



## The family Haliotidae Rafinesque, 1815 in the northeast Pacific

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### Abstract

The abalone of the northeastern Pacific are reviewed. The taxonomy and distribution remains unchanged. McLean's work on abalone is discussed.

### Introduction

The northeast Pacific haliotids, or abalone, are well-known members of the Californian and Oregonian marine faunal provinces, owing to their large size, diversity of species, and importance in sport and commercial fisheries. Much has been written about their biology (Leighton 2000, Geiger & Owen 2012 for review). Collectors should be familiar with all applicable (e.g., recreational, commercial, scientific, indigenous) fishing laws in each region.

Abalone are herbivorous gastropods that are usually sedentary and feed on algae. Their shell color and patterns are both genetically controlled as well as a result of their diet. In most species, feeding on red algae produces reddish colored shells, whereas exclusive feeding upon brown algae results in whitish or green shell coloration.

Abalone are a major prey item of the California sea otter, *Enhydra lutris* (Linnaeus, 1758). Commensal shrimp living in abalone epipodial fold are known from several northeastern Pacific species (Cox 1962).

Sixteen natural and artificial hybrid crosses have been documented (Geiger & Owen 2012 and references therein). The phenotype of these hybrids is intermediate between the two parent species in shell and epipodial characters. The most frequently naturally occurring hybrid is *H. rufescens* x *H. sorenseni*; the others are rare.

### Abbreviations

BOC	Buzz Owen Collection, Gualala, California, USA.
CASIZ	California Academy of Sciences, Invertebrate Zoology, San Francisco, California, USA.
LACM	Natural History Museum of Los Angeles County, California, USA.
NHMUK	The Natural History Museum, London, United Kingdom.
SDMNH	San Diego Museum of Natural History, California, USA.
USNM	United States National Museum of Natural History, Smithsonian Institution, Washington (DC), USA.
M	Monotypy.
OD	Original designation.
SD	Subsequent designation.

### Systematics

#### Haliotidae Rafinesque, 1815

**Description.** Shell to 313 mm, ear-shaped, depressed; spire eccentric, low; row of open holes; interior nacreous; columella broadened; operculum absent.

*Haliotis* Linnaeus, 1758

*Haliotis* Linnaeus, 1758: 779. Type species (SD Montfort 1810: 119): *H. asinina* Linnaeus, 1758. Indo-Pacific.

**Description.** Characters as for family. Juveniles less than 2.5 cm, often difficult to identify.

**Remarks.** A single genus and no subgenera are considered here, following the monographic treatment of Geiger & Owen (2012). These northeastern Pacific species are part of a larger species radiation that includes species from the northwest Pacific (e.g. off the coasts of Japan and China).

