

## Appendix

### **Pictorial Guide to the Mollusks of the Watts Towers**

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August 2018

Information on species characteristics is taken from McLean (1978), Abbott and Haderlie (1980), Haderlie and Abbott (1980), Coan et al. (2000), and Coan & Valentich-Scott (2012). In some cases species names were updated as found in the World Register of Marine Species ([www.marinespecies.org](http://www.marinespecies.org)) in August 2018.

Sizes are given as shell length (L), height (H), or diameter (D), unless otherwise noted. Distances are those between two white lines. All sizes are likely underestimates, since unknown portions of specimens are usually embedded in mortar. Note that specimens in photos are oriented as they are typically seen by observers on the Watts Towers.

Unless otherwise noted, photographs are by Gwen Goodmanlowe.

## **BIVALVIA**

**Oysters, mussels, scallops, and clams**

## *Amiantis callosa*

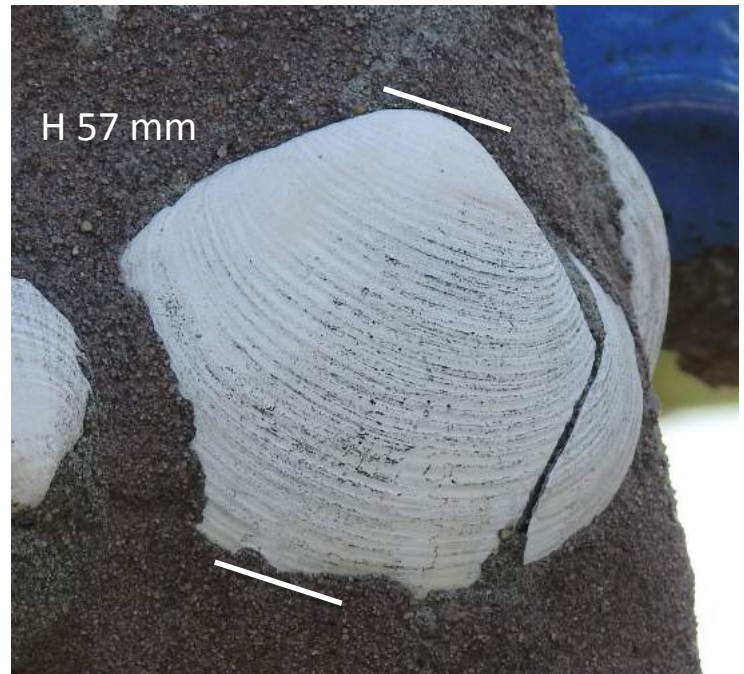
**Common name:** White Venus

**Geographic range:** Santa Barbara, CA to Bahia Santa Maria, Baja California Sur, Mexico.

**Habitat:** Shallowly buried in sandy substrata of wave-exposed headlands.

**Characteristics:** Length to 122 mm. Exterior with closely spaced ribs parallel to the shell margin.

**Distribution:** *A. callosa* are not very abundant on the WT. The highest concentration we observed is on the west side of the base of the Center Tower. Several can also be found on Gazebo ribs 11 and 12, and on the west-most spire on the Ship.



