ISSN 0738-9388

The shallow water chiton fauna of the Salish Sea

Roger N. Clark
Research Associate, Santa Barbara Museum of Natural History
3808 Pinehurst Dr., Eagle Mountain, Utah 84005
insignis69@gmail.com

ABSTRACT The Salish Sea, encompassing the inland waters of Washington State, and southern British Columbia, Canada, has one of the richest chiton faunas in the world, with nearly 40 species to be found in the intertidal and shallow subtidal depths, with a few only found on the outer fringe of Salish Sea, not in the inland waters.

KEY WORDS Salish Sea, chitons, biogeography, biodiversity, mollusca

INTRODUCTION

The Salish Sea (Figure 1), comprises the inland waters of Washington State and southern British Columbia, including Puget Sound, the Strait of Georgia, the Haro Strait, Desolation Sound, and the Strait of Juan de Fuca. At the heart of the Oregonian biogeographical province (Briggs & Bowen, 2011) This region has one of the worlds' richest and most diverse chiton faunas, with 39 species in 6 families to be found from the intertidal zone to moderate diving depths (< 30 m).

This region is undoubtedly the most intensely investigated region in the world for chitons with many large colorful species. Many of these have been illustrated in popular works by Burghardt & Burghardt (1969), Rice (1972), Harbo (2011) and Lamb & Hanby (2005), however an up to date check list has been lacking, and the taxonomy has not been updated since Kozloff (1987). The present systematic arrangement is based largely on Eernisse, Clark & Draeger (2007), except that it follows Sirenko & Clark (2008) in recognizing the family Protochitonidae Ashby, 1825.

The fauna includes some interesting genera of the family Mopaliidae, including two species of the carnivorous *Placiphorella,* stealthy, ambush predators (McLean, 1962, Clark, 1994), and the gigantic *Cryptochiton stelleri* (Middendorff, 1847) the largest chiton species in the world, and the only species in which the girdle completely covers the valves. It is also the center of distribution for the tiny cryptic brooder *Cyanoplax fernaldi* (Eernisse, 1986) of the family Lepidochitonidae.

A checklist summarizing the distribution of species within the Salish Sea based on my own investigations, and examination of the collections at the Royal British Columbia Museum, the Burk Museum, Santa Barbara Museum of Natural History, Los Angeles County Museum of Natural History and the California Academy of Sciences is presented in Table 1.

Relative abundance is based on a single (3 hour) intertidal search or a single SCUBA dive, and is given as follows: very rare = 0-1, rare = 1-2, uncommon = 3-10, common = 11-20, abundant = more than 20. Some species normally occur in deeper water but have been included here if their occurrence has been verified by me from <

30 m depth. Likewise, I have included some species that are unknown from the inland waters of the Salish Sea but because this region is defined to include portions of more exposed coastline, of the outer portion of the Strait of Juan de Fuca, I have included them here but specify they are known only from more exposed habitats in the following species accounts.

SYSTEMATIC ACCOUNT

Class: Polyplacophora Gray, 1821
Subclass: Neoloricata Bergenhayn, 1955

Order: Lepidopleurida Thiele, 1909
Family: Leptochitonidae Dall, 1889
Genus: *Leptochiton* Gray, 1847
Leptochiton cascadiensis Sigwart & Chen, 2017
Leptochiton nexus Carpenter, 1864
Genus: *Hanleyella* Srirenko, 1973
Hanleyella oldroydi (Dall, 1919)
Family: Protochitonidae Ashby, 1825
Genus: *Deshayesiella* Carpenter [in Dall],1879
Deshayesiella spicata (Berry, 1919)

Order: Chitonida Thiele, 1909
Suborder: Chitonina Bergenhayn, 1930
Family: Chaetopleuridae Plate, 1899
Genus: *Chaetopleura* Shuttleworth, 1853
Chaetopleura gemma (Dall, 1879)
Family: Ischnochitonidae Dall, 1889
Genus: *Stenosemus* von Middendorff, 1847
Stenosemus albus (Linnaeus, 1767)
Genus: *Lepidozona* Pilsbry, 1892
Lepidozona cooperi (Suborder Carpenter [in Dall], 1879)
Lepidozona interstincta (Gould, 1852)
Lepidozona golischi (Berry, 1919)
Lepidozona radians (Carpenter, in Pilsbry, 1892)
Lepidozona mertensii (von Middendorff, 1847)
Lepidozona retiporosa (Carpenter, 1864)
Lepidozona willetti (Berry, 1917)

Genus: *Tripoplax* Berry, 1919
Tripoplax trifida (Carpenter, 1864)

Suborder: Acanthochitonina Bergenhayn, 1930
Family: Lepidochitonidae Iredale, 1914
Genus: *Cyanoplax* Pilsbry, 1892
Cyanoplax dentiens (Gould, 1846)
Cyanoplax fernaldi (Eernisse, 1986)
Family: Mopaliidae Dall, 1889
Genus: *Mopalia* Gray, 1847
Mopalia cirrata Berry, 1919
Mopalia egretta Berry, 1919
Mopalia ferreirai Clark, 1991
Mopalia hindsii (Reeve, 1847)
Mopalia imporcata Carpenter, 1864
Mopalia kennerleyi Carpenter, 1864
Mopalia lignosa (Gould, 1846)
Mopalia muscosa (Gould, 1846)
Mopalia phorminx Berry, 1919
Mopalia sinuata Carpenter, 1864
Mopalia spectabilis Cowan & Cowan, 1977
Mopalia swanii Carpenter, 1864
Mopalia vespertina (Gould, 1852)
Genus: *Dendrochiton* Berry, 1911
Dendrochiton flectens (Carpenter, 1864)
Dendrochiton semiliratus Berry, 1927
Genus: *Placiphorella* Dall, 1879
Placiphorella rufa Berry, 1917
Placiphorella velata Carpenter MS, Dall, 1879
Genus: *Tonicella* Carpenter, 1873
Tonicella insignis (Reeve, 1847)
Tonicella lineata (Wood, 1815)
Tonicella new sp., *cf. T. undocaerulea* Sirenko, 1973
Tonicella venusta Clark, 1999
Genus: *Katharina* Gray, 1847
Katharina tunicata (Wood, 1815)
Genus: *Cryptochiton* Middendorff, 1847
Cryptochiton stelleri (Middendorff, 1847)

ISSN 0738-9388

Figure 1. Map of Salish Sea.

SPECIES ACCOUNTS

Leptochiton cascadiensis Sigwart & Chen, 2017
(Plate 1, Figure 2; Plate 9, Figure 41)

Diagnosis. Very small chitons, to about 8 mm; valves whitish (often with orange or black mineral deposits), rounded, with longitudinal & radial rows of minute granules.
Habitat. Found on the bottoms of cobbles and boulders, as well as dead bivalve shells on muddy and sandy substrates from the mid-intertidal to depths of at least 50 m.
Distribution. Southeastern Alaska to Northern California.
Occurrence. Common to abundant, particularly along the Juan de Fuca Strait and in the San Juan Is., and Islands of the Georgia Strait. Less common elsewhere, rare or absent from the lower Puget Sound.
Comments. This small recently described species was previously confused with the more southern *Leptochiton rugatus* (Carpenter, in Pilsbry, 1892), found from central California to Baja California, Mexico.

Leptochiton nexus Carpenter, 1864
(Plate 1, Figure 3)

Diagnosis. Small chitons, 15-20 mm; valves brownish tones, with darker speckling;
rounded, with longitudinal & radial rows of minute granules; girdle with prominent, fine spicules.
Habitat. Found on the bottoms of cobbles, pebbles and dead bivalve shells resting on sand or mud substrates, at depths of 1-145 m, usually below 20 m in the Salish Sea.
Distribution. Kenai Peninsula, Alaska to The Sea of Cortez, Mexico.
Occurrence. Rare in the Salish Sea.
Comments. A larger, broader species than *L. cascadiensis.*

Haneyella oldroydi (Dall, 1919)
(Plate 1, Figure 4)

Diagnosis. Very small chitons, 6-8 mm; valves carinated & bearing minute pustules, whitish, (usually with black mineral deposits); girdle profusely covered with fine spicules.
Habitat. Found on pebbles and dead bivalve shells, on sand substrates at 30-450 m. Sometimes found on dead hexactinellid sponge skeletons in deeper depths.
Distribution. Sitka Sound, Alaska to Cabo San Quintin, Baja California, Mexico, and in the upper Sea of Cortez.
Occurrence. Rare in shallow (< 30 m) water, uncommon at deeper depths.
Comments. Known so far only from Desolation Sound and north of Nanaimo. Although I have

ISSN 0738-9388

not personally collected it in the Salish Sea, I have found it uncommonly at diving depths in southeastern Alaska, and at Monterey Bay, California.

Deshayesiella spicata (Berry, 1919)
(Plate 1, Figure 5)

Diagnosis. Moderately large chitons, 25-35 mm; uniformly brown in color, valves strongly "false beaked" (juga forward projecting); girdle with scattered, sharp spicules.
Habitat. Lives at 20-467 m on rocky and coral/sponge bottoms. In the northern extreme of its range this species lives on vertical rock walls with abundant sponges and corals at depths of 20-35 m.
Distribution. Vancouver, British Columbia to the Sea of Cortez.
Occurrence. Very rare, known so far in the Salish Sea from only two specimens (*leg.* Robert & Tammy Forsyth, 1995).

Chaetopleura gemma (Dall, 1879)
(Plate 1, Figures 6a-b)

Diagnosis. Small chitons, 10-20 mm; typically nearly uniformly green, black or orange, with a white striped black tail valve, sometimes mottled with other colors; valves with longitudinal and radial rows of minute pustules; girdle with fine, slender spicules.
Habitat. On tops or bottoms of cobbles, intertidal to 30 m or more.
Distribution. Moresby Island, B.C. to Baja California.
Occurrence. Uncommon to rare.
Comments. This species is very rare in the Salish Sea, but has been found at Port Gamble, WA, and near Victoria, B.C.

