

**Illustrated Keys to the chitons (Polyplacophora)**  
**by Aaron Baldwin**

The class Polyplacophora is one of the most primitive groups of mollusks. Chitons are unique in having eight shells called plates surrounded by a cartilaginous girdle. It is thought that the eight shells of chitons evolved from fused spicules such as those found in the tunic of Aplacophorans. While all species of chiton today have eight shells, the ancestral condition was probably seven. Evidence for this comes from the fact that the earliest known chiton fossils appear to have only seven “plates” and because the tail plate in chitons develops embryologically much later than the first seven.

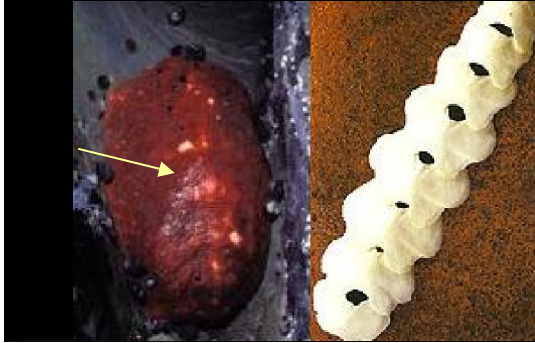
Intertidal chitons tend to remain under rocks during the daytime but become active at night. This is especially true for those species that occur in warmer climates. Amazingly, chitons have “eyes” on the tops of their shells. Some chitons have as many as 11,000 tiny little light receptors! It is possible that they use these to tell day from night. It is also likely that they are used in a fashion similar to the eyes of sea stars for detecting shadows passing over them so that they can clamp tightly to the substrate.

Most chitons are able to cling tightly to rocks. This bond is so tight that a chiton’s shells may break before letting go. When collecting chitons, a thin, dull knife is usually slipped quickly between the chiton and the substrate. The blade is inserted under the posterior end of the chiton where the chiton often lifts the edge of its girdle. Another defense chitons use is the ability to roll into a tight ball when dislodged. It is best quickly to place a collected chiton inside of a box with tight fitting sponges or tie the chiton to a flat board before the chiton can roll.

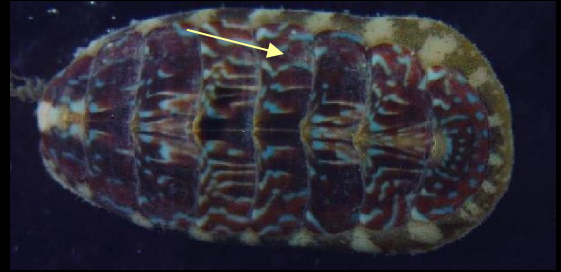
These keys were created originally to supplement the book Tom Rice and I are co-authoring, a 2<sup>nd</sup> edition of his 1972 *Marine Shells of the Pacific Northwest*. In the more final versions of those keys I included only those species common to southeastern Alaska. The decision was made to not include keys in that work, but the possibility of later publishing them as a supplement. I recently updated the keys and added some species not commonly found in Alaska but often seen in British Columbia and further south. These keys are free to use and distribute without charge, provided my name remains attached to them. If any other use is desired (as well as comments or reporting errors and suggestions) please contact me at [ftapb1@uaf.edu](mailto:ftapb1@uaf.edu) or [aaron\\_p\\_baldwin@yahoo.com](mailto:aaron_p_baldwin@yahoo.com).

**Key to the Class Polyplacophora**

**1**



**1a)** Girdle completely covering plates. Plates are white and butterfly-shaped. Commonly exceeding 4" (10 cm) in length, and often 8" (20 cm) or more.  
*Cryptochiton stelleri* (Middendorf, 1847)



**1b)** Girdle not covering plates completely, usually less than 4" (10 cm)

**Go to 2**

**2**



**2a)** Girdle smooth and shiny, dark brown or black. Girdle covers all but medial portion of plates  
*Katherina tunicata* (Wood, 1815)



