggs: Vase-shaped, yellow, about 10 mm long; in clusters on underside of rocks (Abbott and Haderlie 1980); called "sea oats"; (fig. 1B).

Possible Misidentifications

Nucella can be distinguished from other predatory estuarine snails by its sculpture, which is the same on the whorls and spire, by the large last whorl and by the ovate aperture (about 1/2 the shell length). Unlike *Nassarius*, it has no distinct revolving furrow setting off the body whorl from the anterior canal (Keen and Coan 1974). It has no single strong tooth on the anterior margin of the outer lip, as in *Acanthina*. There are no columellar folds as in *Olivella*, *Buccinus*, etc. The siphonal canal is not spout-like, as in *Ocenebra*, and *Ceratostoma*.

There are several species of *Nucella* in the northwest:

Nucella lima, the file dogwhelk, is a subtidal snail with about 16 alternating large and small file-like spiral ridges on the large whorl. It is rare, whitish to brown in color, short-spired and somewhat smaller than *N. lamellosa* (to 43 mm).

Nucella canaliculata, the channeled dogwhelk, is white to or orange, sometimes banded. It has a high spire, a prominent

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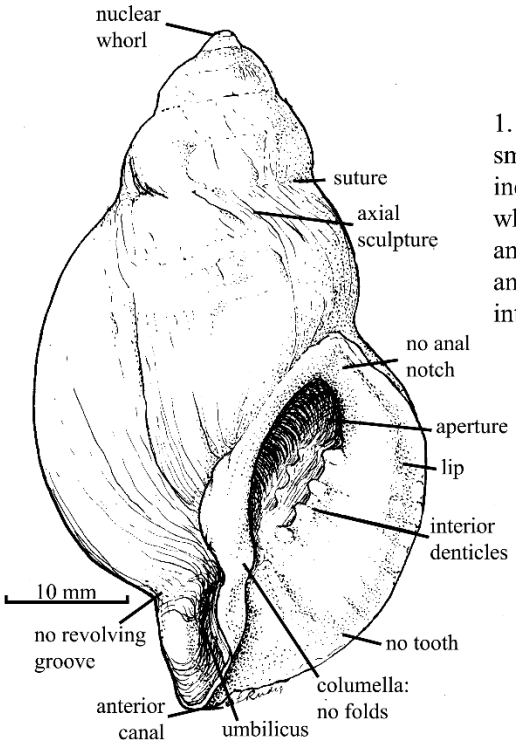
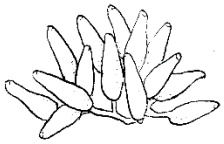
Nucella lamellosa

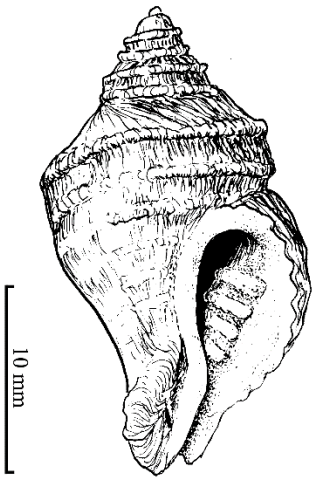


1. *Nucella lamellosa* (posterior view, H:54mm) x2: smooth variety; fusiform; 5 whorls (nuclear whorl inconspicuous); axial sculpture on both spire and body whorl; ovate aperture almost 1/2 shell length; narrow anterior canal; smooth outer lip without posterior denticles, anal notch or marginal tooth; columella without folds; interior rows of denticles, umbilicus closed; suture not deep.

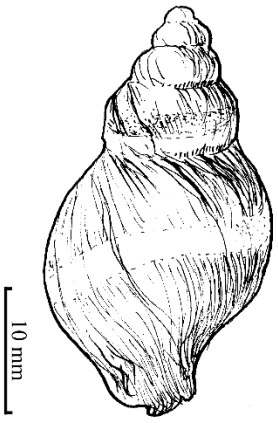
1a. Operculum x2.



1b. Egg cluster x1.



2. Spiral ribbed variation x2: 1-2 strong horizontal ribs at top of each whorl, smaller ribs below; fine axial sculpture between ribs; whorls angled, flattened.



3. Smooth, banded variation x2.

4. Frilly, lamellar variation x1: axial sculpture strong.

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shoulder below the deep suture, and rounded spiral ridges of equal size with axial lamellae between them. It is small, to just over 30 mm. Usually found in mussel beds, it is rare in bays (Kozloff 1974).