Stenosemus albus (Linnaeus, 1767)
(Plate 1, Figure 7)

Diagnosis. Small chitons, 10-15 mm; valves smooth except for growth lines; girdle pebbly appearing, scales cylindrical, juxtaposed; color solid white, usually with black mineral stains.
Habitat. On pebbles and dead bivalve shells resting on sand, silt or mud, 10-100 m (below 25 m in the Salish Sea).
Distribution. Arctic, circum-boreal, in the NE Pacific south to the Salish Sea.
Occurrence. Rare to uncommon.
Comments. May be confused with white specimens of *Lepidozona radians,* but distinguished by the unique, cylindrical girdle scales.

Lepidozona cooperi (Carpenter MS, Dall, 1879)
(Plate 1, Figure 8)

Diagnosis. Moderately large chitons, 30-40 mm; valves & girdle uniformly gray or dull green, carinated, central areas with longitudinal ribs, radial areas with rows of oblong tubercles; girdle with oval, convex, ribbed scales.
Habitat. Found on the bottoms of cobbles and boulders, intertidal to about 10 m.
Distribution. Vancouver Island to northern Baja California; outer straights of Juan de Fuca.
Occurrence. Common to abundant.

Lepidozona interstincta (Gould, 1852)
(Plate 1, Figures 9a-b)

Diagnosis. Small chitons, 15-25 mm; color shades of reddish-brown or pale orange with maroon and/or white markings, interior of valves white; valves smooth appearing, central areas radial areas with very faint riblets; girdle with small, slightly bent scales, with 10-12 riblets.
Habitat. On cobbles or dead bivalve shells, low intertidal to 60 m or more.

ISSN 0738-9388

Distribution. Cook Inlet, Alaska to at least southern Oregon.
Occurrence. Rare to common, particularly below 20 m.
Comments. Very similar to *Lepidozona radians,* (Plate 1, Figure 11a) but distinguished by the smaller scales and white interior of valves.

Lepidozona golischi (Berry, 1919)
(Plate 1, Figure 10a-b)

Diagnosis. Small, 20-25 mm; valves uniformly white, tan or pale orange, central areas with fine riblets, radial areas rather smooth (sometimes with 1-3 sulci), with a few scattered or incomplete rows of granules; girdle scales very small, with 14-16 fine riblets.
Habitat. Found on vertical rock walls, cobbles or shells, at 25-1400 m.
Distribution. Sitka, Baranof Island, Alaska to northern Baja California.
Occurrence. Very rare to rare. Most often obtained in deep water trawls.
Comments. I have taken a single specimen at 25 m on a wall, near Vancouver, British Columbia. Previously reported from Georgia Strait in deep water (217 m), by Cowan (1964).

Lepidozona radians (Carpenter in Pilsbry, 1892)
(Plate 1, Figure 11a; Plate 2, Figures 11b-e)

Diagnosis. Small chitons 20-30 mm; central areas microscopically pitted, radial areas with faint riblets; girdle with minute, roundly rectangular scales bearing about 12 fine striations; color vary variable, often streaked or speckled with olive, brown white, tan, blue and other colors, rarely solid white, interior of valves bluish.
Habitat. On bottoms of cobbles resting on or lightly buried in sand, low intertidal to 150 m.
Distribution: Sitka Sound, Baranof Island, Alaska to northern Baja California.
Occurrence. Rare to common, may be locally abundant.
Comments. Very similar to *L. interstincta*, (Plate 1, Figures 9a-b) but broader, and interior of valves bluish in color.

Lepidozona retiporosa (Carpenter, 1864)
(Plate 2, Figures 13a-d; Plate 9, Figure 45)

Diagnosis. Small, 10-15 mm (rarely to 20 mm); valves uniformly colored or mottle with reddish-brown, or orange tones, rarely cream; central areas finely pitted, radial areas with rows of fine (often obsolete) granules; girdle scales very small, with faint striations.
Habitat. On large cobbles, pebbles and dead bivalve shells, lowest intertidal to 1460 m.
Distribution. Cook Inlet, Alaska to southern Baja California Sur.
Occurrence. Very rare to uncommon intertidally, uncommon to common below 15 m.
Comments. This species is frequently dredged in deeper waters.

Lepidozona mertensii (von Middendorff, 1847)
(Plate 2, Figures 12a-e; Plate 9, Figures 44a-b)

Diagnosis. Moderately large chitons, 35-50 mm; valves carinated, variably colored, reddish, orange or purple tones, often speckled with white, rarely uniformly colored, or nearly uniform, with two white bands; central areas with strong longitudinal ribs and much weaker cross-ribbing, radial areas with rows of coarse rounded pustules; girdle scales large, convex, crowned with a short nipple.
Habitat. Found on the bottoms of cobbles and boulders, intertidal to 100 m.
Distribution. Cook Inlet to northern Baja California.
Occurrence. Common to abundant.

ISSN 0738-9388

Lepidozona willettii (Berry, 1917)
(Plate 2, Figures 14a-b)

Diagnosis. Small chitons, 25-30 mm; valves orange-brown, rarely with white markings; central areas with fine longitudinal riblets and finer cross-ribbing, radial areas with granule topped ribs, separated by sulci; girdle scales with 20-25 fine riblets, and crown with a striated nipple.
Habitat. Vertical rock walls, and cobbles resting on sand.
Distribution. Sitka Sound, Baranof Island, Alaska to northern Baja California, 20-275 m.
Occurrence. Rare to common, may be locally abundant.

Tripoplax trifida (Carpenter, 1864)
(Plate 3, Figures 15a-b)

Diagnosis. Moderately large 40-60 mm; valves mottled or maculated with orange, brown and white; central areas pitted, radial areas smooth, except for sulci; girdle scales large, smooth, bent.
Habitat. Vertical rock walls and boulders, intertidal to 110 m.
Distribution. Eastern Aleutian Islands to the Salish Sea.
Occurrence. Rare (intertidally) to common.
Comments. Previously listed as *Ischnochiton trifidus,* or *Lepidozona trifida.* Clark (2008b) raised the subgenus *Tripoplax* to full generic rank.

Cyanoplax dentiens (Gould, 1846)
(Plate 3, Figures 16a-d; Plate 9, Figure 43)

Diagnosis. Small chitons, 15-25 mm; valves evenly microgranular, variably colored and patterned, mucro of tail valve about central, post muscronal area slightly concave; gridle leathery appearing; gills extend to beneath suture of valves 2 & 3.
Habitat. Most often found at about 1 m or more above 0.0 tide level, on sides of boulders.
Distribution. Prince William Sound, Alaska to to San Luis Obispo County, California.
Occurrence. Uncommon to abundant.
Comments. Populations of this species show a wide range of colors and patterns.

Cyanoplax fernaldi (Eernisse, 1986)
(Plate 3, Figures 17a-b, Plate 9, Figure 42)

Diagnosis. Very small chitons, 8-15 mm; valves evenly granular, dark brown, often with white markings, rarely turquoise; mucro of tail valve central, postmucronal area convex; gills extending to beneath valve 4; girdle velvety appearing.
Habitat. Found at about 2 m above 0.0 tide level, nestled amongst barnacles and anemones.
Distribution. Yakobi Island, southeastern Alaska to Brookings, Curry County, Oregon.
Occurrence. Uncommon to rare, but may be locally abundant.
Comments. This tiny species is often overlooked because of its small size & nestling habit. One of the few brooding species of chiton on our coast (Eernisse, 1986, 1988).

Mopalia cirrata Berry, 1919
(Plate 3, Figures 18a-b)

Diagnosis. Small chitons, 20-25 m; with strongly pustulose radial ribs. Setae very long, up to one half of animal length, bearing usually strongly recurved, ringlet like bristles.
Habitat. Lives on the sides and bottoms of cobbles & boulders in relatively calm areas with good current or tidal exchange, and on rock walls, from the low intertidal (Hanselman, 1990) to at least 40 m.
Distribution. Found from Unalaska Island, Aleutian Islands, Alaska to San Mateo County, California.
Occurrence. Rare to uncommon.

ISSN 0738-9388

Comments. This species may be distinguished from the similar *M. sinuata* (Plate 9, Figures 27a-c) by 1) the strongly pustulose sculpture of the radial ribs, and 2) the very long setae, up to ½ of the animals length, bearing a single row of long, usually ringlet-like bristles.

Mopalia egretta Berry, 1919
(Plate 3, Figures 19a-b)

Diagnosis. Moderately large chitons (25-40 mm); valves typically brick red, with white or pale tan, rarely with blue streaks; setae, very sparce, relatively long, fine, slender, bearing long, slender, needle-like bristles.
Habitat. Occurs primarily on vertical rock walls at depths of 18-140 m.
Distribution. Kodiak Island, Alaska to Carmel Bay, California.
Occurrence. Rare to very rare.

Mopalia ferreirai Clark, 1991
(Plate 3, Figures 20a-c)

Diagnosis. Relatively large chitons, 40-60 mm; valves variably colored and patterned, setae with short bristles, giving a bushy look.
Habitat. On tops, sides and bottoms of boulders, and in crevices on rock walls, at depths of 1-18 m.
Distribution. From Kodiak Island, Alaska to Morro Bay, San Luis Obispo County, California.
Occurrence. Very rare in the Salish Sea, found only near the entrance of the Strait of Juan de Fuca, near Neah Bay, Washington and southwestern Vancouver Island, near Port Renfrew, B.C. and east to the vicinity of Victoria, B.C.
Comments. Previously confused with the southern *Mopalia lowei* Pilsbry, 1918, Clark (1991). Similar to *M. swanii* (Plate 5, Figures 29a-f), but has more delicate sculpture, and thicker setae which bear short, straight bristles on three sides.