**2b)** Girdle smooth, scaly or hairy, not covering lateral areas of plates

**Go to 3**

**3**



**3a)** Girdle appearing smooth due to spicules or granules being microscopic in size.

**Go to 4**

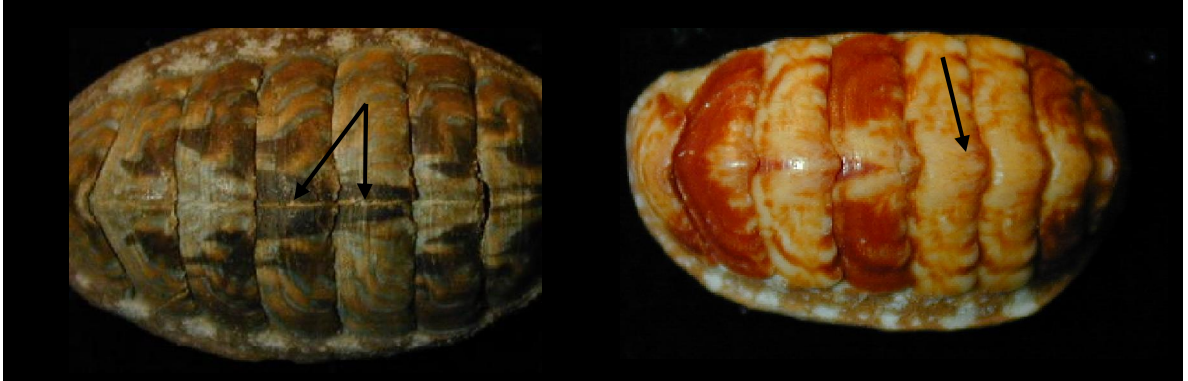


**3b)** Girdle with hairs, scales or spicules such that it does not appear smooth. Spicules may be small (choice 11 a) or hairs very fine and/or sparse (choices 23a & b, 20a, 21b)

**Go to 11**

**Key to the Class Polyplacophora (cont'd)**

**4**



**4a)** Plates 2-7 split down mid-line by cartilage-like tissue (This may be difficult to see on dorsal side, easily seen by magnification)

*Schizoplax brandtii* (Middendorf, 1847)

**4b)** Plates 2-7 not split down midline.

**Go to 5**

**5**



**5a)** Medial portions of plates with many rows of very fine, white or light yellow colored wavy lines, rest of plate nearly solid red-brown to black. Girdle commonly green with yellow or orange markings in the form of small dots

*Tonicella insignis* (Reeve, 1847)

**5b)** Medial portion of plates solid or without wavy white lines. Girdle variable in color.

**Go to 6**

**6**



**6a)** Girdle with granules easily visible with low magnification. Coloration variable but not commonly with orange, pink and red dominant color of plates. Genus *Lepidochitona*.

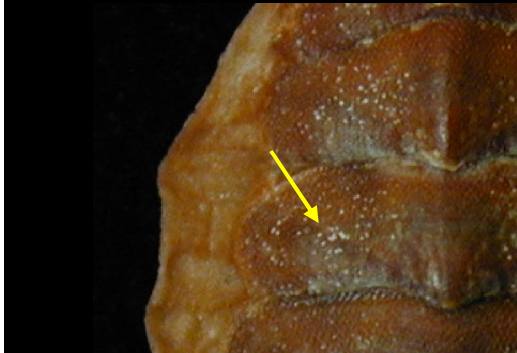
**Go to 7**

**6b)** Girdle with granules very small, visible under higher magnification. Coloration variable but often with orange, pink and/or red on plates and often with pattern of closely-spaced lines.

**Go to 8**

**Key to the Class Polyplacophora (cont'd)**

**7**

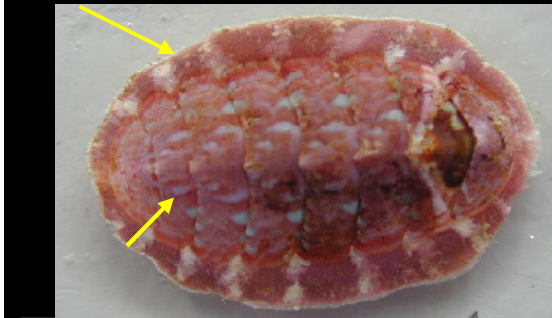


**8a)** Lateral areas of plates with dense granules. Plates not typically eroded. Plate coloration commonly including blue flecks. Girdle with alternating light and dark bands, usually with numerous tiny white dots. Low to mid intertidal.  
*Lepidochitona dentiens* (Gould, 1846)



**7b)** Lateral areas of plates with granules spaced apart. Plates often highly eroded. Plate coloration dark. Girdle may be spotted but lacking light and dark bands. High intertidal zone.  
*Lepidochitona fernaldi* Eernisse, 1986

**8**



**8a)** Color pattern of lateral areas of plates typically consisting of white or off-white flecks, stripes, and/or chevron-shaped marks. Lacking any dark stripes. Girdle pink with radiating white stripes and/or tiny white dots. Rarely exceeding 1.5 cm.  
*Tonicella venusta* Clark, 1999



**8b)** Color pattern of lateral areas of plates typically with distinct striped, these often dark colored. Girdle variable but usually not with white stripes and tiny dots (but see choice 9a). Often exceeding 2 cm.