Gazebo Rib 12, exterior



Gazebo Rib 11, exterior

## *Argopecten ventricosus*

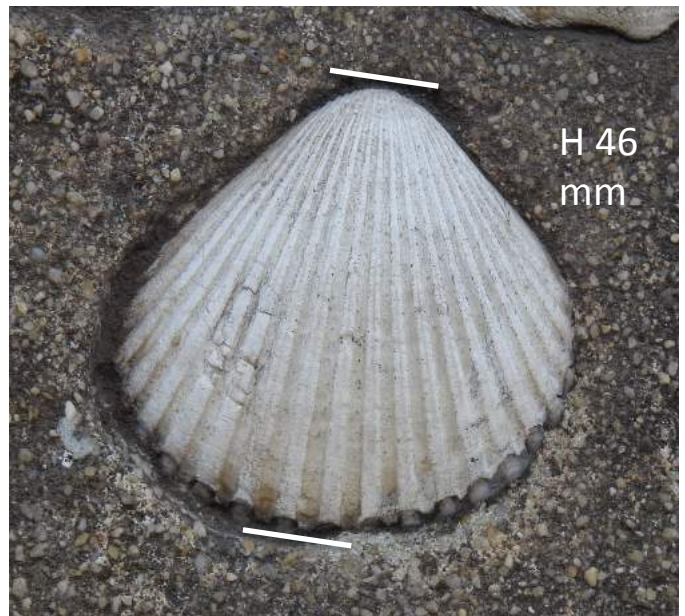
**Common name:** Pacific Calico Scallop

**Geographic range:** Santa Barbara, CA, to Bayovar, Peru.

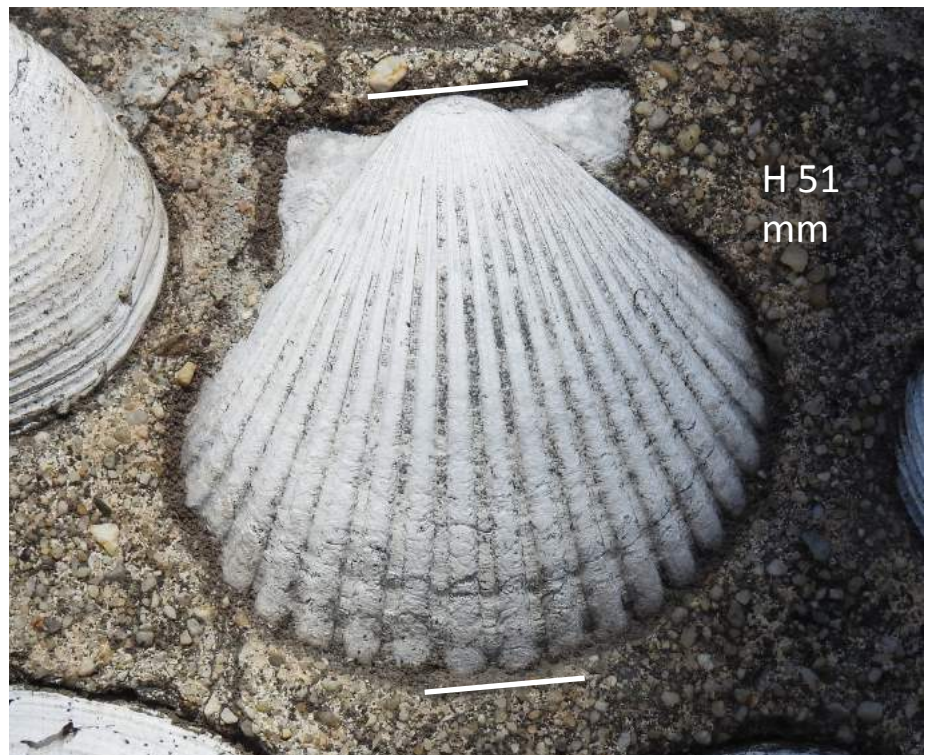
**Habitat:** Living on surface of mud and sand in bays and lagoons.

**Characteristics:** Height to 95 mm. 16-22 radial ribs with narrow interspaces.

**Distribution:** One of the most abundant shells on the WT, *A. ventricosus* is present on most major structures. The “ears” of scallops on the WT are usually covered with mortar, as in the top specimen pictured.



Chimney



Chimney



## *Chama exogyra*

**Common name:** Pacific Jewelbox

**Geographic range:** Bodega Head, CA, to Cabo San Lucas, Mexico.

**Habitat:** Cemented to rocky or other hard substrates on wave-exposed shores.

**Characteristics:** Length to 40 mm. Thick shell, with one valve cemented to the substrate in the adult stage, and the other valve resembling a lid. Sculpture of small commarginal frills and irregular spines.

**Distribution:** Chamids are relatively uncommon on the WT, with a few occurring on the South Wall (both exterior and interior), and on the East, Center, and West Towers. The specimen below is larger than previously recorded for *C. exogyra*, but has sculpture consistent with that species.



South Wall  
interior post 19

## *Chione californiensis*

**Common name:** California Venus

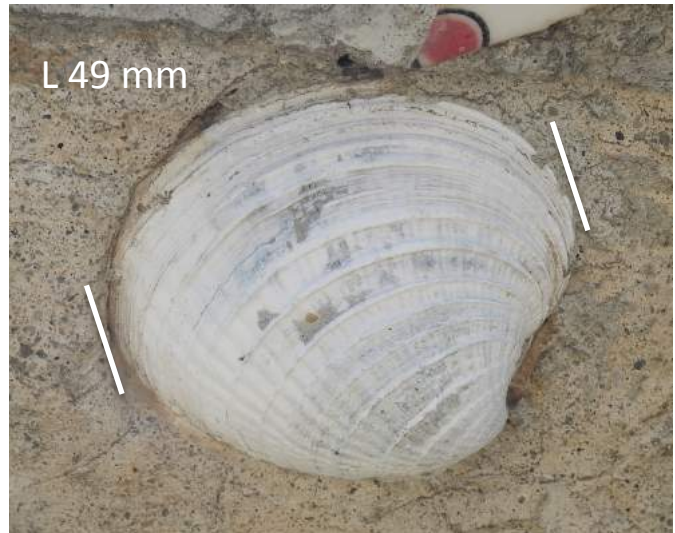
**Geographic range:** Santa Barbara, CA, to Acapulco, Mexico.

**Habitat:** Partially buried on sandy mudflats in bays.

**Characteristics:** Length to 80 mm. Shell sculpture includes widely spaced commarginal lamellae (visible on the specimens pictured below).

**Distribution:** *C. californiensis* may be the most abundant and widespread mollusc on the WT. It is present on all major structures, often in abundance, and often in mixed assemblages with *C. undatella*, *Chionista fluctifraga*, *Argopecten ventricosus*, and small specimens of *Tivela stultorum*.

A Tower,  
west side



A Tower middle ring





## *Chione undatella*

**Common name:** Frilled Venus

**Geographic range:** Goleta, CA, to Paita, Peru.

**Habitat:** Partially buried on mud and sandflats in bays.

**Characteristics:** Length to 60 mm. Shell sculpture includes closely spaced commarginal lamellae (the “frills” referred to in the common name) visible on the specimen pictured below). *C. californiensis* also has commarginal lamellae, but much more widely spaced than those of *C. undatella*.

**Distribution:** Though perhaps not as common as *C. californiensis*, very common and abundant throughout all major parts of the WT.

A Tower, west side



## *Chionista fluctifraga*

**Common name:** Smooth Venus

**Geographic range:** Santa Barbara, CA, to Bahia Guasimas, Mexico.

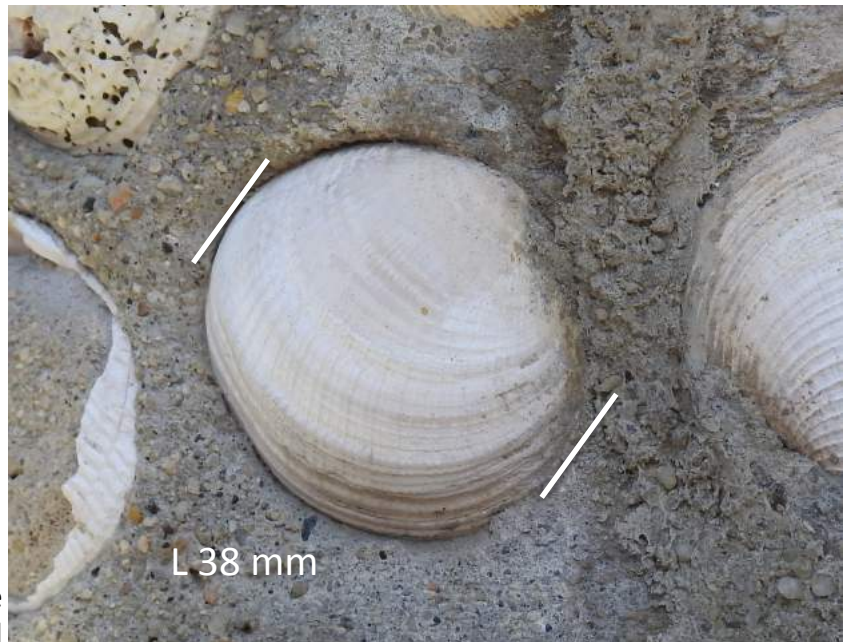
**Habitat:** Partially buried on mud and sandflats in bays.