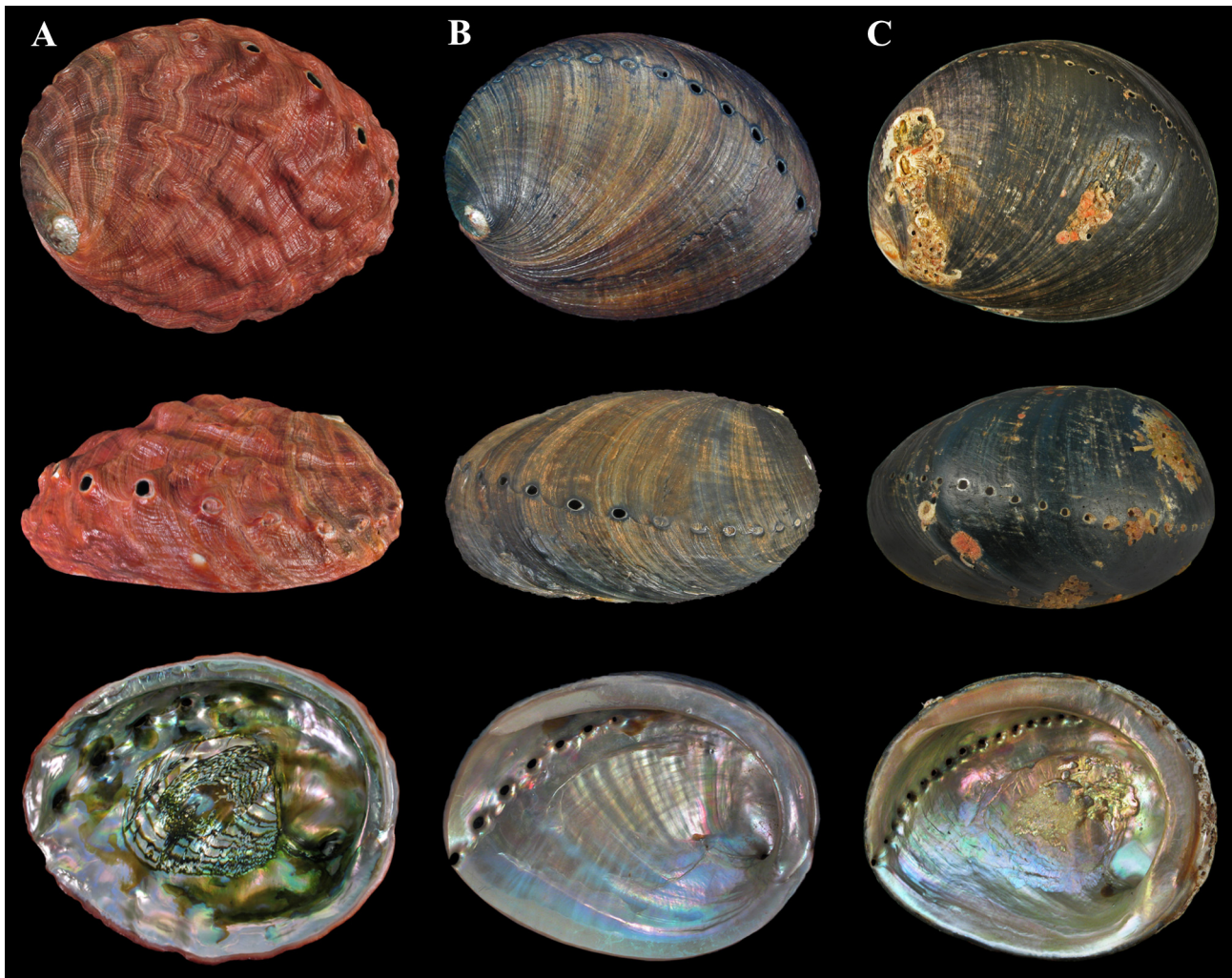
*Haliotis rufescens* Swainson, 1822  
(Figure 1A)

*Haliotis rufescens* Swainson, 1822: 2. Syntypes ?. California.

*Haliotis californiana* Valenciennes, 1832: 267. Holotype ?. California.

*Haliotis ponderosa* C.B. Adams, 1848: 138–139. Holotype lost (Turner 1956: 75). Not type locality given.

*Haliotis rufescens hattorii* Bartsch, 1940: 52, pl. 8, figs 4–6. Holotype USNM 535761. Santa Barbara, California.



**FIGURE 1.** A. *Haliotis rufescens* Swainson, 1822, 8 m, Crook Point, San Miguel Island, Santa Barbara County, California (BOC), 213 mm. B. *Haliotis cracherodii cracherodii* Leach, 1814, Intertidal, Point Loma, San Diego County, California (BOC), 105 mm. C. *Haliotis cracherodii californiensis* Swainson, 1822. Intertidal. 1 km south of West Anchorage, Guadalupe Island, Baja California (BOC), 110 mm.

**Description.** Shell to 313 mm, heavy, strongly arched; open holes 3–5, medium size to large, raised; sculpture of prosocline, irregular folds, many fine spiral cords. Color brick red, often with light red to cream bands; growing edge usually red. Nacre silvery in young specimens (<10 cm), typically with dark green, blue tones. Prominent muscle scar in large specimens.

**Distribution.** Central Oregon coast to central Baja California. On rocks, lowest intertidal to 20 m. Abundant in the past, today locally common to scarce.

***Haliotis cracherodii* Leach, 1814 and *H. cracherodii californiensis* Swainson, 1822**

(Figure 1B, C)

*Haliotis cracherodii* Leach, 1814–1817 (1814): 131, pl. 8. Holotype NHMUK 1950.8.28.11. California.

*Haliotis interrupta* Valenciennes, 1832: 267–268. Holotype ?. America aequinoctialis.

*Haliotis cracherodii* var. *splendidula* Williamson, 1892: 198. Holotype LACM 1035. Point Vincent, California.