**Go to 9**

**9**



**9a)** Head plate without concentric pattern of lines. Rarely exceeding 2.5 cm. Girdle similar to choice 8a in having white stripes and tiny white dots but differs in having dark coloration on plates.  
*Boreochiton berengensis* (Yakovleva, 1952)

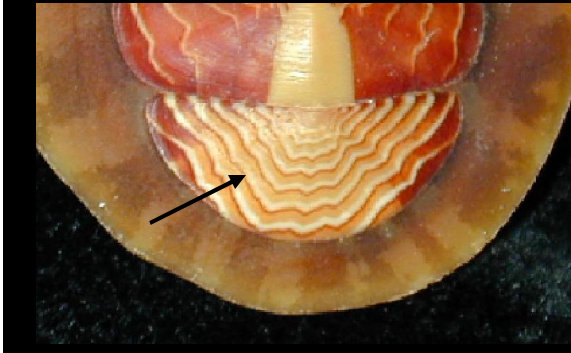


**9b)** Head plate nearly always with concentric pattern of parallel lines which may be red, maroon, white, black, etc.

**Go to 10**

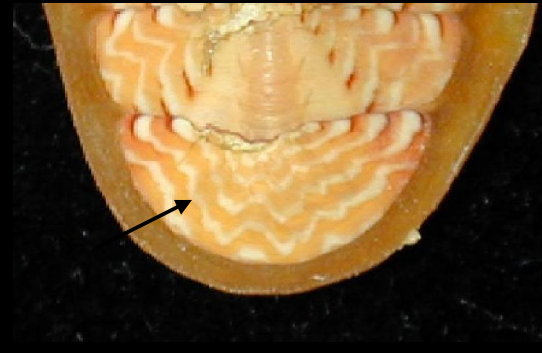
**Key to the Class Polyplacophora (cont'd)**

**10**



**10a)** Head plate with dark brown or red-brown lines bordering concentric lines. Usually without electric blue stripes on plates when alive. Abundant mid intertidal species

*Tonicella lineata* (Wood, 1815)



**10b)** Head plate with zigzag white (may be blue when alive) concentric lines without a dark border. Commonly with bright electric blue stripes and flecks when alive. Common low intertidal and shallow subtidal species.

*Tonicella undocaerulea* Sirenko, 1973

**11**



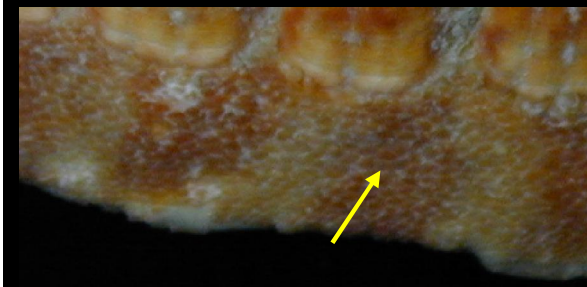
**11a)** Girdle with minute, transparent spicules. Color of plates and girdle white, usually stained yellow or rust. Found on undersides of rocks that are buried in somewhat anoxic environments. Rarely exceeding 1 cm. *Leptochiton rugatus* (Carpenter, 1892)



**11b)** Girdle with distinct hairs (may be very fine or sparse) or distinct overlapping snake-like scales.

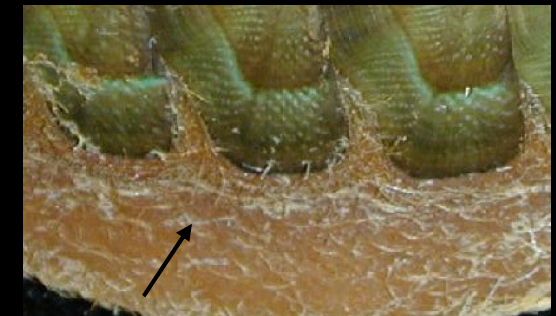
**Go to 12**

**12**



**12a)** Girdle with snake-like overlapping scales. Family Ischnochitonidae.

**Go to 13**



**12a)** Girdle with distinct hairs, although these may be fine (see choices 23a and 23b) and/or sparse (see choices 18a, 20a, and 21b)

**Go to 18**

Key to the Class Polyplacophora (cont'd)

13

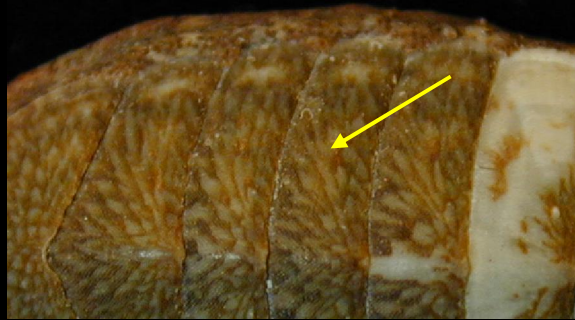


**13a)** Color of plates and girdle solid white or off-white (plates may be encrusted with black marl that can be picked off). Uncommon species only found deeper than 150 meters, and more often below 500 meters. *Lepidozonia abyssicola* (Smith and Cowan, 1966)