**Characteristics:** Length to 86 mm. The exterior of the shell is the least sculptured of the three *Chione* and *Chionista* spp. present in California. The posterior end of the shell often has a purple-brown stain, but this is often faded in WT specimens. Often somewhat difficult to differentiate from eroded specimens of the two species of *Chione*, but it is usually more triangular in shape.

**Distribution:** Probably the least common of these three species on the WT, but still fairly abundant and widespread.



Ship, central spire



Ship, second spire  
from the east end



## *Crassadoma gigantea*

**Common name:** Giant Rock-Scallop

**Geographic range:** Prince William Sound, AK, to Bahia Magdalena, Mexico.

**Habitat:** Rocky substrates on wave-exposed shores; intertidal and subtidal.

**Characteristics:** Height to 228 mm. Adults with shells cemented to the substratum by the right valve. Valves sometimes with irregular, scaly radial ribs.

**Distribution:** We found only a single, partial shell of *C. gigantea* on the WT. It is embedded in the South Wall interior, in the panel between posts 19 and 20.

South Wall interior panel between posts 19 and 20



**\**Crassostrea gigas***

**Common name:** Pacific Oyster

**Geographic range:** Native to the northwest Pacific (e.g., Japan), but it was introduced to the west coast of the United States repeatedly since the late 1800s, and reproductive populations are established from British Columbia to southern California.

**Habitat:** Cemented on hard substrates in relatively protected waters. In southern California, often found on man-made structures in bays.

**Characteristics:** Height to 450 mm. Shell tends to be very elongate dorso-ventrally. Shell exterior often with irregular commarginal frills.

**Distribution:** We know of only one shell of *C. gigas* on the WT, on the South Wall exterior between posts 3 and 4.



South Wall exterior  
between posts 3 and 4



## *Donax Gouldi*

**Common name:** Gould Beanclam

**Geographic range:** Pismo Beach, CA to Arroyo del Conejo, Mexico.

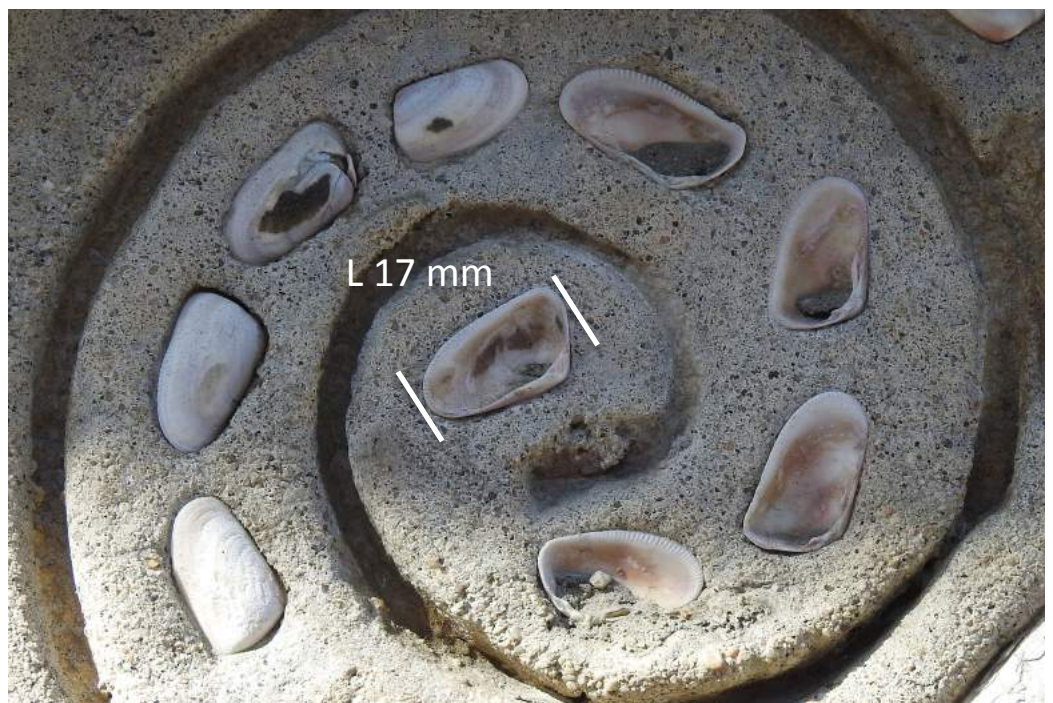
**Habitat:** Shallowly buried on wave-exposed sandy shores.

**Characteristics:** Length to 35 mm. Anterior end of shell long, posterior end abruptly truncate. Ventral inner margins of shells crenulate.

**Distribution:** Common and widespread on the WT, often in groups and arranged into spirals, hearts, or other shapes. One of the few shells that is often found with the interior of the valve facing the observer.