Nucella ostrina is the other *Nucella* most often found in estuaries; it usually occurs in heavier surf than *N. lamellosa*. Called the rock-dwelling dogwinkle, it is generally only up to 20 mm long. This snail has alternately large and small, often nodulose, spiral ridges over most of the shell. (These ridges are often obscure). It has no noticeable axial sculpture. Found in the mid- and high intertidal in mussel beds, *N. ostrina* is easily confused with variation of *N. lamellosa* (fig. 2).

Ecological Information

Range: Bering Strait to central California (Abbott and Haderlie 1980).
Local Distribution: Coos Bay: Pigeon Point, Empire; Umpqua estuary: Ziolkouski Beach (1/2 mile from mouth).
Habitat: On rocks with mud, sand substrate; often in protected bays (McLean 2007); below mussel beds on outer shores.
Salinity: Collected at 30: lower, more marine parts of bays with more constant saline concentrations.
Temperature: Cold to temperate waters. Geographic distribution would indicate a preference for cool temperatures. Lower part of bay does not generally have high temperatures. Smallest individuals have highest thermal limits; snails active at 0-30 °C (Bertness 1977).
Tidal Level: Found at low intertidal, lower than other species of the genus. Largest animals lowest in tidal range (Bertness 1977).
Associates: Primary prey is barnacle *Balanus,* which shows reduced settlement and metamorphosis in areas occupied or previously occupied by *N. lamellosa* (Johnson and Strathmann 1989); found with porcelain crab *Petrolisthes*, brachyuran crabs *Hemigrapsus* and *Cancer oregonensis*, chiton *Mopalia*, isopod *Idotea*, anemones *Anthopleura elegantissima* and *A. artemesia*, nudibranch *Onchidoris,* gastropods *Tegula* and *Pisaster ochraceus*. Discarded *N. lamellosa* shells often inhabited by the hermit crab *Pagurus hirsuitusculus*.
Weight: Largest collected (including shell) 28 gr. (wet).
Abundance: One of the most abundant intertidal snails of the northwest; becomes less abundant in California. By far the most common *Nucella* species in the Coos Bay estuary.

Life History Information

Reproduction: Mates in winter and spring (California) by aggregations of snails; individuals become sexually mature in 4th year, when they often return to their hatching site and join a breeding group (Abbott and Haderlie 1980); individuals tend to breed with same group. Gestation is approximately 20 months. Spawning occurs in June. Egg capsules deposited synchronously with other females; development varies with temperature: snails emerge after 140 days (at 6.8°C), after 67-91 days (9.6-11 °C) (Seavy 1977). Capsules protect embryos from low salinity stress by reducing the rate at which the osmotic concentration of intracapsular fluid decreases (Pechenik 1982). Capsules rarely contain "nurse eggs" (sterile eggs to be consumed by the developing snail larvae): nearly all eggs are fertile. Just over half of eggs reach hatching stage. There is high mortality among young snails and of 1000 eggs (from one female, one year) probably fewer than 10 grow to one year of age (Lyons and Spight 1973).
Growth Rate: Varies greatly with food supply. Shell growth, type, dependent on food: barnacle diet produces heavy, stout shells. Water-soluble chemical cues released by *Cancer productus* and by damaged conspecifics induced *N. lamellosa* to improve the defense effectiveness (thickness and morphology) of their shells (Appleton and Palmer 1988).
Longevity: Sexually mature at four years (Abbott and Haderlie 1980).
Food: Primarily barnacles: *Balanus glandula* and *B. cariosus*, on which it is the primary predator (Puget Sound) (Kozloff 1974). Mussels (outer shores), periwinkles and other mollusks. Radula penetrates shell of prey with aid of secretions from boring organ on foot (Abbott and Haderlie 1980).
Predators: Crabs (*Cancer productus*, *Hemigrapsus oregonensis*) egg capsules and

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young snails heavily preyed upon by other *Nucella*. *Nucella lamellosa* exhibits hatching plasticity by taking longer to hatch in the presence of predators (*Hemigrapsus oregonensis*) and increasing rate of hatching in the presence of conspecific adults (Miner et al. 2010).

Behavior: The presence of a natural predator (*Cancer gracilis*) while *N. lamellosa* is feeding on *Mytilus californianus* results in an increased number of incomplete drill holes, suggesting that *N. lamellosa* abandons its prey more frequently when in the presence of a known predator (Chattopadhyay and Baumiller 2007).

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