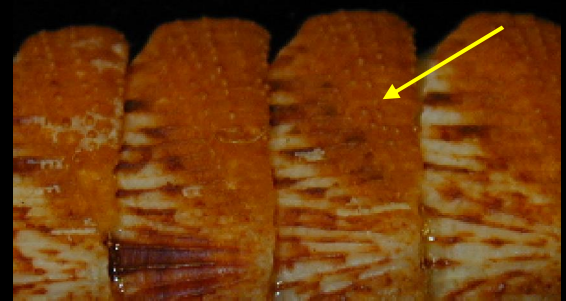


**13b)** Color of plates variable, but not commonly white. In rare albinistic specimens that may be white, there are commonly stripes or bands of a different color present as well. Includes common intertidal and shallow subtidal species  
**Go to 14**

14

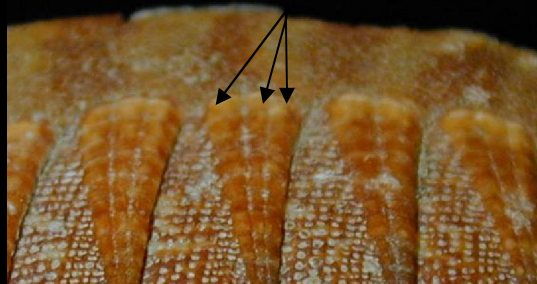


**14a)** Sculpture on plates 2-7 so minute as to be not readily visible to the naked eye. Microscopic examination reveals the presence of tiny pustules on central areas  
*Lepidozonia interstincta* (Gould, 1852)

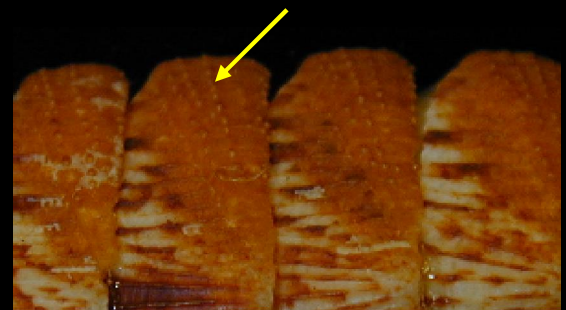


**14b)** Sculpture on plates 2-7 may be somewhat fine but readily visible to the naked eye. Sculpture of central areas consists of delicate pits or raised longitudinal ribs.  
**Go to 15**

15



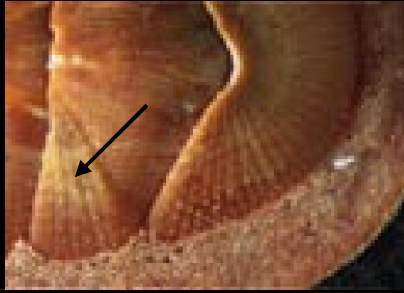
**15a)** Lateral areas of plates 2-7 with three very wide, flat ribs. Central area pitted.  
*Lepidozonia trifida* (Carpenter, 1864)



**15b)** Lateral area of plates 2-7 with rows of tubercles, pustulate or knobby ribs, or multiple (more than three) very fine ribs  
**Go to 16**

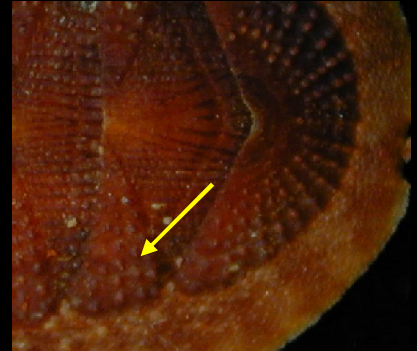
Key to the Class Polyplacophora (cont'd)

16



16a) Lateral area of plates 2-7 with raised, tubercled ribs, these may be very fine. Central area with delicate pits

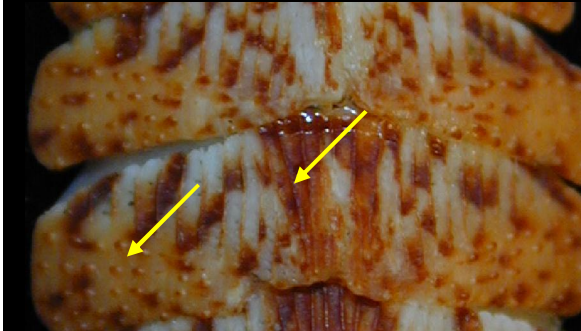
*Lepidozona willetti* (Berry, 1917)



16b) Lateral area of plates 2-7 with rows of tubercles only (no raised rib). Central area either pitted or with longitudinal ridges

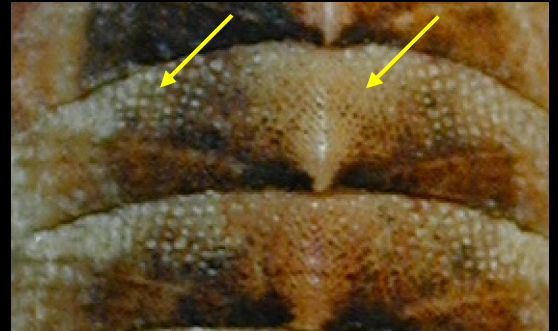
Go to 17

17



17a) Central area of plates 2-7 with strong, longitudinal ridges. Lateral area of plates 2-7 with rows of fine hemispherical nodules. Common intertidal species. Sometimes a very bright violet color, especially around the Sitka area.