Ship, south side



Ship, north side

*\*Dosinia elegans*

**Common name:** Elegant Dosinia

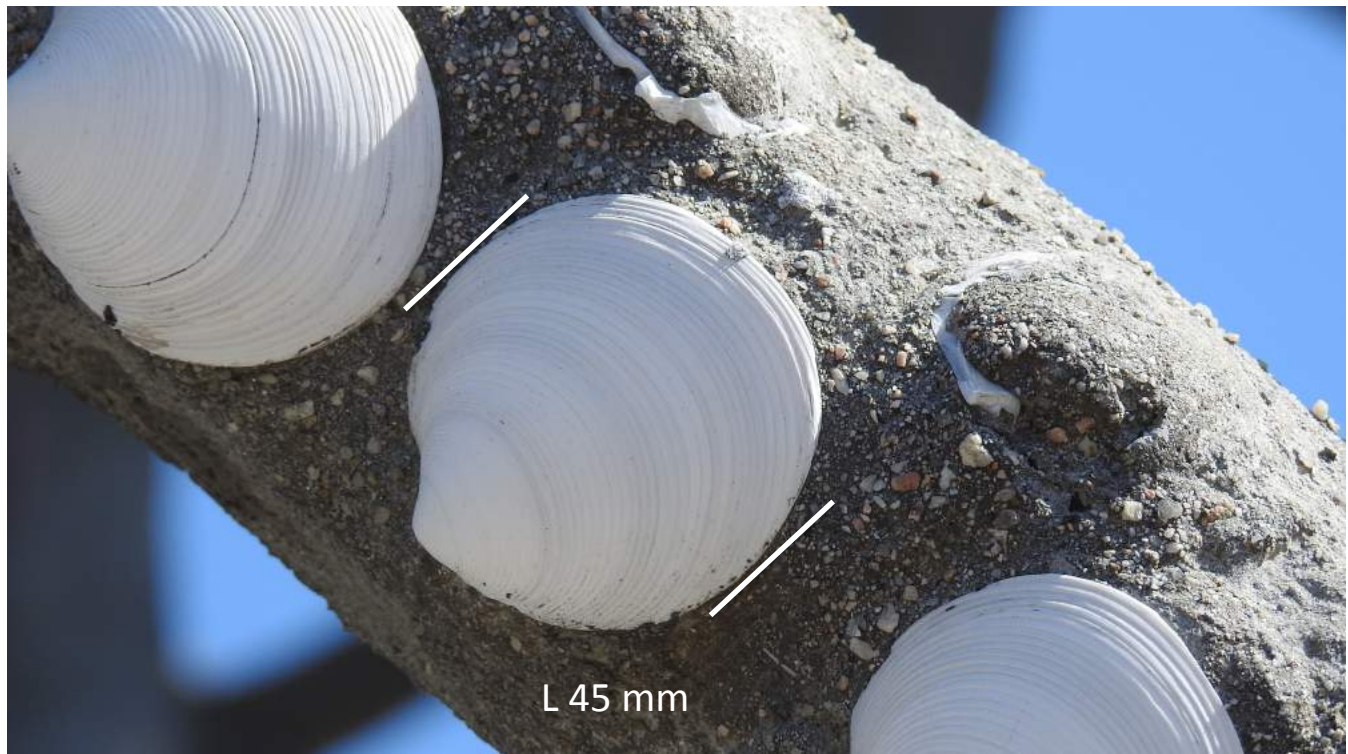
**Geographic range:** North Carolina to the Gulf of Mexico, Caribbean Central America.

**Habitat:** Moderately deeply buried in sand, mud in eelgrass in protected areas.

**Characteristics:** Circular shape, strong, closely-spaced commarginal ribs over entire shell.

**Distribution:** We found *D. elegans* only in a few places on the WT, usually in groups. It is present, for example, on the South Wall interior, on the arch over the East Gate; on the out support on the NE side of the West Tower; and on the west-most spire of the Ship.

South Wall exterior between posts 13 and 14 (arch above East Gate)





## *Lithophaga plumula*

**Common name:** Feathered Datemussel

**Geographic range:** Monterey, CA to Manta, Ecuador.

**Habitat:** Like piddocks (*Penitella* sp.), datemussels bore holes into solid substrata like sedimentary rock (like that pictured below). They can be found intertidally or subtidally, depending on the species.

**Characteristics:** Empty burrow at least partially lined with calcium carbonate.

**Distribution:** We know of only one place that lithophagine-bored rock can be found on the WT: the North Wall interior between posts 13 and 14 (the “pantry” shelving, on the outer left wall of the pantry).



North Wall interior  
between posts 13 and  
14 (“pantry” shelving)

Photo by Bruno Pernet

width of rock 58 mm

## *Macoma nasuta*

**Common name:** Bent-nose Macoma

**Geographic range:** Cook Inlet, AK, to Punta Rompiente, Mexico.

**Habitat:** Deeply buried in intertidal or subtidal sand or silt habitats. Usually in wave-protected habitats, but sometimes in wave-exposed.

**Characteristics:** Length to 110 mm. Posterior end (lower end in specimen pictured) narrower than anterior end. Sometimes bent on narrow end.

**Distribution:** We know of only one specimen of *M. nasuta* on the WT, a fairly large shell (pictured) found on the west side of the base of the Center Tower.



Center Tower, base on  
the west side

Photo by Bruno Pernet



## *Macoma secta*

**Common name:** White-sand Macoma

**Geographic range:** Queen Charlotte Islands, British Columbia, to Bahia Magdalena, Mexico.

**Habitat:** Deeply buried in sand in bays and other wave-protected habitats, intertidal to subtidal.

**Characteristics:** Length to 120 mm. Posterior end of shell (to the right in the specimen pictured) longer than anterior end, broadly truncate.

**Distribution:** We have identified only a single shell of *M. secta* on the WT, on rib 11 of the Gazebo. That shell is pictured below.