Mopalia hindsii (Sowerby MS, Reeve, 1847)
(Plate 4, Figure 21a-b)

Diagnosis. Large chitons, 75-116 mm (largest of the *Mopalia*); valves with brown or green tones, sculpture fine; setae often fairly profuse, short, very fine with fine, straight bristles.
Habitat. On tops and sides of boulders, and in sea caves, mid-intertidal to 8 m.
Distribution. Kodiak Island, Alaska to Alamitos Bay, Los Angeles County, California.
Occurrence. Common to abundant.
Comments. Unusually large animals, reaching more than 100 mm are found at Indian Is., near Hadlock, WA.

Mopalia imporcata Carpenter, 1864
(Plate 4, Figures 22a-b)

Diagnosis. Small, 15-20 mm chitons; valves brown, green or yellow tones, strongly sculptured with longitudinal ribs and radial rows of rounded pustules, tail valve with posterior mucro; girdle with bushy, trough shaped setae bearing 4-5 profuse rows of relatively long, curved bristles.
Habitat. On sides & bottoms of boulders in areas of good tidal flow or strong currents, at 1-50 m.
Distribution. Kenai Peninsula, Alaska to northern Baja California, Mexico.
Occurrence. Rare, but may be locally uncommon.
Comments. Similar to *M. phorminx* but distinguished by 1) the round radial pustules, 2) the heavier setae, and 3) the posterior mucro of the tail valve.

Mopalia kennerleyi Carpenter, 1864
(Plate 4, Figure 23a-f; Plate 9, Figure 50)

Diagnosis. Relatively large, 50-65 mm; valves very variable in color and pattern, tail valve twice as broad as wide, indented posteriorly;

ISSN 0738-9388

girdle with strap-like setae bearing two rows of slender, white spicules.
Habitat. Tops, sides and bottoms of cobbles and boulders, intertidal to 10 m.
Distribution. Aleutian Islands, Alaska to northern California.
Occurrence. Common to abundant.
Comments. Previously confused with the more southern (central California to northern Baja) *Mopalia ciliata* (Sowerby II, 1840) Clark (2008a). Setae illustrated by A. Draeger, in Eernisse, *et al.* (2007).

Mopalia lignosa (Gould, 1846)
(Plate 4, Figure 24a-f; Plate 9, Figure 52)

Diagnosis. Relatively large chitons, 50-80 mm; valves carinated, smooth or finely pitted, streaked or feathered with brown and green, or black and white, rarely other colors; girdle with small recurved setae, usually bearing a single, sparse row of minute spicules.
Habitat. On sides and bottoms of cobbles & boulders, intertidal to 10 m.
Distribution. Cook Inlet, Alaska to central California (Morro Bay and San Miguel Island).
Occurrence. Common to abundant.
Comments. One of the Salish Sea's most variable and beautiful chitons.

Mopalia muscosa (Gould, 1846)
(Plate 5, Figure 25a-b)

Diagnosis. Large chitons, 60-90 mm; valves coarsely sculptured, dark brown, sometimes with lighter mottling; girdle profusely covered with stiff, brown pointed bristles.
Habitat. On tops of boulders and bedrock, high to mid-intertidal.
Distribution. Dall Island, southeastern Alaska, to northern Baja California, Mexico.
Occurrence. Uncommon to abundant.
Comments. The valves of this species are often very eroded. This species is very tolerable to drying, differences in temperature and salinity.

Mopalia phorminx Berry, 1919
(Plate 5, Figures 26a-b)

Diagnosis. Small chitons, 10-23 mm; valves tan or light brown (often with darker markings), bearing radial rows of triangular, downwardly directed pustules, tail valve with mucro of tail valve post central; girdle with slender setae bearing long, slender bristles.
Habitat. Found on cobbles, dead bivalve shells, and dead wood fragments at 18-130 m.
Distribution. Prince William Sound, Alaska to San Pedro Bay, California.
Occurrence. Rare to very rare.
Comments. This species may be distinguished from the similar *M. imporcata* (Plate 4, Figures 22a-b) by 1) the unique, triangular pustules, large diagonal and posterior rows with similar but smaller rows between, 2) fine setae and 3) the sub-central position of the mucro of the tail valve.

Mopalia sinuata Carpenter, 1864
(Plate 5, Figures 27a-c; Plate 9, Figure 46)

Diagnosis. Small chitons, rarely exceeding 20 mm; valves with reddish, green and brown mottlings, bearing strong raised radial ribs, central areas pitted; setae long, thick, bearing two laterally recurved rows of bristles.
Habitat. On sides of cobbles and boulders, and in rocky crevices in areas of good tidal exchange or swift currents, from the intertidal to 60 m.
Distribution. Kenai Peninsula, Alaska to San Luis Obispo County, California.
Comments. Similar to *Mopalia cirrata*, but distinguished by the smoother sculpture and feather-like setae.

ISSN 0738-9388

Mopalia spectabilis Cowan & Cowan, 1977
(Plate 5, Figures 28a-d)

Diagnosis. Large chitons, 50-70 mm; valves typically light green, with red flecks and brilliant blue zigzag lines, rarely nearly solid orange; setae relatively long, bushy, trough-shaped, bearing five rows of long, recurved bristles.
Habitat. On the sides and bottoms of loose cobbles and boulders, as well as in sea caves and on rock walls, intertidal to 30 m.
Distribution. Kodiak Island, Alaska to Santa Barbara County, California.
Comments. This large colorful species is unlikely to be confused with other members of the genus.

Mopalia swanii Carpenter, 1864
(Plate 5, Figure 29a-f; 5, Plate 9, Figure 51)

Diagnosis. Large chitons, to 60 mm; valves variably colored and patterned, sculpture fine, central areas pitted; setae very small < 2 mm, with fine, recurved bristles.
Habitat. Found on the bottoms of cobbles and boulders, and on rock walls, intertidal to 30 m.
Distribution. Unalaska Island, Aleutian Islands, Alaska to San Francisco Bay, California.
Comments. This colorful species is a voracious, omnivorous grazer, often found scowering barnacles, sponges, ascidians and all other invertebrates and algae down to the bedrock.

Mopalia vespertina (Gould, 1852)
(Plate 6, Figure 30a-e)

Diagnosis. Large chitons, 60-80 mm; valves smooth or nearly smooth, sometimes with weakly beaded radials; color usually greenish or brown tones, sometimes purplish or white; interior of valves white usually flushed with pink at the apices; girdle encroaching nearly to valve apices, bearing short fine bristles with fine, strongly recurved bristles.
Habitat. On tops, sides and bottoms of rocks and boulders, intertidal to 30 m.
Distribution. Sitka, Alaska to Morro Bay, California.
Occurrence. Uncommon to abundant.
Comments. Similar to *Mopalia hindsii* (Plate 4, Figures 21a-b) and *Mopalia lignosa* (Plate 4, Figures 24a-f), but distinguished by the setae which have very fine, strongly recurved bristles.

Dendrochiton flectens (Carpenter, 1864)
(Plate 6, Figures 31a-e)

Diagnosis. Small chitons, 10-20 mm, rarely to 30 mm; plates microgranular, variably colored, with blue, green, red and orange, often mottled or nearly uniform in color, with blue spots on edges of valves; girdle fleshy, with a single, medial row of setae, often only around valves 7-8, bearing a single row of recurved bristles.
Habitat. On tops, sides and bottoms of cobbles and boulders.
Distribution. Kenai Peninsula, Alaska to Isla San Geronimo, Baja California, Mexico (Ferreira, 1980), low intertidal to 50 m.
Occurrence. Patchy, rare to common.
Comments. Another small colorful species.

Dendrochiton semiliratus Berry, 1927
(Plate 6, Figure 32)

Diagnosis. Small chitons, 10-12 mm, rarely to 15 mm; valves subcarinated, lateral areas scarcely defined, central areas with 6-12 narrow, longitudinal ribs, most not reaching the posterior edge of the valves; color shades are reddish or cinnamon, rarely with some cream colored valves; setae sparce, fine, with a few fine, slender bristles.
Habitat. Found on clean (silt free) cobbles resting on sand, at depths of 25-130 m.

ISSN 0738-9388

Distribution. Sitka Sound, Baranof Island, Alaska to Santa Catalina Island, California.
Occurrence. Rare, but may be locally common.
Comments. Very similar to *D. flectens* (Plate 6, Figures 31a-c), but distinguished by the ribbed central areas.

Placiphorella rufa Berry, 1917
(Plate 6, Figure 33)

Diagnosis. Large chitons, 40-50 mm, but can reach 80 mm; outline broadly oval, valves uniformly reddish or pink; girdle very broadly expanded anteriorly, scaled setae restricted to margin of girdle.
Habitat. Found on boulders and bedrock (often on wall ledges) at 20-50 m.
Distribution. Central Aleutian Islands, Alaska to Southern Oregon 1-140 m.
Occurrence. Uncommon to rare.
Comments. This species was first reported in the Salish Sea by Anderson, 1993. In the Salish sea it is typically found below 18 m.

Placiphorella velata Carpenter MS, Dall, 1879
(Plate 6, Figure 34)

Diagnosis. Large, 40-50 mm, but can reach over 70 mm; outline broadly oval, valves variously streaked with brown, white, pink and green; girdle broadly expanded anteriorly, sparsely covered with scaly setae.
Habitat. Found on boulders and bedrock, from the intertidal to at least 30 m.
Distribution. Cook Inlet and Prince William Sound, Alaska to northern Baja California.
Occurrence. Uncommon to abundant.
Comments. *P. velata* is only rarely found in interior waters, but is often quite common in coastal areas.

Tonicella insignis (Reeve, 1847)
(Plate 7, Figure 35; Plate 9, Figure 48)

Diagnosis. Relatively large chitons, 35-40 mm, but can reach 60 mm; valves smoothish, red, with transvers, white zigzag lines on central areas.
Habitat. found on the sides and tops of boulders, from the low intertidal to at least 50 m.
Distribution. Unalaska Island, Aleutian Islands, Alaska to Oregon.
Occurrence. Uncommon to common, may be locally abundant.
Comment. This is perhaps the most strikingly beautiful chiton on the entire Pacific coast.