*Lepidozona mertensii* (Middendorff, 1847)



17b) Central area of plates 2-7 with rows of delicate pits. Lateral area of plates 2-7 with rows of almost pointed granules. Uncommon low intertidal and subtidal species.

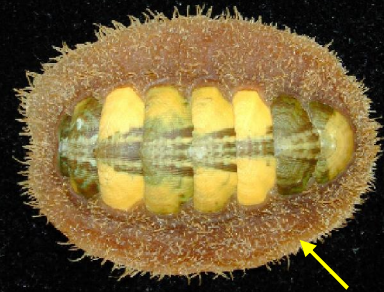
*Lepidozona retiporosa* (Carpenter, 1864)

18



18a) Girdle with granules as well as hairs. Few long hairs extend posteriorly. Hairs present only opposite the sutures of the plates. Hairs long and curved, with row of comb-like short bristles on one side.

*Dendrochiton flectens* (Carpenter, 1864)



18b) Girdle without granules. Hairs either covering entire surface of girdle or restricted to anterior-most portion of girdle. Family Mopaliidae

Go to 19

Key to the Class Polyplacophora (cont'd)

19



**19a)** Anterior margin of girdle elongated into a flap-like structure that is at least half again as wide as rest of girdle. Girdle hairs very sparse and may be restricted to anterior margin of girdle. Genus *Placiphorella*.

Go to 20

**19b)** Girdle more or less a uniform width around chiton. Outline of plates distinctly elongate oval. Girdle hairs variable but most often covering all of girdle. Genus *Mopalia*.

Go to 22

20



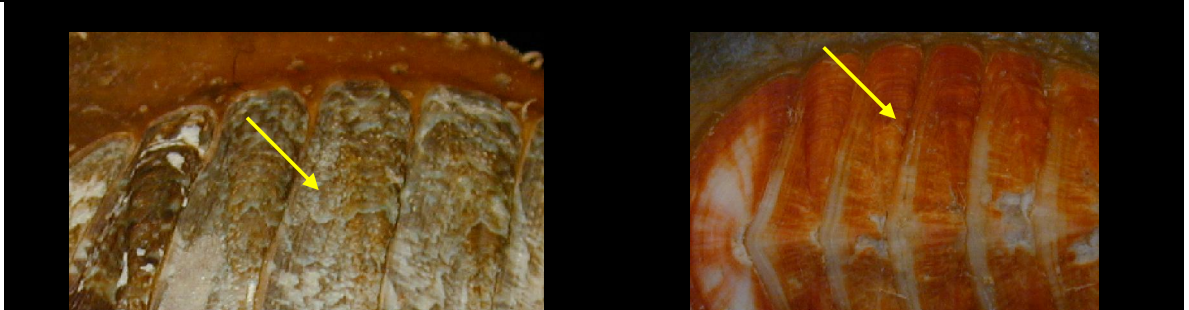
**20a)** Plates a uniform white or off-white (may have dark staining that flakes off). Inhabiting very deep water, usually below 300 meters.

*Placiphorella pacifica* Berry, 1919

**20b)** Plates with mottled color or solid orange, red, brown, etc. but not white.

Go to 21

21



**21a)** Plates usually mottled with several colors, nearly always including olive green. Girdle tends to have abundant, thick hairs. Common intertidal species.

*Placiphorella velata* Dall, 1879

**21b)** Plates usually orange or red, with mottling limited to white or brown and not olive green. Girdle hairs very sparse and often limited to anterior margin of girdle. Common subtidal species.

*Placiphorella rufa* Berry, 1917



Key to the Class Polyplacophora (cont'd)

22



22a) Girdle sometimes appearing naked because of the small size of the hairs. Hairs are sparse and very fine. Length of hairs under 2 mm in length.

Go to 23



22b) Girdle obviously hairy. Hairs may be short and fine, but are profuse and usually over 2 mm in length.

Go to 24

23



23a) Girdle commonly flesh or tan colored, occasionally with alternating tan and brown stripes. Valves obviously sculptured. Girdle hairs usually about 0.5 mm in length. Color highly variable, but rarely forest green.

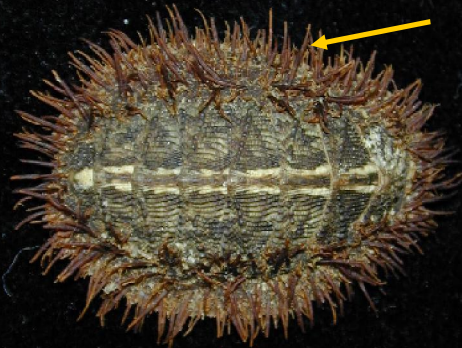
*Mopalia swanii* Carpenter, 1864



23b) Girdle usually brown in color. Valves very smooth, without obvious sculpturing. Girdle hairs usually between 1-2 mm in length. Color of plates commonly mottled forest green with red or white patches.