Gazebo Rib 11



## *Mytilus californianus*

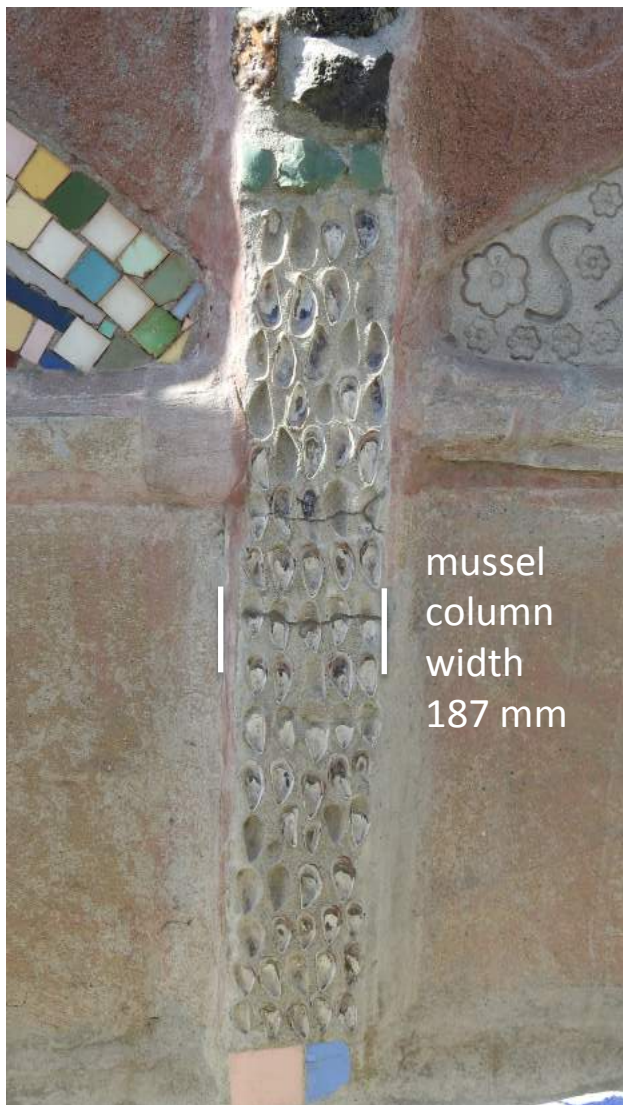
**Common name:** California Mussel

**Geographic range:** Cook Inlet, AK, to Punta Rompiente, Mexico.

**Habitat:** Attached by byssus on wave-exposed rocky shores or on other hard substrate.

**Characteristics:** Length to 251 mm. Elongate, with characteristic elongate - subtriangular shape.

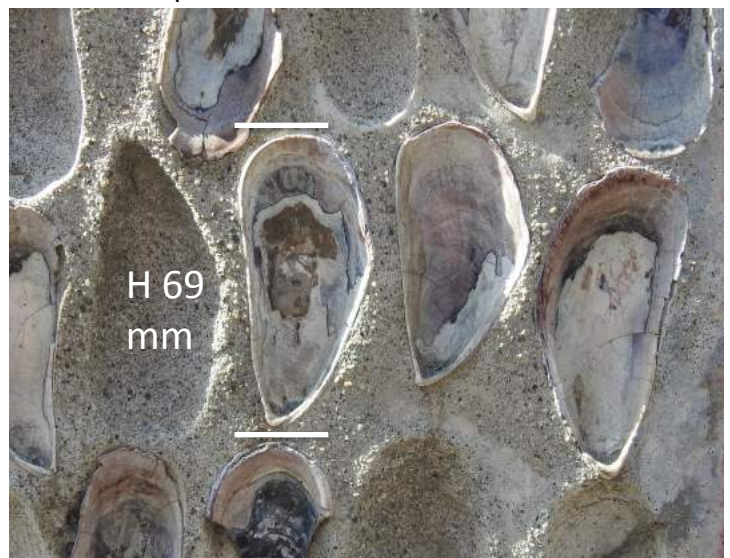
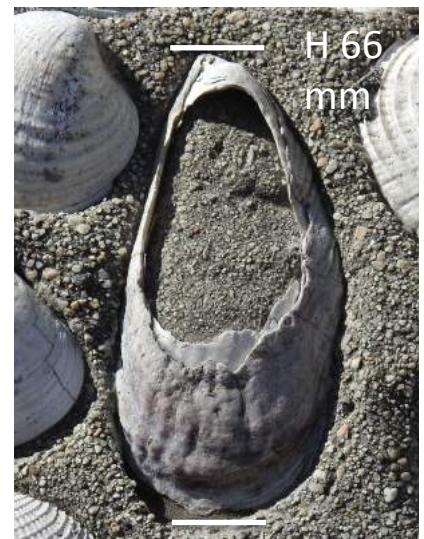
**Distribution:** Quite uncommon on the WT, with one major exception – a group of 75-80 shells embedded with interior facing the observer on South Wall interior post 4. We are aware of only one other shell of *M. californianus* the WT, on South Wall interior post 19.



South Wall  
interior post 4

South Wall  
interior post 19

South Wall  
interior post 4





## *Panopea generosa*

**Common name:** Pacific Geoduck

**Geographic range:** Kodiak Island to Magdalena Bay, Mexico.

**Habitat:** Very deeply buried in sand or mud, usually in bays but also found offshore.

**Characteristics:** Length to 200 mm. Rectangular shape, rough commarginal ribs, truncate on one end.

**Distribution:** We observed only a single shell of *P. generosa* on the WT, on the east-most spire of the Ship.



Ship, east-most spire

## *Penitella* sp.

**Common name:** Piddocks

**Geographic range:** N/A

**Habitat:** Like datemussels (*Lithophaga* sp.), piddocks bore holes into solid substrata like sedimentary rock (like that pictured below). They can be found intertidally or subtidally, depending on the species.

**Characteristics:** The circular boreholes with smooth-walled, cylindrical burrows visible in the pictures below are characteristic of pholads. The shells present in some of the holes are likely those of a nestling clam, *Petricola carditoides*. Note that these chunks of bored stone can be difficult to distinguish from stone bored by *Lithophaga* sp. Lithophagine burrows are typically lined by calcium carbonate; piddock burrows are not.