*Haliotis californiensis* Swainson, 1822: 1, pl. 80. Types ?. California [based on species name].

*Haliotis cracherodii rosea* Orcutt, 1900: 30. Holotype USNM 162010. Near Mazatlan?.

*Haliotis californiensis* var. *bonita* Orcutt, 1900: 30. Holotype USNM 162008. Near Santa Barbara.

*Haliotis cracherodii* var. *holzneri* Hemphill, 1907: 59–60. 1 of 3 syntypes CASIZ 058826. Lower [= Baja] California.

*Haliotis cracherodii* form *imperfurata* Dall, 1919: 370. Holotype USNM 219850. San Pedro, California.

*Haliotis cracherodii lusus* Finlay, 1927: 492 [new name for *H. cracherodii imperfurata* Dall (non Gmelin, 1791)].

*Haliotis cracherodii* form *expansa* Talmadge, 1954: 2. Holotype ?. Corona del Mar, California.

**Description.** Shell to 216 mm, heavy, rounded oval; almost smooth, with fine growth lines; holes small, flush with surface of shell, usually 5–8 open color black with hint of blue or green, periostracum if present fine, brown; nacre brilliant silver white, muscle scar as faint outline only in larger specimens.

**Distribution.** Northern California to central Baja California. On rocks and in crevices from almost high tide line to 6 m. Historically abundant, now locally uncommon to extirpated.

**Remarks.** The subspecies *H. c. californiensis* (Fig. 1C) is restricted to Guadalupe Island, Baja California (29° N), and has 12–16 open holes. Malformed specimens, including those lacking holes have given rise to a number of synonyms.

***Haliotis kamtschatkana* Jonas, 1845 and *H. kamtschatkana assimilis* Dall, 1878**

(Figure 2A, B)

*Haliotis kamtschatkana* Jonas, 1844–1845 (1845): 168. Holotype ?. “Unalaska,” erroneous.

*Haliotis assimilis* Dall, 1878: 46. Holotype USNM 31267. San Diego, California.

*Haliotis aulaea* Bartsch, 1940: 53, pl. 8, figs 1–3. Holotype USNM 535848. Cayucas [= Cayucos], California, 8–10 fm.

*Haliotis smithsoni* Bartsch, 1940: 54, pl. 8, figs 7–10. Holotype USNM 60425. Santa Catalina Island, California.

**Description.** Shell to 162 mm, oval oblong, thin; sculpture irregular with knobs, broad spiral cords; holes medium size, raised, 3–6 open; Color variably mottled, streaked with red, green, brown, white, rarely with spiral orange band, very rare all orange; nacre bright, no muscle scar.

**Distribution.** Sitka, Sitka County, Alaska, to Point Conception, Santa Barbara County, California (*kamtschatkana*); Monterey to central Baja California (*assimilis*). On rocks and in crevices, usually 12–30 m; exceptionally as shallow as 3, and as deep as 100 m. Historically abundant in British Columbia and Alaska, now rare. Locally common in parts of northern Baja California.

**Remarks.** Subspecies *H. kamtschatkana assimilis* differs by: shell to 187 mm, rounded, medium weight; holes 4–7 open; predominant spiral cords, less distinct irregular knobs.