*Mopalia vespertina* (Gould, 1852)

24



24a) Girdle hairs very dense, thick, and rubbery. Inside of valves nearly solid bright blue-green. Abundant in British Columbia and south, rare in SE Alaska.

*Mopalia muscosa* (Gould, 1846)

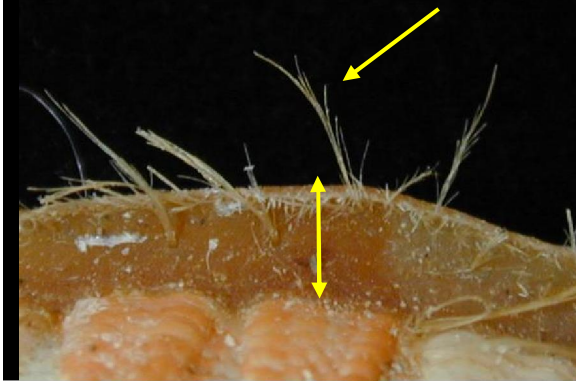


24b) Girdle hairs dense or not dense but never very thick, stiff or rubbery. Inside of valves variable but not usually bright blue-green (most often white). Includes species throughout the range of these keys

Go to 25

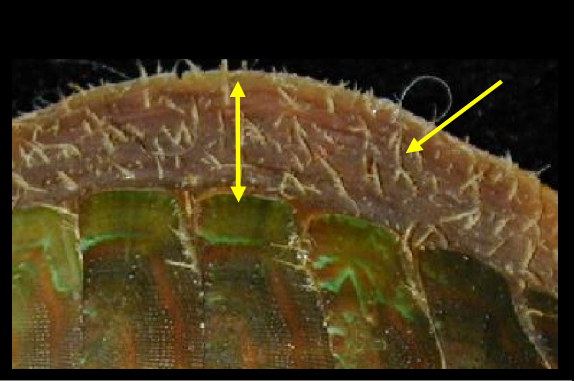
Key to the Class Polyplacophora (cont'd)

25



25a) At least some girdle hairs as long as girdle is wide. In some species the girdle hairs are as long as half of the width of the entire chiton (Caution: in dried specimens girdle may shrink, width refers to living or wet specimens).

Go to 26



25b) No girdle hairs as long as the girdle is wide.

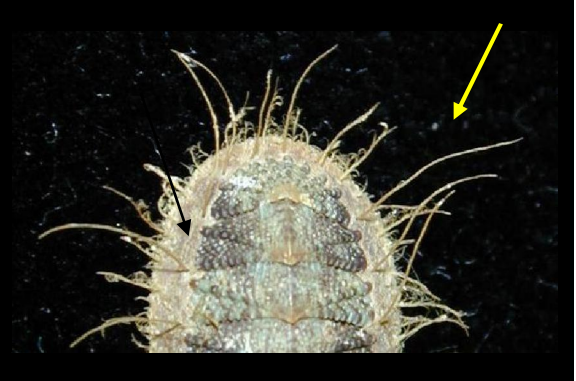
Go 28

26



26a) Longest girdle hairs as wide as girdle or only slightly longer. Tufts of girdle hairs resemble egret feathers. Rare subtidal species

*Mopalia egretta* Berry, 1919



26b) Longest girdle hairs half the width of the entire chiton or longer. Includes uncommon intertidal species

Go to 27

27



27a) Longest girdle hairs may be half as long as entire chiton. Girdle hairs with sparse, irregular spines. Central areas finely cancellate. Lateral area well defined by a row of very large pustules

*Mopalia cirrata* Berry, 1919



27b) Longest girdle hairs approaching half as wide as entire chiton. Girdle hairs appearing feather-like due to many fine spines. Central areas pitted. Lateral area well defined by a heavy rib.

*Mopalia sinuata* Carpenter, 1864

**Key to the Class Polyplacophora (cont'd)**

**28**



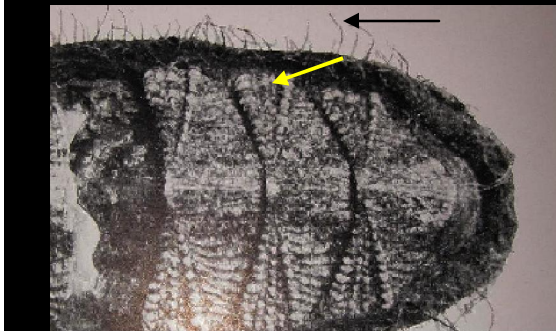
**28a)** Head valve with ten radiating ribs (or rows of pustules forming rib) that are about as wide as the space in between them. Includes uncommon species.