Tonicella lineata (Wood, 1815)
(Plate 7, Figures 36a-f; Plate 9, Figure 49)

Diagnosis. Relatively large chitons, to about 50 mm; valves smoothish, variably patterned, usually with maroon-black, red-orange & white longitudinal lines, dark lines on head valve forming a gothic arch; Solid white specimens are blue, green or purple in life.
Habitat. On tops, sides and bottoms of cobbles and boulders, and on bedrock and rock walls, especially those covered with encrusting coralline red algae, intertidal to about 10 m.
Distribution. Adak Island, Aleutian Islands, Alaska, to central California.
Occurrence. Common to abundant.
Comments. Another of the most strikingly beautiful chitons of the Salish Sea.

Tonicella cf. undocaerulea Sirenko, 1973
(Plate 7, Figure 37a-c)

Diagnosis. Medium sized chitons, 20-30 mm, rarely to 40 mm; valves light orange, with zigzag white lines (brilliant blue in life), and maroon streaks on pleural areas, post mucronal area of tail valve variable, convex to concave; girdle fleshy.

ISSN 0738-9388

Habitat. Lives on sides and tops of rocks encrusted with coralline algae, from low intertidal zone to at least 45 m.
Distribution. Kodiak Island, Alaska, to Monterey Bay, California.
Occurrence. Rare to common.
Comments. In a previous review of the *Tonicella lineata* species complex (Clark 1999), this colorful species was identified as *Tonicella undocaerulea*, whose type locality is in Japan, but since then some subtle morphological distinctions and molecular differences have been noted, and its species status has been further investigated (R.N. Clark and D.J. Eernisse, in prep.). Whether or not it is a separate species, it is separated by several thousand kilometers from the nearest northwestern Pacific populations of *T. undocaerulea*.

Tonicella venusta Clark, 1999
(Plate 7, Figures 38a-b; Plate 9, Figure 47)

Diagnosis. A small species, 10-17 mm; valves light orange or pinkish, with white (blue or purple in life) zigzag lines, pleural areas usually with large white, triangular markings; girdle sandy appearing due to the dense calcareous elements
Habitat. Lives on sides and tops of boulders encrusted with coralline algae, *Lithothamnion spp.* from extreme low intertidal zone to at least 140 m.
Distribution. Kodiak Island, Alaska to Isla Cedros, Baja California, Mexico.
Occurrence. Rare to uncommon.
Comments. Another small, but very colorful species. Differs from *Tonicella cf. undocaerulea*, (Plate 7, Figures 37a-c) by the sandy girdle and lack of maroon-black markings on plates.

Katharina tunicata (Wood, 1815)
(Plate 8, Figures 40a-b)

Diagnosis. Very large 80-110 mm chitons, only 1/3 portion (usually eroded) of valves exposed through shiny black girdle.
Habitat. On tops and sides of cobbles and boulders, middle to upper intertidal areas.
Distribution. Aleutian Islands to northern Channel Islands, California.
Occurrence. Common to abundant.
Comments. One of the largest and most recognizable chitons on the Pacific coast.

Cryptochiton stelleri (von Middendorff, 1847)
(Plate 8, Figure 39a-c; Plate 9, Figure 54)

Diagnosis. Very large, 250-350 mm, but can reach over 400 mm. velvety girdle completely covering the valves; color often solid brick red-brown, but may be golden or gray, sometimes red mottled with gray-white or orange.
Habitat. Found on rock or sand, intertidal to at least 80 m.
Distribution. NE Hokkaido Island, Japan to northern Channel Islands, California.
Occurrence. Uncommon to abundant.
Comments. This is by far the largest species of chiton in the world.

ACKNOWLEDGEMENTS

I am grateful to Dr. Philip Lambert and Kelly Sendall (retired), Royal British Columbia Museum, Victoria; Dr. Alan Kohn, Burke Museum, University of Washington, Seattle (emeritus); Elizabeth Kools, California Academy of Sciences; Dr. Jann Vendetti and Lindsey Groves, Los Angeles County Museum of Natural History; and Dr. Henry Chaney and Dr. Daniel Geiger, Santa Barbara Museum of Natural History; and Rick Harbo, Nanaimo, B.C. I also thank the two anonymous reviewers for their comments.

LITERATURE CITED

Anderson, R.C. 1993. A range extension for *Placiphorella rufa*. The Festivus 25(3):30.

Briggs. J.C. & B.W. Bowen. 2011. A realignment of marine biogeographic provinces with particular reference to fish distributions. Journal of Biogeography. 39:12-30.

Burghardt, G E. & L. Burghardt. 1969. West Coast Chiton, special report no. 4, San Francisco Aquarium Society. 45 pp.

Clark, R. 1991. A new species of *Mopalia* (Polyplacophora: Mopaliidae) from the Northeast Pacific. The Veliger 34(3):309-313.

Clark, R. 1994. Review of the Genus *Placiphorella* Dall, 1879, ex Carpenter MS (Polyplacophora: Mopaliidae) with descriptions of two new species. The Veliger 37(3):290-311.

Clark, R. N., 1999. *Tonicella lineata* (Wood, 1815) species complex (Polyplacophora: Tonicellidae), with descriptions of two new species. American Malacological Bulletin 15(1):33-46.

Clark, R. 2008a. *Mopalia kennerleyi* Carpenter, 1864, a forgotten species and its southern analogue *Mopalia ciliata* (Sowerby, 1840). American Malacological Bulletin 25:71-76.

Clark, R. N., 2008b. Two new chitons of the genus *Tripoplax* Berry, 1919 from the Monterey sea Canyon. American Malacological Bulletin 25:77-86.

Cowan, I. McT. 1964. New Information on the Distribution of marine Mollusca on the coast of British Columbia. The Veliger 7(2):110-113.

Eernisse, D.J., R. Clark, & A. Draeger. 2007. (Polyplacophora) Light and Smith's Manual, Intertidal Invertebrates from Central California to Oregon. 4th Ed. Edited by James T. Carlton. 701-713. University of California Press.

Eernisse, D.J., 1986. The Genus *Lepidochitona* Gray, 1821 (Mollusca: Polyplacophora) in the Northeastern Pacific Ocean (Oregonian and Californian Provinces). Zoologische Verhandelingen 228.

Eernisse, D. J. 1988. Reproductive patterns in six species of *Lepidochitona* (Mollusca: Polyplacophora) from the Pacific Coast of North America. Biological Bulletin 174:287-302.

Ferreira, A. J. 1980. The Family Lepidochitonidae Iredale, 1914 (Mollusca: Polyplacophora) in the Eastern Pacific. The Veliger 25(2):93-138.

Hanselman, G.A. 1990. "Twins" *Mopalia cirrata* Berry and *Mopalia sinuata* Carpenter. The Festivus 22(1):3-7.

Harbo, R. 2011. Welks to Whales. Coastal Marine Life of the Pacific Northwest. Second Edition. Harbour Publishing, Madeira Park, B.C. 328 pp.

Kozloff, E.N. 1987. Marine Invertebrates of the Pacific Northwest. University of Washington Press. 511 pp.

Lamb, A. and B.P. Hanby. 2005. Marine Life of the Pacific Northwest. Harbour Publishing. 398 pp.

McLean, J.H. 1962. Feeding behavior of the chiton *Placiphorella.* Proceedings of the Malacological Society of London. 35:23-26.

Rice, T.C. 1972. Marine Shells of the Pacific Northwest. Ellis Robinson Publishing. 102 pp.

Sirenko, B.I. & R. Clark. 2008. *Deshaysiella spicata* (Berry, 1919) (Mollusca: Polyplacophora) a valid species. Ruthenica 18(1):1-7.