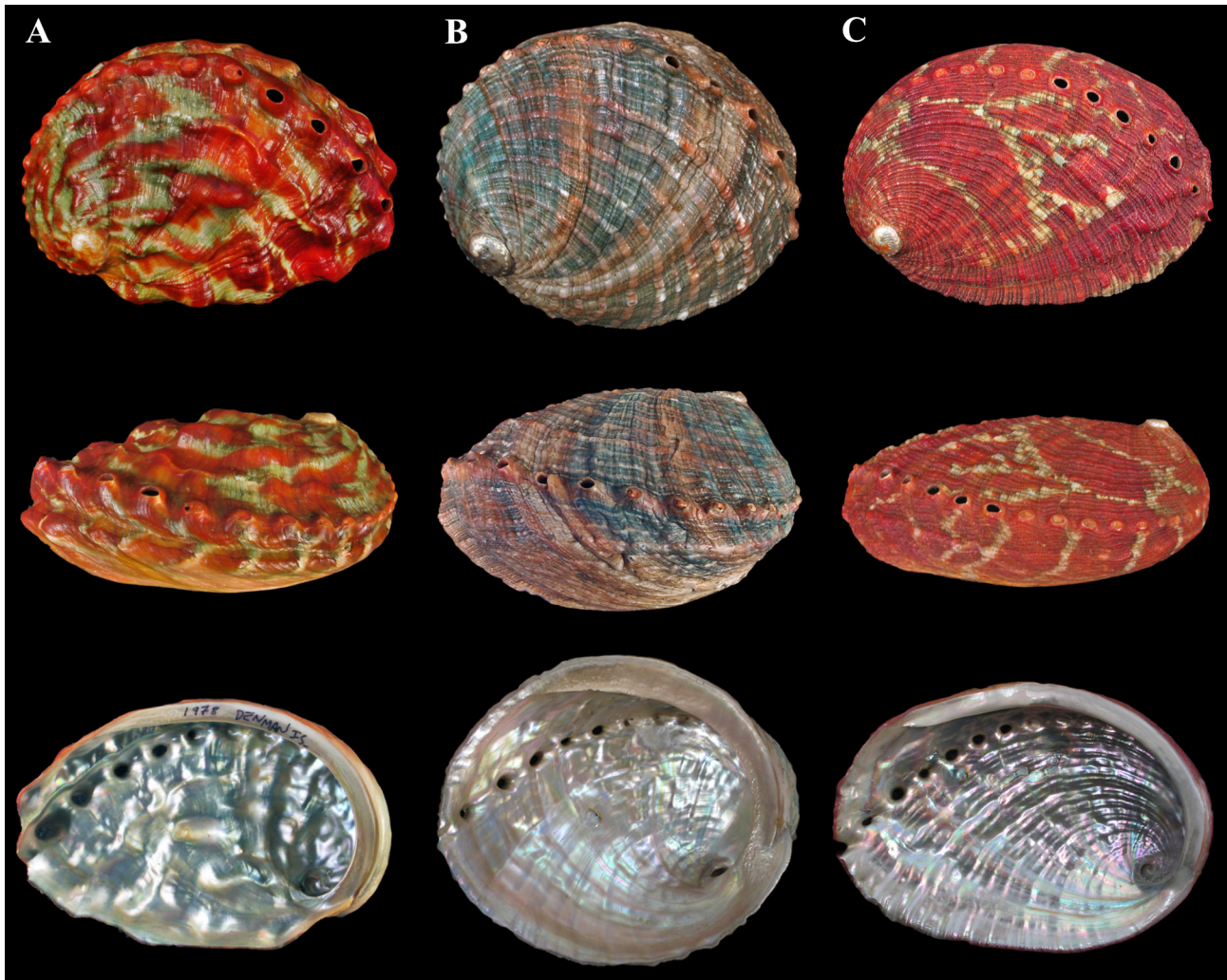
***Haliotis walallensis* Stearns, 1899**

(Figure 2C)

*Haliotis fulgens* var. *walallensis* Stearns, 1899: 140–141. Holotype USNM 98327. Gualala, California.

**Description.** Shell to 179 mm, flat, medium to light-weight; sculpture with fine spiral cords, faint concentric lamellae; holes 6–8 open, small, hardly elevated; color brick red with blue-green, white mottling or spiral streaks, juveniles (<25 mm) rarely orange; nacre magenta and green, no muscle scar.

**Distribution.** Southern Washington to central Baja California. On and on undersides of rocks, from 1–20 m. Historically common to uncommon, today common in northern part of range, uncommon to rare in southern extent of range, i.e. Baja California.



**FIGURE 2.** A. *Haliotis kamtschatkana kamtschatkana* Jonas, 1845, 3 m, Denman Island, British Columbia (BOC), 112 mm. B. *Haliotis kamtschatkana assimilis* Dall, 1878, 20 m, Point Loma, San Diego County, California (BOC), 136 mm. C. *Haliotis walallensis* Stearns, 1899, 3 m, Pigeon Point, San Mateo County, California (BOC), 110 mm.

***Haliotis fulgens* Philippi, 1845, *H. fulgens guadalupensis* Talmadge, 1964, *H. fulgens turveri* Bartsch, 1942**  
(Figure 3B)

*Haliotis fulgens* Philippi, 1845: 150. Holotype whereabouts unknown. Type locality not designated.