**Distribution:** Pholad-bored rock can be found in two places on the WT, including the Pinnacles on the interior of the South Wall, and the main level of the A Tower.

South Wall interior  
between posts 16  
and 17 (Pinnacles)



South Wall interior  
between posts 16  
and 17 (Pinnacles)





## *Psammotreta obesa*

**Common name:** California Fat Tellin

**Geographic range:** Point Conception, CA to Bahia Magdalena, Mexico.

**Habitat:** Deeply buried in sand subtidal on wave-exposed coasts.

**Characteristics:** Posterior dorsal margin of shell set off by prominent radial fold.

**Distribution:** We know of only two shells of *P. obesa* on the WT. One is embedded in the South Wall interior between posts 20 and 21 (this specimen is pictured below); the other is on an overhead support linking the Ship to the South Wall.

South Wall interior between posts 20 and 21





***\*Saxidomus gigantea***

**Common name:** Washington Butterclam

**Geographic range:** Seward Peninsula, AK to Capitola, CA (though Coan et al. [2000] note that one museum specimen is labeled as from San Pedro, CA).

**Habitat:** Deeply buried in mud or sandy mud in protected bays.

**Characteristics:** Length to 136 mm. Inflated; fine, closely spaced, irregular commarginal ribs.

**Distribution:** We know of only two shells of *S. gigantea* on the WT. Both are located on the North Wall interior panel between posts 9 and 10, and they are adjacent to each other. One of them is pictured below; the other can be found immediately above this one.

North Wall interior between posts 9 and 10





## *Saxidomus nuttalli*

**Common name:** California Butterclam

**Geographic range:** Humboldt Bay, CA, to Punta Rompiente, Mexico.

**Habitat:** Deeply buried in mud or sand of bays and lagoons.

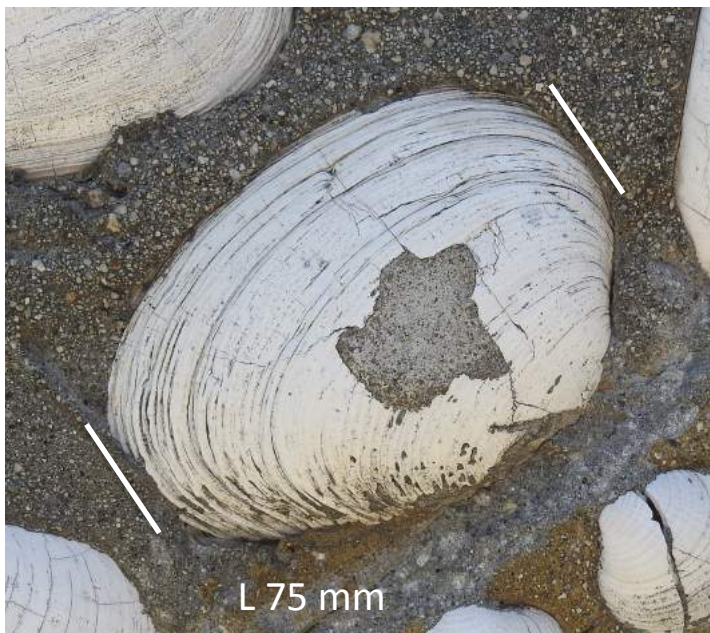
**Characteristics:** Length to 150 mm. Shell exterior with closely spaced, regular commarginal ribs that are more prominent towards the posterior end of the shell.

**Distribution:** Shells of *S. nuttalli* are rare on the WT. None are present on the South Wall, but at least one can be found on the North Wall interior panel between posts 9 and 10. Another can be found on rib 7 of the Gazebo. A shell that is likely that of *S. nuttalli* can be found on west side of the House Chimney.

Gazebo Rib 7 interior



North Wall interior between posts 9 and 10



## *Semele decisa*

**Common name:** Clipped Semele

**Geographic range:** Point Arguello, CA, to San Felipe, Mexico.

**Habitat:** Wave-exposed coast, intertidal or subtidal, in sand or gravel.

**Characteristics:** Truncate posterior end, and heavy commarginal folds and grooves. The heavy sculpture differentiates it from the shell of *Psammotreta obesa*, which is otherwise similar in shape.

**Distribution:** We know of only a single shell of *S. decisa* on the WT, on the North Wall interior between posts 9 and 10.



North Wall  
interior  
between posts  
9 and 10



## *Tagelus californianus*

**Common name:** California Tagelus

**Geographic range:** Humboldt Bay, CA, to Costa Rica.

**Habitat:** Deeply buried in mud and sand of protected bays.

**Characteristics:** Length to 130 mm. Elongate shell. The shell below is at least 65 mm long, suggesting that it is likely *T. californianus*; a plausible alternative is *T. affinis*, which is only known to reach 60 mm in length.

**Distribution:** We know of only two *Tagelus* shells on the WT: one on the middle ring of the A Tower, and one on the central column of the East Tower.



A Tower  
middle ring

## *Tivela stultorum*

**Common name:** Pismo Clam

**Geographic range:** Stinson Beach, CA, to Bahia Magdalena, Mexico.

**Habitat:** Near surface of wave-exposed sandy beaches.

**Characteristics:** Heavy shell, roughly triangular in shape. Exterior of shell with smooth surface, often cream to brownish colored (though specimens in WT are often bleached from the sun).

**Distribution:** One of the most common bivalves on the WT; specimens are found on most major structures. The Ship in particular bears many shells of *T. stultorum*, including a ring of shells (all heavily damaged) encircling its level one. Small shells of *T. stultorum* are often found in arrays of *Chione* spp. and *Argopecten ventricosus* on both sides of the South Wall. All of the towers bear some *T. stultorum*.