ISSN 0738-9388

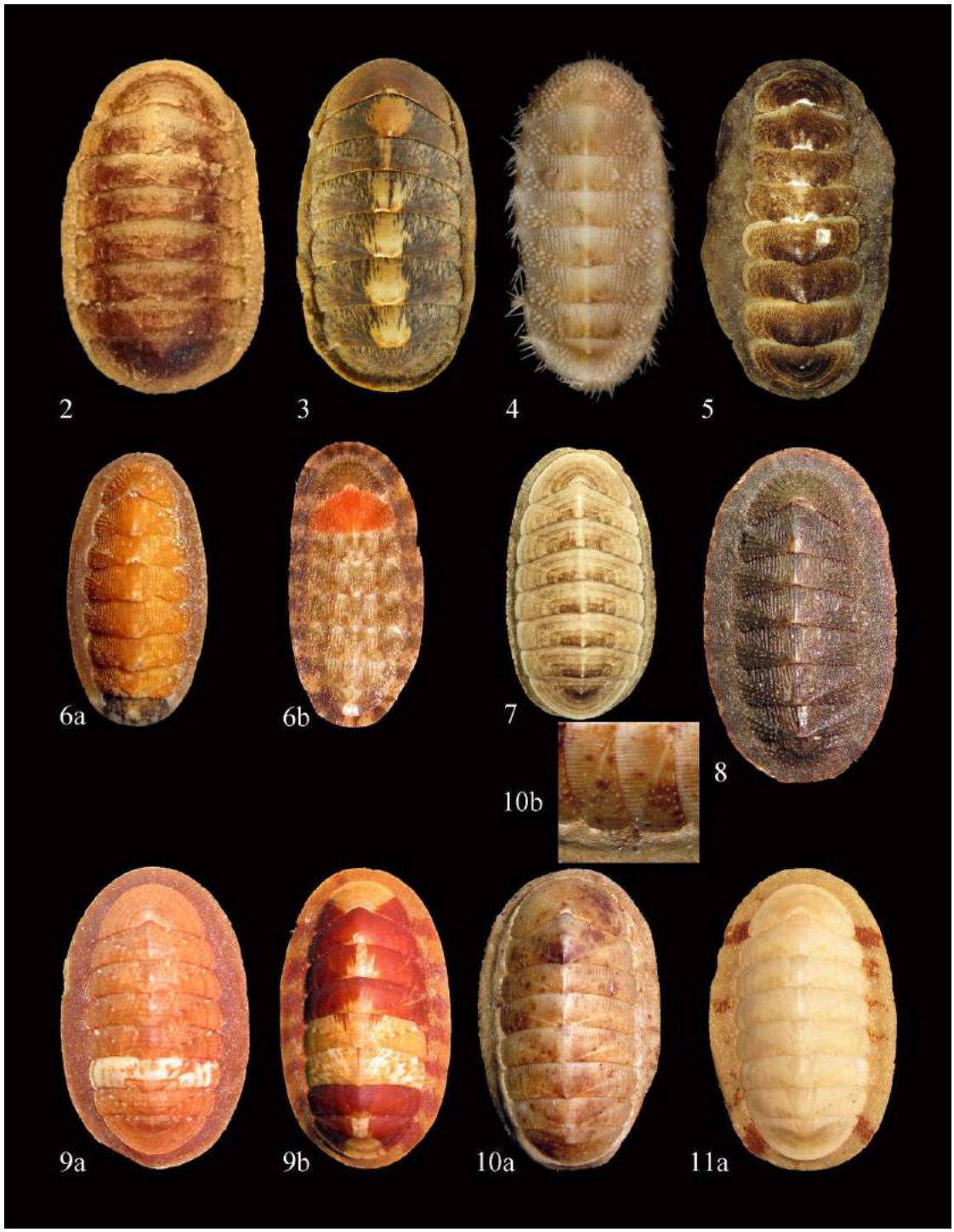

Plate 1. Figures 2-11a.
2= *Leptochiton cascadiensis*, Sekiu, WA, 7.5 mm; **3=** *Leptochiton nexus*, Monterey, CA, 15 mm; **4=** *Hanleyella oldroydi*, Monterey, CA, 7 mm; **5=** *Deshayesiella spicata*, Vancouver, B.C., 34 mm; **6a=** *Chaetopleura gemma*, Monterey, CA, 17 mm; **6b=** *Chaetopleura gemma*, Ucluelet, B.C., 16 mm; **7=** *Stenosemus albus*, Kachemak Bay, AK, 15 mm; **8=** *Lepidozona cooperi*, Makkaw Bay, WA, 25 mm; **9a=** *Lepidozona interstincta*, San Juan Is., WA, 21 mm; **9b=** *Lepidozona interstincta*, Port Gamble, WA, 22 mm; **10a=** *Lepidozona golischi*, Vancouver, B.C., 22.5 mm; **10b=** *L. golischi*, close up of valve sculpture; **11a=** *Lepidozona radians*, Brookings, OR, 20.5 mm.

ISSN 0738-9388

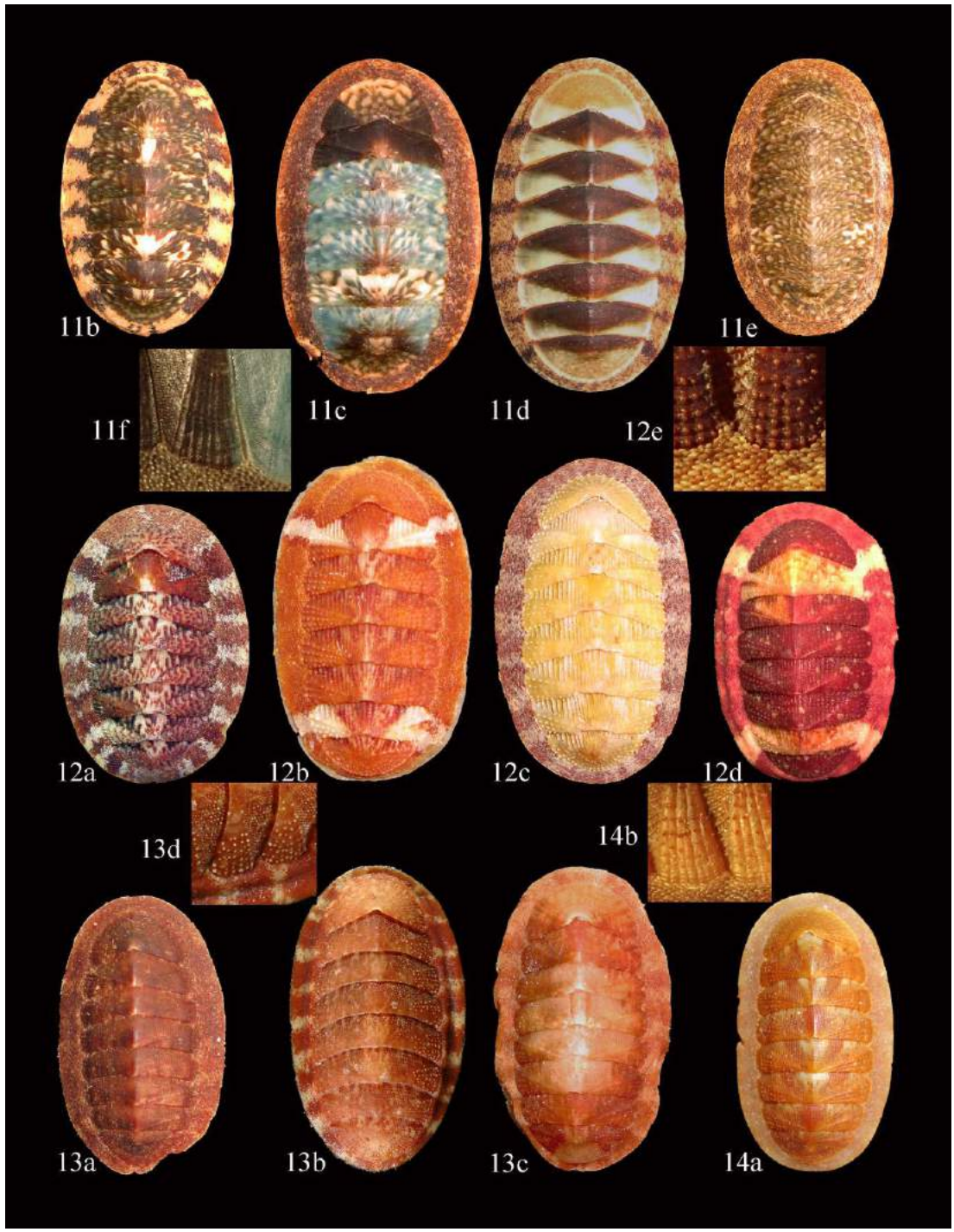

Plate 2. Figures 11b-14.
11b= *Lepidozona radians*, Monterey, CA, 26 mm; **11c=** *Lepidozona radians*, Baja California, 23 mm; **11d=** *L. radians,* Monterey, CA, 21 mm; **11e=** *L. radians*, Monterey, CA, 23 mm; **11f=** *L. radians*, close-up of valve sculpture; **12a=** *Lepidozona mertensii*, Timber Cove, CA, 38 mm; **12b=** *L. mertensii*, Franklin Point, CA, 26 mm; **12c=** *L. mertensii*, Hadlock, WA, 30 mm; **12d=** *L. mertensii*, Sitka, AK, 29 mm; **12e=** *Lepidozona mertensii*, close-up of valve sculpture; **13a=** *Lepidozona retiporosa*, Tacoma, WA, 16 mm; **13b=** *Lepidozona retiporosa*, San Pedro Bay, CA, 24 mm; **13c=** *L. retiporosa*, Vancouver Is., B.C., 14.5 mm; **13d=** *L. retiporosa*, close-up of valve sculpture; **14a=** *Lepidozona willetti*, Ketchikan, AK, 28 mm; **14b=** *L. willetti*, close-up of valve sculpture.