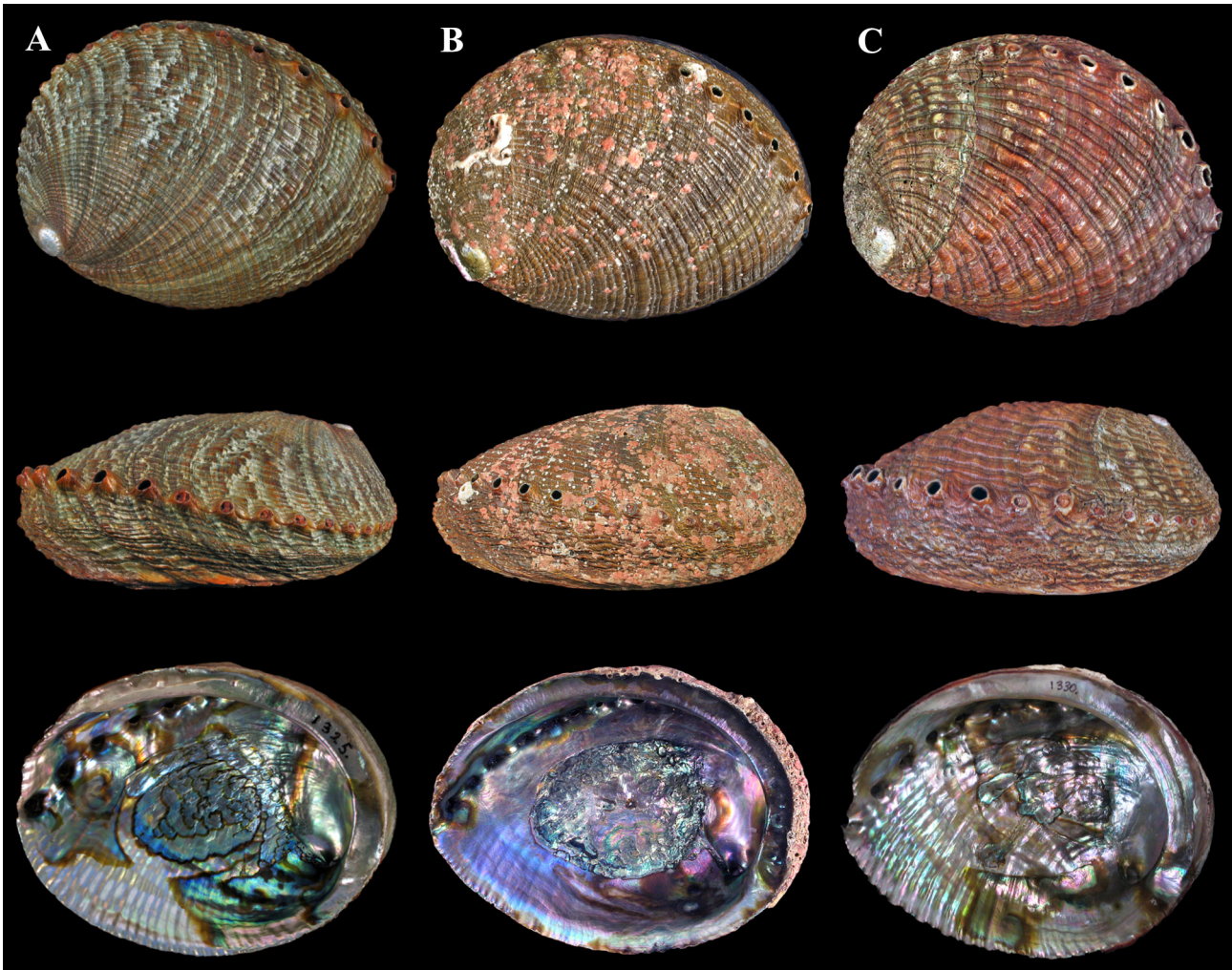
*Haliotis splendens* Reeve, 1846: pl. 3, fig. 9. Syntypes NHMUK 1950.3.16.65–66. California.

*Haliotis planilirata* Reeve, 1846: pl. 16, fig. 62. Type whereabouts unknown, not NHMUK. No type locality given.

*Haliotis fulgens turveri* Bartsch, 1942: 57. Holotype USNM 508764. Magdalena Bay, Baja California.

*Haliotis fulgens guadalupensis* Talmadge, 1964: 375. Holotype SDNHM H-1-30-60/1068. Guadalupe Island, Baja California.