Ship, east-most spire



South Wall exterior between posts 19 and 20





## *Trachycardium quadragenarium*

**Common name:** Spiny Pricklycockle

**Geographic range:** Monterey, CA, to Punta Rompiente, Mexico.

**Habitat:** Shallowly buried in bays or offshore, in sand or mud.

**Characteristics:** Sculpture of strong radial ribs with small thorn-like spines. The spines are strongest on the ventral part of the shell as well as anteriorly and posteriorly (several of these spines can be seen on the specimen pictured).

**Distribution:** We know of only a single shell of *T. quadragenarium* on the WT. It is found in an array of *Chione* spp., small *Tivela stultorum*, and *Argopecten ventricosus* on the South Wall interior panel between posts 19 and 20.

South Wall interior between posts 19 and 20



## *Tresus nuttalli*

**Common name:** Pacific Gaper

**Geographic range:** Kodiak Island, AK, to Bahia Magdalena, Mexico.

**Habitat:** Very deeply buried in mud in wave-protected habitats like bays.

**Characteristics:** Posterior end longer than anterior, with a noticeable gape at the posterior end.

**Distribution:** We have identified only one shell of *T. nuttalli* on the WT. It can be found on the North Wall interior panel between posts 9 and 10.

North Wall interior between posts 9 and 10





## **GASTROPODA**

### **Snails**

## *Cerithideopsis californica*

**Common name:** California Horn Snail

**Geographic range:** Bolinas Bay, CA to San Ignacio Lagoon, Mexico.

**Habitat:** Crawling on surface of intertidal mud in bays and estuaries.

**Characteristics:** Height to 45 mm. High-spired shell, with prominent axial ribs.

**Distribution:** We know of only a single shell of *C. californica* on the WT, on the lower part of the South Wall exterior panel between posts 15 and 16. The shell is quite eroded.

South Wall exterior panel between posts 15 and 16





## *Crossata* sp.

**Common name:** Frog Shell

**Geographic range:** N/A (if the California Frog Shell, *Crossata californica*, Monterey Bay to the Gulf of California, Mexico).

**Habitat:** N/A (if *C. californica*, in gravel pockets between rocks, or on subtidal sandy substrates).

**Characteristics:** Height to 130 mm. Large, solid shell, with spiral sculpture including some blunt nodes.

**Distribution:** Only a single specimen can be found on the WT, on the South Wall exterior post 11. The shell is highly eroded (or possibly purposefully ground down), revealing the columella.



South Wall  
exterior  
post 11

## *Haliotis cracherodii*

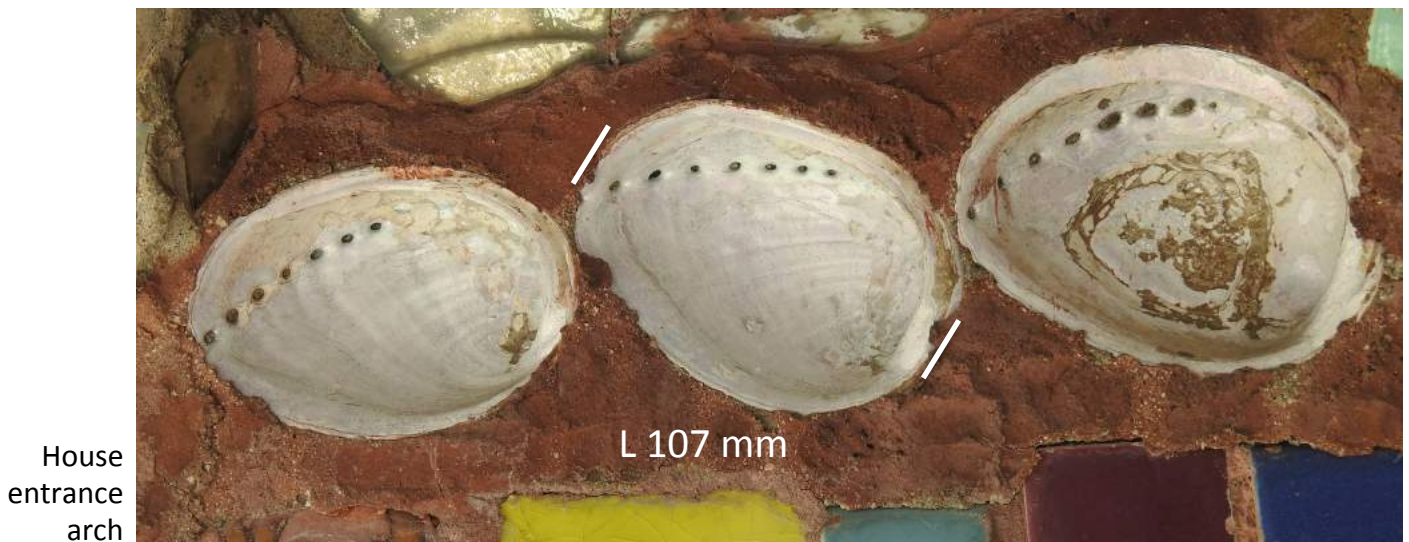
**Common name:** Black Abalone

**Geographic range:** Mendocino County, California to Cabo San Lucas, Mexico.

**Habitat:** Rock substrates in wave-exposed intertidal or subtidal zones.

**Characteristics:** Length to >200 mm. Intact abalone shells are easily identified by the row of holes in the shell. Fragments of shells (very common on WT) are easily identified if oriented interior facing the observer, as the interior is lined with iridescent nacre. This layer is sometimes faded in WT fragments.

**Distribution:** We know of only six intact shells, three on the South Wall interior above the Front Gate, and three on the canopy over the House front door. These are *H. cracherodii*. There are many fragments of abalone shells on WT; these may be *H. cracherodii*, or may be from other species (e.g., green abalone, *H. fulgens*).