ISSN 0738-9388

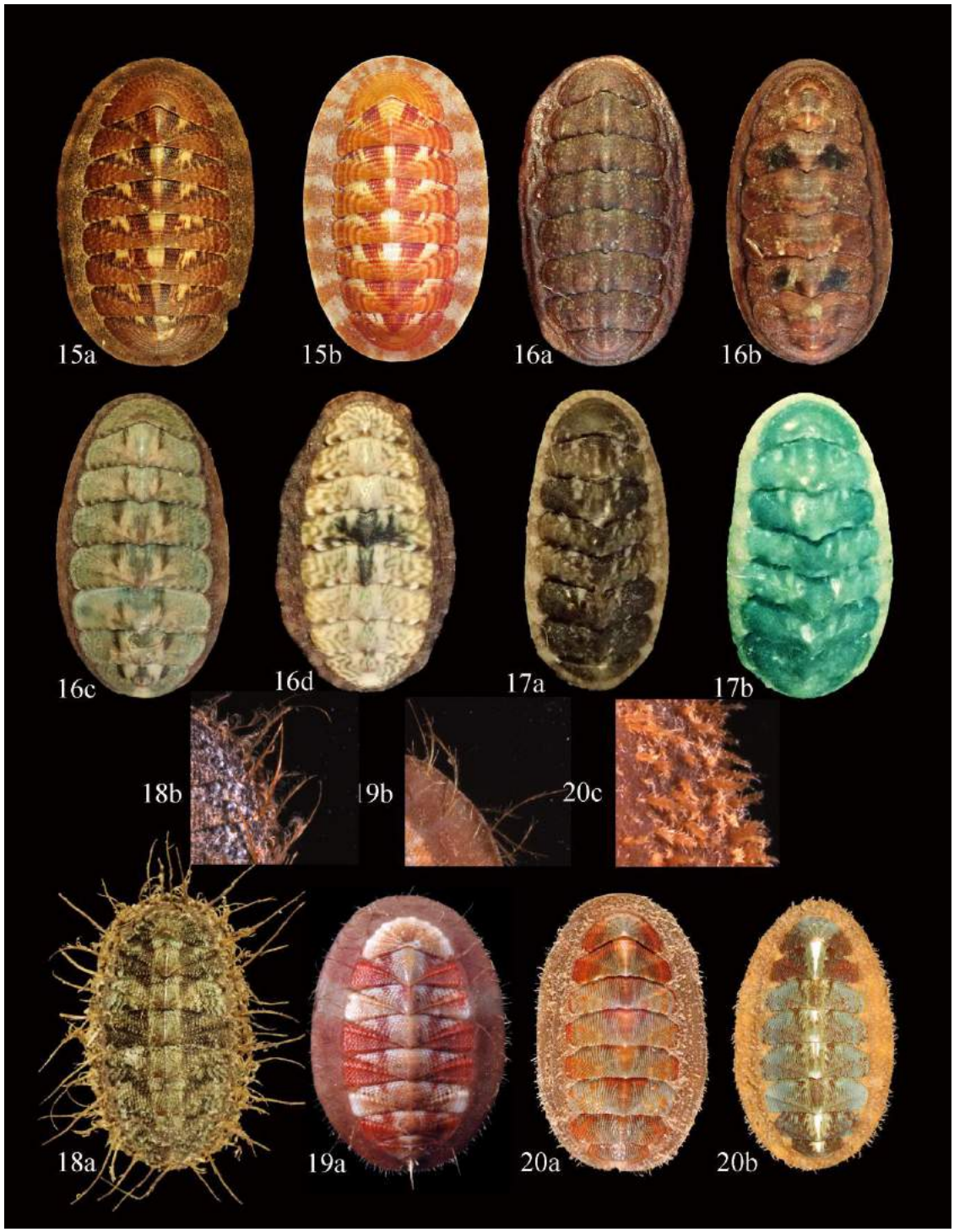

Plate 3. Figures 15-20.
15a= *Tripoplax trifida*, Vancouver, B.C., 44 mm; **15b=** *T. trifida*, Kodiak, AK, 41 mm; **16a=** *Cyanoplax dentiens*, Point Delgado, CA, 19 mm; **16b=** *C. dentiens*, Sitka, AK, 15 mm; **16c=** *C. dentiens*, Sitka, AK, 17 mm; **16d=** *C. dentiens,* Point Delgado, CA, 15 mm; **17a=** *Cyanoplax fernaldi*, Tacoma, WA, 8 mm; **17b=** *C. fernaldi*, Tacoma, WA, 6 mm; **18a=** *Mopalia cirrata,* Cape Arago, OR, 17 mm; **18b=** *M. cirrata*, close-up of setae; **19a=** *Mopalia egretta*, Ketchikan, AK, 23 mm; **19b=** *M. egretta*, close-up of setae; **20a=** *Mopalia ferreirai*, Metlakla, AK, 44 mm; **20b=** *M. ferreirai*, Monterey, CA, 35 mm; **20c=** *M. ferreirai*, close-up of setae.

ISSN 0738-9388

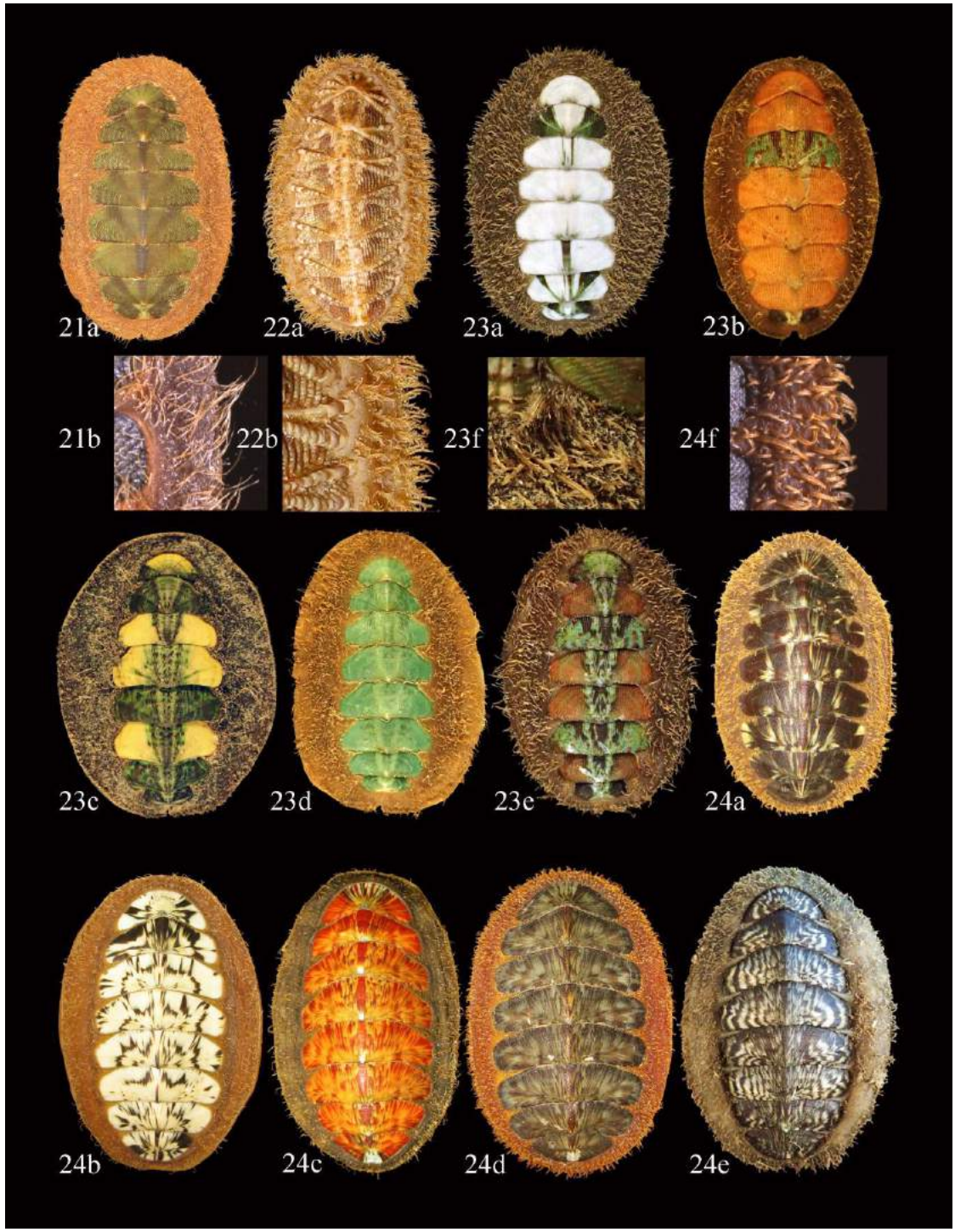

Plate 4. Figures 21-24.
21a= *Mopalia hindsii*, Monterey, CA, 50 mm; **21b=** *M. hindsii*, close-up of setae; **22a=** *Mopalia imporcata*, Port Gamble, WA, 18 mm; **22b=** *M. imporcata*, close-up of setae; **23a=** *M. kennerleyi*, Ketchikan, AK, 42 mm; **23b=** *M. kennerleyi*, Point Arena, CA, 37 mm; **23c=** *Mopalia kennerleyi*, Port Hardy, B.C., 48 mm. **23d=** *M. kennerleyi*, Port Gamble, WA, 50 mm; **23e=** *M. kennerleyi,* Adak Island, AK, 41 mm; **23f=** *M. kennerleyi*, close-up; **24a=** *Mopalia lignosa*, Metlakatla, AK, 53 mm; **24b=** *M. lignosa*, Tacoma, WA, 49 mm; **24c=** *M. lignosa*, Tacoma, WA, 55 mm; **24d=** *M. lignosa*, Brookings, OR, 41 mm; **24e=** *M. lignosa*, Hadlock, WA, 58 mm; **24f=** *M. lignosa*, close-up of setae.