**Description.** Shell to 255 mm, relatively low, heavy; sculpture of broad spiral cords with narrower interspaces; holes 4–7 open, medium in size, slightly raised; color light to dark brown, usually with some green mottling; nacre dark blue with magenta and green sheen, some conchiolin deposits, muscle scar posteriorly truncated.



**FIGURE 3.** A. *Haliotis fulgens fulgens* Philippi, 1942, 8 m, Santa Cruz Island, Santa Barbara County, California (BOC), length 158 mm. B. *Haliotis fulgens guadalupensis* Talmadge, 1964, West Anchorage, Guadalupe Island, Baja California (BOC), length 160 mm. C. *Haliotis fulgens turveri* Bartsch, 1942, 6 m, Santa Margarita Island, Magdalena Bay, Baja California (BOC), length 161 mm.

**Distribution.** Central California to southern Baja California. On rocks, 0–10. Historically common, now uncommon to scarce.

**Remarks.** The subspecies *H. fulgens guadalupensis* from Guadalupe Island, Baja California, grows to 165 mm, is taller and has more even cording. The subspecies *H. fulgens turveri* from the Magdalena Bay area of Baja California has stronger, wider cording, a highly silvered nacreous interior, and less muscle scar development in mature specimens. Type material for the nominate subspecies by Philippi is unknown (Coan & Kabat 2017). While many types of Reeve are at NHMUK the types of *H. planilirata* have not been found, despite several visits by both authors since 1992.

***Haliotis corrugata* Wood, 1828 and *H. corrugata oweni* Talmadge, 1966**  
(Figure 4A, B)

*Haliotis corrugata* “Gray,” Wood, 1828: 26, 39, pl. 8, fig. 6. NHMUK (McLean 1966, not in NHMUK database, not found during visits since 1992). No type locality given.

*Haliotis nodosa* Philippi, 1845: 149. Holotype whereabouts unknown. Not type locality given.

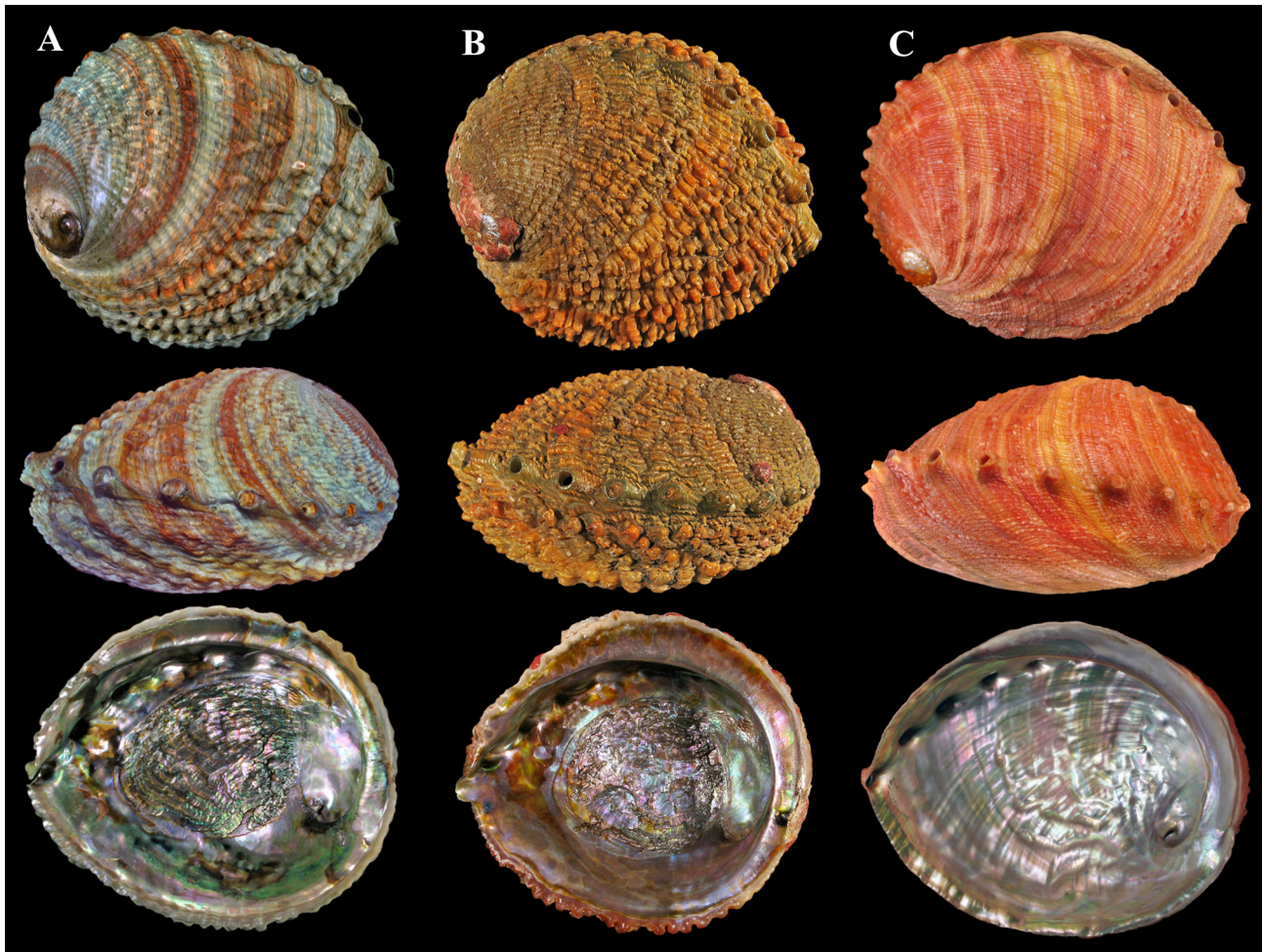
*Haliotis corrugata oweni* Talmadge, 1966: 1–4. Holotype LACM 1147. Guadalupe Island, Baja California.