***\*Lobatus gigas***

**Common name:** Queen Conch

**Geographic range:** Western Atlantic coasts of North and South America.

**Habitat:** In seagrass beds on sand.

**Characteristics:** Height to 350 mm. Solid, coiled shell with heavy protruding knobs.

**Distribution:** Only one shell of *L. gigas* is present on the WT, on the South Wall exterior panel between post 26 and the Garage Gate.



South Wall exterior  
panel between post  
26 and the Garage  
Gate

## *Megastraea undosa*

**Common name:** Wavy Turban Snail, Wavy Top Snail

**Geographic range:** Point Conception, CA, to Isla Asuncion, Mexico.

**Habitat:** Crawling on surface of rocky substrates on wave-exposed shores.

**Characteristics:** Diameter to 110 mm. Shell sculptured with wavy ridges and nodules.

**Distribution:** We know of only one shell of *M. undosa* on the WT. It is located on the central pinnacle of the Pinnacles (South Wall interior), about 1/3 of the way up from its base to its top.



South Wall  
interior, central  
pinnacle of  
Pinnacles



## *Megathura crenulata*

**Common name:** Giant Keyhole Limpet

**Geographic range:** Monterey Bay, CA to Asuncion Island, Mexico.

**Habitat:** Crawling on surface of wave-exposed rocky intertidal.

**Characteristics:** Length (of shell) to 130 mm. Large apical “keyhole”. Fine, closely spaced ribs from keyhole to edge of shell on its exterior surface; the interior of the shell is smooth.

**Distribution:** We know of two *M. crenulata* on the WT. The easiest to see is embedded dorsal up (shell ribs visible) on rib 7 of the Gazebo (bottom picture). The other can be found embedded dorsal down (interior of the shell facing the observer) on inner surface of the east-most vertical support of the A Tower (top picture).

A Tower, inner  
side of east-most  
vertical support



Gazebo, Rib 7

***\*Melongena corona***

**Common name:** Florida Crown Conch

**Geographic range:** Florida to South America.

**Habitat:** Crawling on the surface of sand and mud in bays.

**Characteristics:** Coiled shell with distinct flattened whorls, spines on edges of whorls.

**Distribution:** Only a single shell of this species is found on the WT, on the South Wall exterior between posts 16 and 17. The shell is highly eroded, revealing the columella.



South Wall  
exterior,  
between posts  
16 and 17



## *Nassarius fossatus*

**Common name:** Channeled Nassa

**Geographic range:** Vancouver Island, Canada, to San Ignacio Lagoon, Mexico.

**Habitat:** Crawling on and in mud and sand in bays and lagoons.

**Characteristics:** Height to 47 mm. Closely-spaced spiral ridges. Deep groove around the base of the shell.

**Distribution:** We know of only a single, fairly damaged shell of *N. fossatus* on the WT, located on the base of the south side of the House chimney. The shell is very eroded.



House  
Chimney,  
south side

## *Neverita reclusiana*

**Common name:** Southern Moon Snail

**Geographic range:** Mugu Lagoon, CA, to Mazatlan, Mexico.

**Habitat:** Crawling under the surface of sand or mud in bays and lagoons.

**Characteristics:** Diameter of shell to 70 mm. Few whorls. The most characteristic features of this species are, in the specimens found in WT, always embedded in the mortar.

**Distribution:** *N. reclusiana* are fairly uncommon on the WT, and always embedded with the apex of the shell facing the observer. They can be found on the NE side of the lowest ring of the A Tower; on the Gazebo, on ribs 6 and 12, and on the entry arch; and on the East Tower, on the inner ring of supports, three loops up, on the SW side.

Gazebo Rib  
6, interior



Gazebo entry  
arch, interior





## *Thylacodes squamigerus*

**Common name:** Scaled Worm Snail

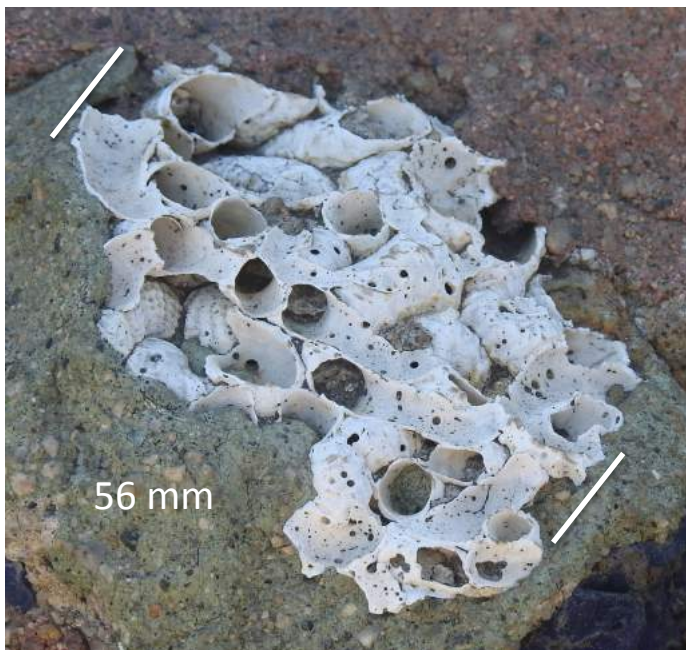
**Geographic range:** Monterey Bay, CA, to Punta Abreojos, Mexico.

**Habitat:** Cemented to hard substrates (rocks, wharf pilings) in protected or wave-exposed habitats.

**Characteristics:** Diameter of individual shells to 12 mm; length of individual shells to 125 mm. Occur in aggregations of irregularly coiling tubes cemented to hard substrates.

**Distribution:** Small aggregations of *T. squamigerus* are scattered throughout the WT. Some can be found on the South Wall interior (e.g., on the panel between posts 16 and 17, and on post 17), the North Wall interior (between posts 12 and 14), the main level of the A Tower, the NE side of the base of the West Tower, the central column of the Center Tower, and on the east-most spire of the Ship.

A Tower, west side



South Wall interior between posts 16 and 17 (Pinnacles)