ISSN 0738-9388

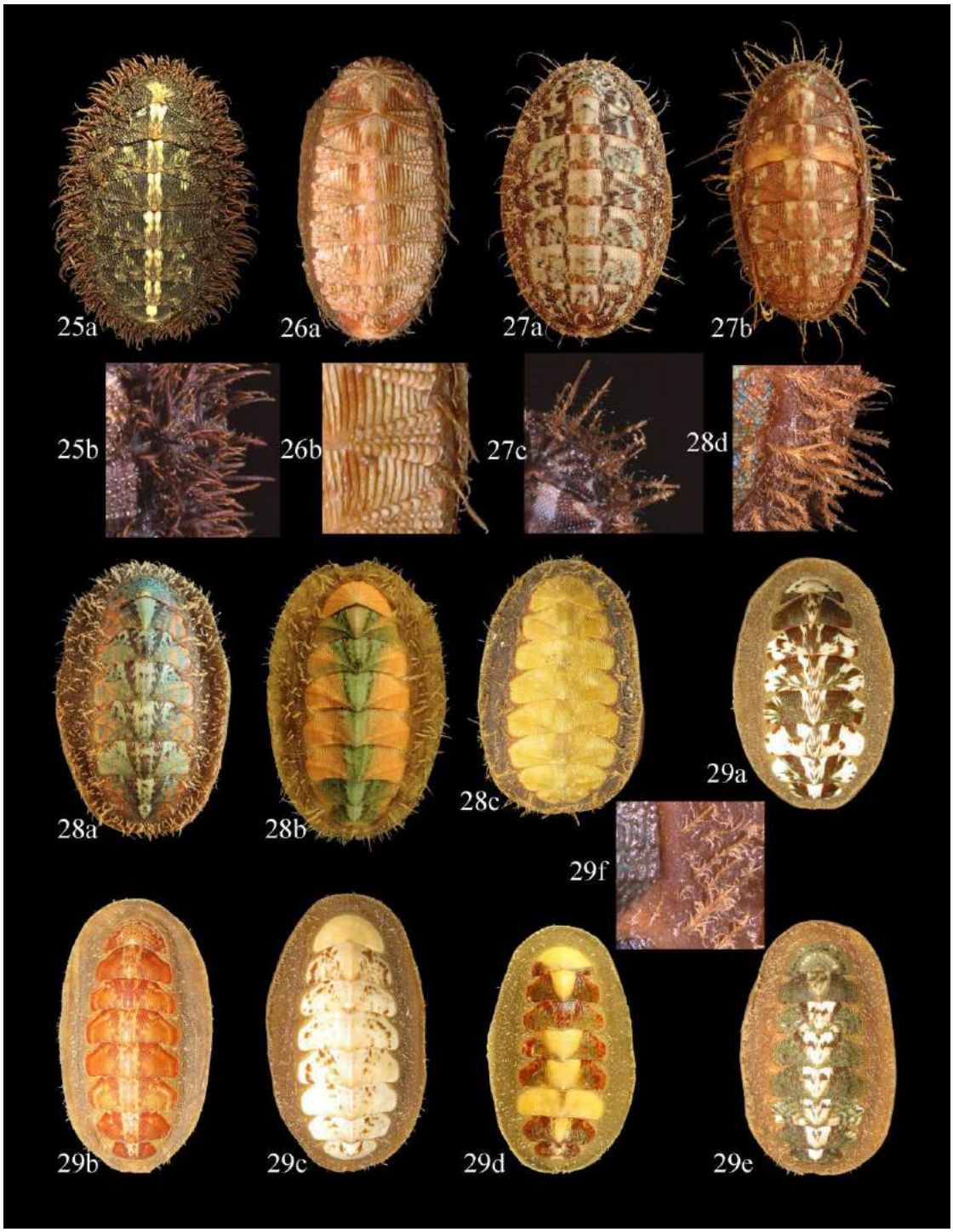

Plate 5. Figures 25-29.
25a= *Mopalia muscosa*, Morro Bay, CA, 44 mm; **25b=** *M. muscosa*, close-up of setae; **26a=** *Mopalia phorminx*, Ketchikan, AK, 16 mm; **26b=** *M. phorminx*, close-up of setae; **27a=** *Mopalia sinuata*, Port Gamble, WA, 17 mm; **27b=** *M. sinuata*, Lopez Island, WA, 18 mm; **27c=** *M. sinuata*, close-up of setae; **28a=** *Mopalia spectabilis*, Tacoma WA, 46 mm; **28b=** *M. spectabilis*, Moss Beach, CA, 43 mm; **28c=** *M. spectabilis*, Hadlock, WA, 47 mm; **28d=** *M. spectabilis*, close-up of setae; **29a=** *Mopalia swanii*, Coos Bay, OR, 41 mm; **29b=** *M. swanii,* close-up of setae; **29c=** *M. swanii*, San Juan Is., WA, 42 mm; **29d=** *M. swanii*, Coos Bay, OR, 35 mm; **29e=** *M. swanii*, Hadlock, WA, 35 mm; **29f=** *M. swanii*, Coos Bay, OR, 35 mm.

ISSN 0738-9388

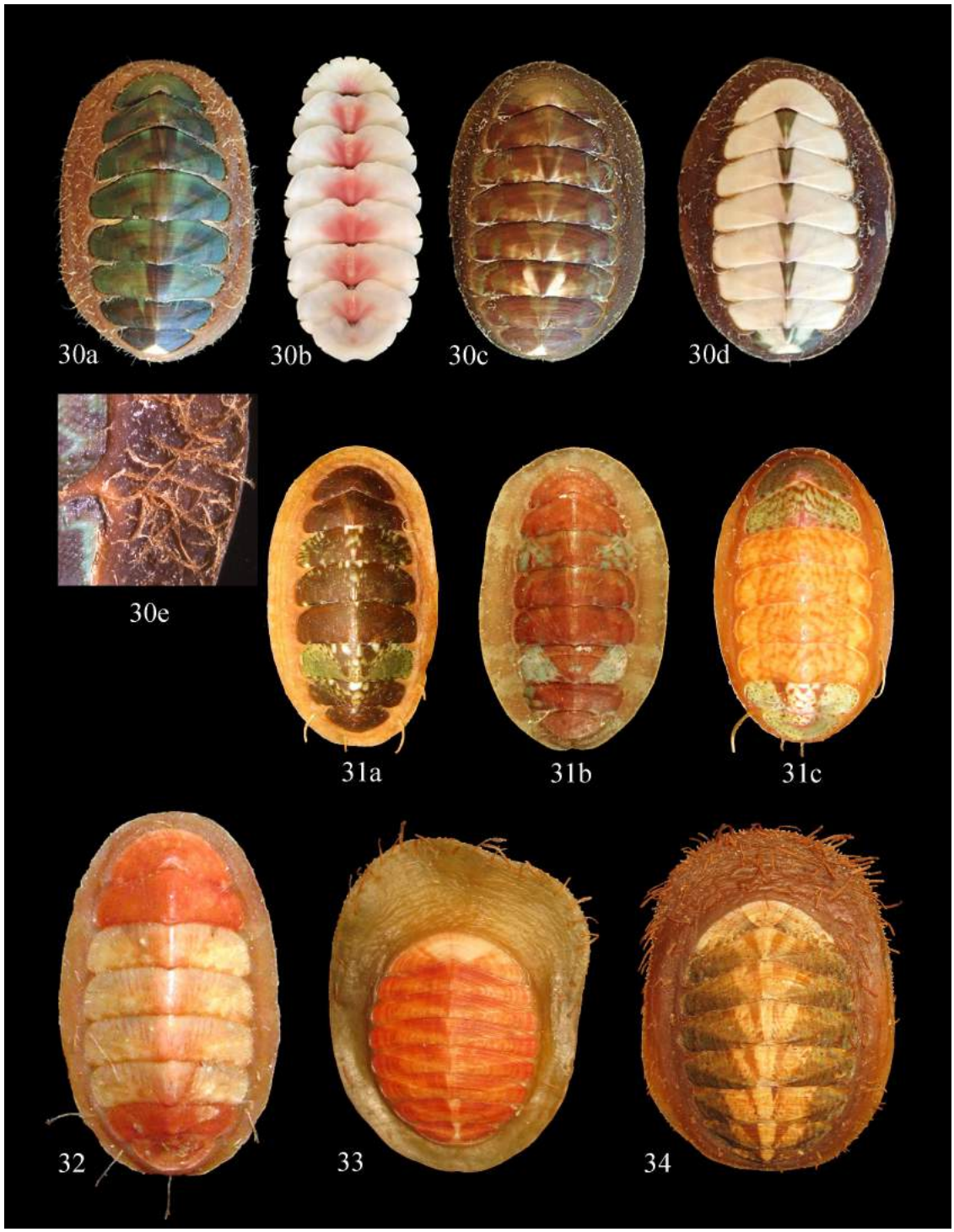

Plate 6. Figures 30-34.
30a= *Mopalia vespertina*, Port Gamble, WA, 48 mm; **30b=** *Mopalia vespertina,* interior of valves; **30c=** *Mopalia vespertina,* Port Gamble, WA, 38 mm; **30d=** *Mopalia vespertina,* Port Gamble, WA, 43 mm; **30e=** *Mopalia vespertina*, close-up of setae; **31a=** *Dendrochiton flectens*, Monterey Bay, CA, 23 mm; **31b=** *Dendrochiton flectens*, Ketchikan, AK, 16 mm; **31c=** *Dendrochiton flectens*, Pidgeon Point, CA, 17 mm; **32=** *Dendrochiton semiliratus*, Metlakatla, AK, 8 mm; **33=** *Placiphorella rufa*, Ketchikan, AK, 35 mm; **34=** *Placiphorella velata*, Neah Bay, WA, 60 mm.