*Haliotis corrugata diegoensis* Orcutt, 1900: 31. Holotype USNM 162007. La Jolla, California.

**Description.** Shell to 245 mm, rounded, heavy, sculptured with strong knobs, irregular growth lines; holes 2–4 open, large, strongly elevated; color pale green, pink, purple. Radial bands usually faint. Nacre brilliant, often with thick conchiolin deposits; muscle scar posteriorly truncated.

**Distribution.** Central California to central Baja California. On rocks in more protected areas, 5–25 m. Historically common, now scarce.

**Remarks.** The subspecies *H. corrugata oweni* from Guadalupe Island, Baja California (29° N) grows to 165 mm, is more arched, and has denser sculpture. The whereabouts of the type material of *H. nodosa* is unknown (Coan & Kabat 2017).



**FIGURE 4.** A. *Haliotis corrugata corrugata* Wood, 1828, 12 m, Santa Cruz Island, Santa Barbara County, California, (BOC), 186 mm. B. *Haliotis corrugata oweni* Talmadge, 1966, 3 m, Punta del Vapor, Guadalupe Island, Baja California, (BOC), 119 mm. C. *Haliotis sorenseni* Bartsch, 1940. 25 m. Santa Cruz Island, Santa Barbara County, California (BOC), 184 mm.

***Haliotis sorenseni* Bartsch, 1940**  
(Figure 4C)

*Haliotis sorenseni* Bartsch, 1940: 50–51, pl. 6. Holotype USNM 535688. S of Point Conception, California.

**Description.** Shell to 226 mm, rounded oblong, light-weight, highly arched; sculpture of many fine cords, some irregular oblique folds; holes 3–5 open, medium size, highly elevated; color white, light brick red, dark pink, with some white mottling; nacre brilliant silver, no muscle scar.

**Distribution.** Point Conception, Santa Barbara County, California, to central Baja California. On off-shore reefs, 20–60 m. Historically common, today listed in the USA as an endangered species.

## Discussion

McLean started his malacological career with his dissertation work on abalone (McLean 1966) and contributed the archaeogastropods, including abalone, to Keen's *Sea Shells of Tropical West America* (McLean 1971). He described one species outside the geographic boundaries of this volume, *Haliotis roberti* McLean, 1970, now recognized to be a subspecies (or synonym) of *Haliotis dalli* Henderson, 1915 by Geiger & Owen (2012). His interest in abalone was further cultivated by a collaboration with Buzz Owen (Owen *et al.* 1971) on the abalone hybrids. McLean also supervised Geiger's (1999) dissertation on abalone.

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