**Go to 29**

**28b)** If ribs are present on head valve, they are much smaller than the spaces in between them. Includes common intertidal species.

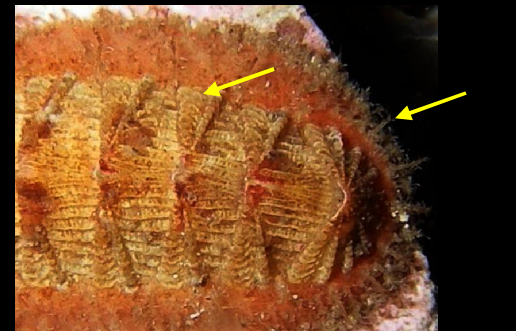
**Go to 30**

**29**



**29a)** With 2-3 smaller ribs in between the large rib that defines the lateral area of plates 2-7 and the large rib that defines posterior margin of plates 2-7. Girdle hairs only sparsely branched. Rare, subtidal species.

*Mopalia phorminx* Berry, 1919



**29b)** Without 2-3 smaller ribs in between the large rib that defines the lateral areas of plates 2-7 and the large rib that defines the posterior margin of plates 2-7. Girdle hairs short but heavily branched. Uncommon intertidal species

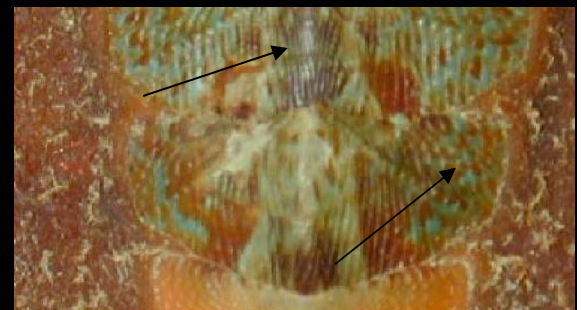
*Mopalia imporcata* Carpenter, 1864

**30**



**30a)** Plates 2-7 with rows of longitudinal pits on central areas. Girdle often dark brown or gray with tiny yellow or tan dots. Plates typically dark green (rarely yellow or white) and covered with feather-like pattern of dark lines.

*Mopalia lignosa* (Gould, 1846)

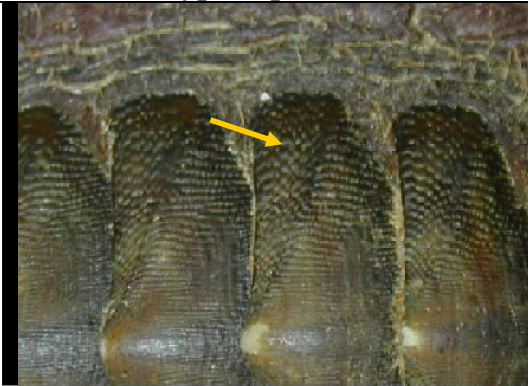


**30b)** Plates 2-7 with pustules, ridges, or both on central areas. Plates variable in color but not olive green with feather-like pattern of dark lines.

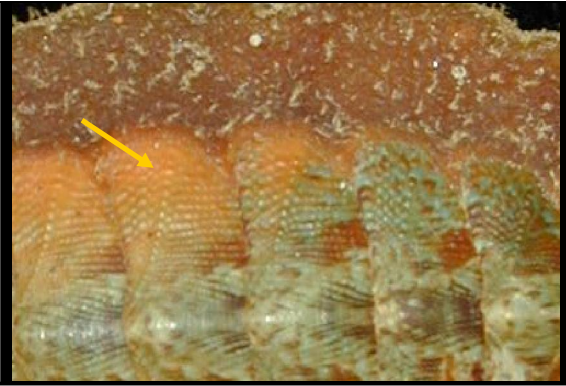
**Go to 31**

**Key to the Class Polyplacophora (cont'd)**

**31**



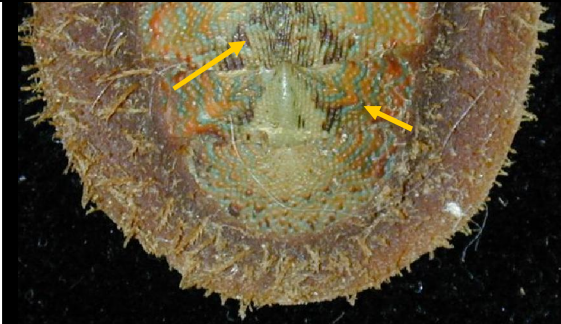
**31a)** With a distinct crosshatched “basket-weave” pattern on plates 2-7. Girdle very wide, sometimes nearly as wide as width of plates. Plates often a solid dark green brown, gray, or nearly black. Plates sometimes bicolored with white.



**31b)** Without crosshatched “basket-weave” pattern. Girdle not exceptionally wide. Color highly variable, but most often multi-colored and usually including green, white, yellow, brown, and often red and blue.