ISSN 0738-9388

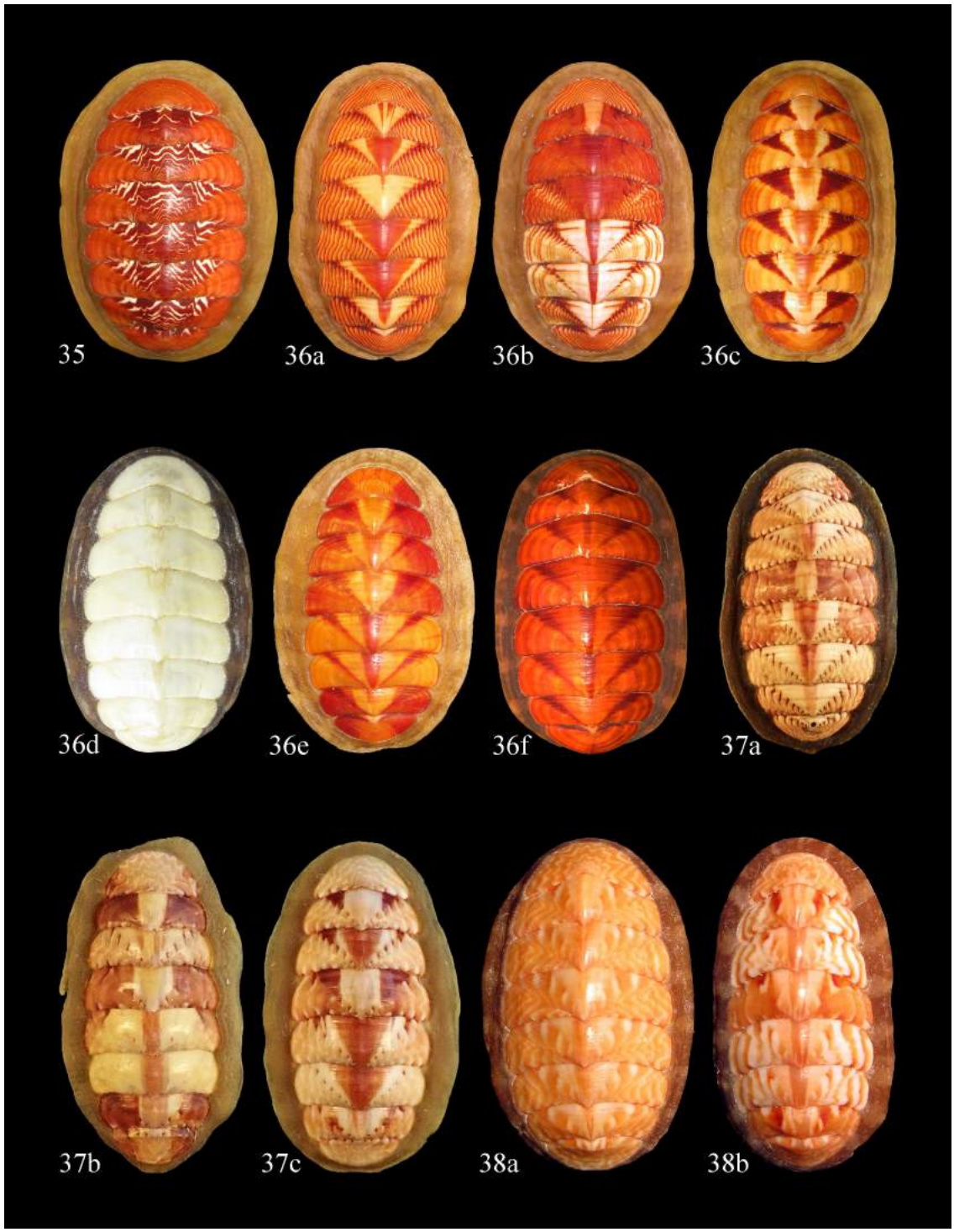

Plate 7. Figures 35-38.
35= *Tonicella insignis,* Tacoma, WA, 55 mm; **36a=** *Tonicella lineata,* Tacoma, WA, 40 mm; **36b=** *T. lineata,* Tacoma, WA, 44 mm; **36c=** *T. lineata,* Tacoma, WA, 48 mm; **36d=** *T. lineata,* Victoria, B.C., 21 mm; **36e=** *T. lineata,* Tacoma, WA, 38 mm; **36f=** *T. lineata,* Bowen Is., B.C., 38 mm; **37a=** *Tonicella cf. undocaerulea.* Broughton Strait, B.C., 40 mm; **37b=** *T. cf. undocaerulea,* Ketchikan, AK, 24 mm; **37c=** *T. cf. undocaerulea*. Turn Island, WA, 36 mm; **38a=** *Tonicella venusta,* Victoria, B.C., 17 mm; **38b=** *T. venusta,* Tofino Sound, B.C., 15 mm.

ISSN 0738-9388

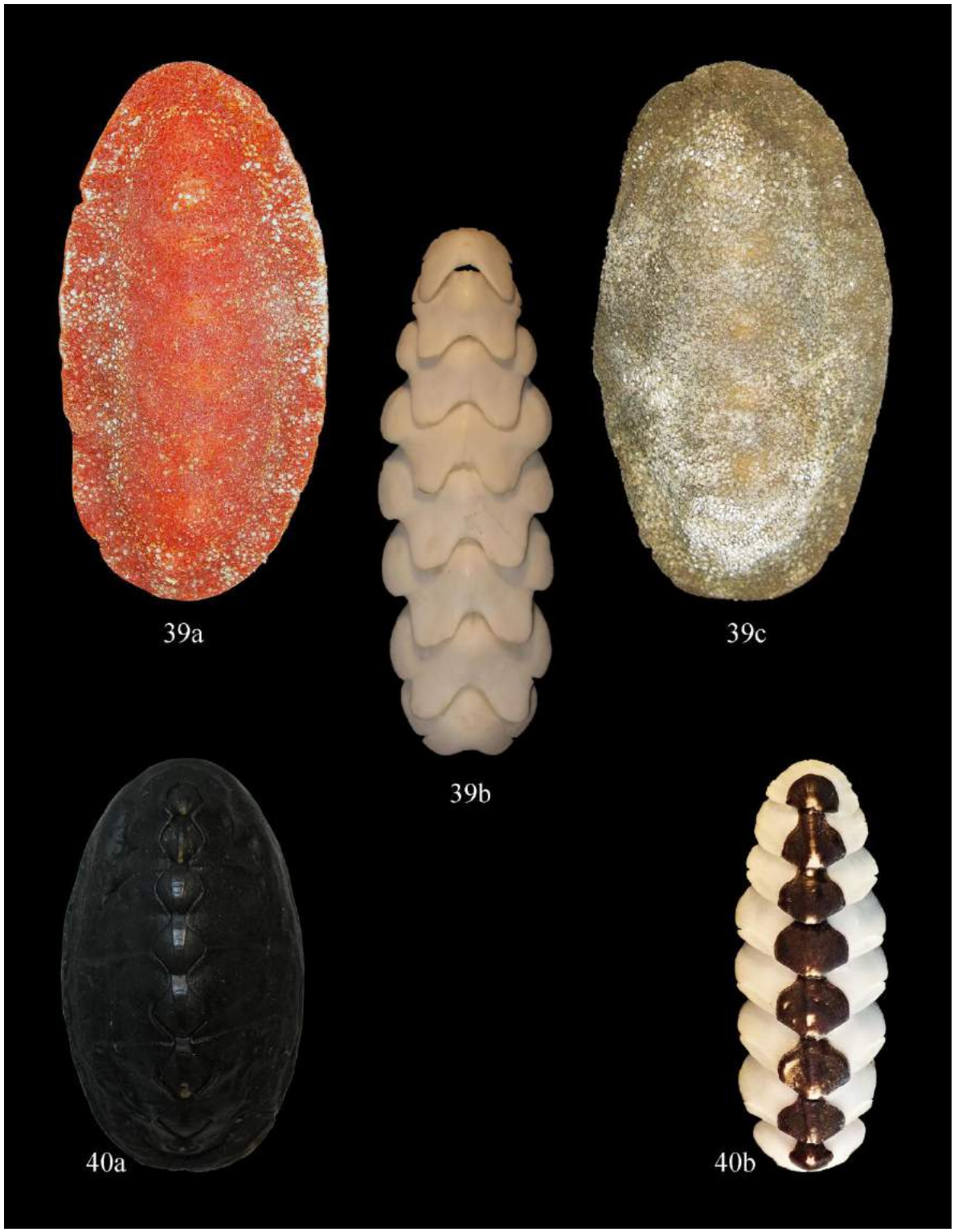

Plate 8. Figures 39-41.
39a= *Cryptochiton stelleri,* Brookings, OR, 73 mm; **39b=** *C. stelleri,* articulated valves; **39c=** *C. stelleri,* Tacoma, WA, 113 mm; **40a=** *Katharina tunicata,* Coos Bay, OR, 80 mm; **40b=** *K. tunicata,* articulated valves.

ISSN 0738-9388

Plate 9 (live animals, in situ – all intertidal). Figures 41-54.
41= *L. cascadiensis* – Sekiu, WA; **42=** *C. fernaldi* – Tacoma, WA; **43=** *C. dentiens* – Sekiu, WA; **44 A-B=** *L. mertensii* – Hadlock, WA; **45=** *L. retiporosa* – Tacoma, WA; **46=** *M. sinuata* – Port Gamble, WA; **47=** *T. venusta* – Neah Bay, WA; **48=** *T. insignis* - Tacoma, WA; **49=** *T. lineata* (albino) – Neah Bay, WA; **50=** *M. kennerleyi* – Tacoma, WA; **51=** *M. swanii* – Hadlock, WA; **52=** *M. lignosa* – Tacoma, WA; **53=** *P. velata* – Neah Bay, WA; **54=** *C. stelleri* – Tacoma, WA.

ISSN 0738-9388

Taxon	DS	NA	JI	VA	SO	VI	SJI/GI	PWN	HA	PG	A	S	NB	SE	TA	OL
L. cascadensis	X	X			X	X	X	X			X	X	X			
L. nexus		X	X			X	X									
H. oldroydi	X	X														
D. spicata				X												
C. gemma							X			X			X			
S. albus	X						X									
L. cooperi												X	X			
L. interstincta	X	X	X			X	X		X		X		X		X	
L. golischi				X												
L. radiens		X			X	X	X	X					X			
L. mertensii	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L. retiporosa	X	X	X			X	X		X	X	X		X		X	
L. willetti				X												
T. trifida			X	X		X	X			X			X		X	
C. dentiens					X	X	X		X	X	X	X	X	X	X	
C. fernaldi					X	X	X						X		X	
M. cirrata		X				X	X		X	X			X		X	
M. egretta		X		X		X	X									
M. ferreirai					X	X	X						X			
M. hindsii	X	X		X	X	X	X		X	X	X	X	X	X	X	
M. imporcata		X				X	X		X	X	X				X	
M. kennerleyi	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
M. lignosa	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M. muscosa	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M. phorminx							X									
M. sinuata		X		X		X	X		X	X	X		X			
M. spectabilis		X	X	X	X	X	X		X	X	X	X	X		X	
M. swanii	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
M. vespertina	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
D. flectens		X			X	X	X	X	X	X		X	X		X	
D. semiliratus		X														
P. rufa			X				X						X			
P. velata					X		X						X			
T. insignis	X	X	X	X		X	X		X	X		X	X		X	
T. lineata	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
T. cf. undocaerulea		X		X	X	X	X	X	X	X			X			
T. venusta		X				X	X						X			
K. tunicata	X	X		X	X	X	X	X	X	X		X	X	X	X	
C. stelleri	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 1. DS= Desolation Sound, BC; **NA=** Nanaimo, BC; **JI=** Jervis Inlet; **VA=** Vancouver, BC; **VI=** Victoria, BC; **SJI/GI=** San Juan Islands, WA/Gulf Islands, BC; **SO=** Sook, BC; **HA=** Hadlock (Oak Bay/Indian Island), WA; **PWN=** Port Washington Narrows; **PG=** Port Gamble, WA; **S=** Sekiu, WA; **NB**= Neah Bay, WA; **A=** Anacortes, WA.; **SE=** Seattle, WA; **TA=** Tacoma, WA; **OL=** Olympia, WA.