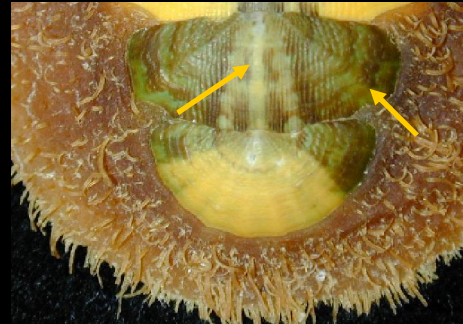
**Go to 32**

**32**



**32a)** Central area of plates 2-7 pitted in longitudinal rows. Girdle commonly banded light orange and brown. Nearly always with bright turquoise zigzag markings

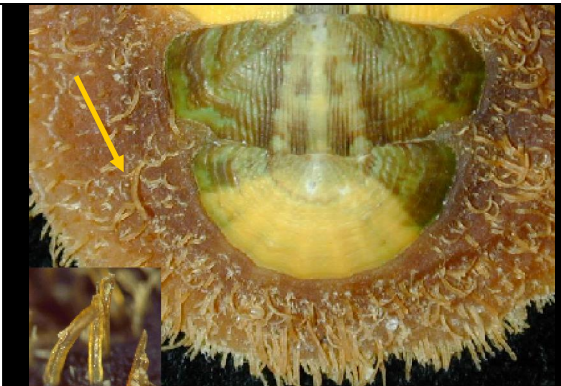
*Mopalia spectabilis* Cowan and Cowan, 1977



**32b)** Central areas of plates 2-7 with longitudinal ridges. Girdle commonly light to dark brown, but may be banded. Rarely with turquoise zigzag markings.

**Go to 32**

**33**



**33a)** Hairs on girdle short (about 3 mm) and strap-shaped (see inset), without abundant branches. Very common mid to upper intertidal species.

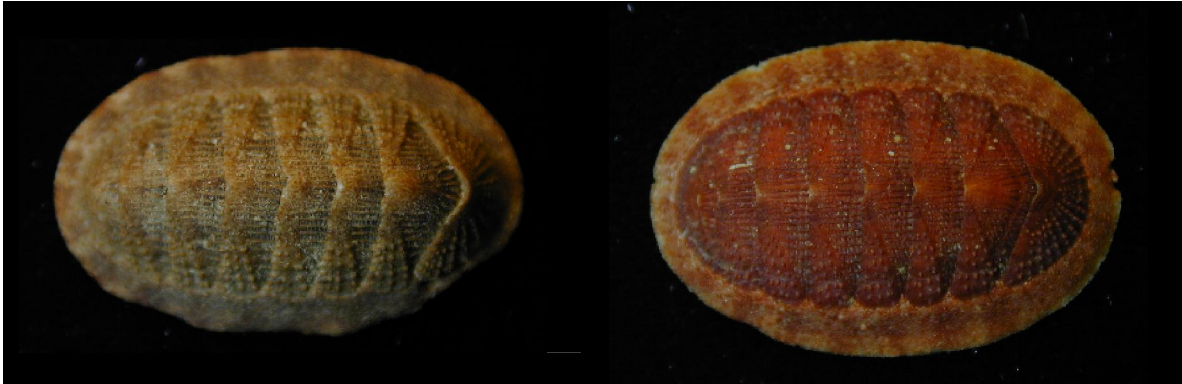
*Mopalia kennerleyi* Carpenter, 1864



**33b)** Hairs on girdle long (over 3 mm) and heavily branched, giving a mossy appearance. Common low intertidal and shallow subtidal species.

*Mopalia ferreirai* Clark, 1991

Additional: Steps leading to couplet 17a (*Lepidozона mertensii*) also lead to another species, *Lepidozона cooperi* Pilsbry, 1892, in British Columbia and further south. The two can be easily separated by the fact that the valves of *L. cooperi* are very high-peaked in profile:  $\wedge$  nearly as tall as wide while valves of *L. mertensii* are not as tall in profile about 1.5 times wider than tall:  $\wedge$ . Another difference is that the lateral areas of plates 2-7 of *L. cooperi* have pustules on slightly raised ribs while *L. mertensii* has pustules in rows but not on raised ribs. Finally, *L. cooperi* tends to gray or gray-green in color, while *L. mertensii* is commonly mottled orange, brown, red, or violet.



*Lepidozона cooperi* Pilsbry, 1892

*Lepidozона mertensii* (Middendorff, 1847)

Acknowledgements: Photo in couplet 29a (*Mopalia phorminx*) reproduced from Berry, 1919. Comprehensive dried collection of Eastern Pacific chitons for photographs were loaned by William “Beetle Bill” Smith. Roger Clark helped immensely through many hours of field time as well as aiding in difficult identifications. Thomas Rice reviewed drafts of this document and made many valuable suggestions.

#### References:

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