Discoveries of New Marine Species of the Aleutian Islands

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Abstract

During the summers of 2006 and 2007 divers descended the shallow (<20 m), nearshore marine waters of the Aleutian Islands to conduct the first Alaska Monitoring and Assessment Program (AKMAP) of this remote region. AKMAP coastal surveys are based on the Environmental Protection Agency National Coastal Assessment procedures using a probabilistic sampling design featuring monitoring of select environmental indicators. Ancillary products that emerged from the Aleutian surveys were the discoveries of several species new to science. As of 2011, the following discoveries were confirmed and published in peer-reviewed journals: one new genus and species of benthic marine alga; one new species of sea anemone; one new genus of sea star; and 17 new species of sea stars. This paper presents an overview of these published new species.

Keywords: alga, new species, sea anemone, sea stars, taxonomy

Introduction

Between 2000 and 2009 approximately 2700 scientists from more than 80 nations were involved in more than 540 expeditions in all oceans, thus contributing to the Census of Marine Life (Ausubel et al., 2010). Among the millions of species collected in marine waters, the Census found more than 6,000 potentially new species and completed formal descriptions of more than 1,200 of them. The Census found living creatures everywhere it looked, even in the most extreme environments. Extreme and remote environments are where one would expect to find new species because of the difficulty of accessing these locations. One such extreme and remote environment is the Aleutian Islands of Alaska. The Aleutian Archipelago lies west of the Alaska Peninsula, extending westward from Unimak Island to Attu Island, a distance of nearly 1,200 miles (1,931 km). Over 200 Aleutian Islands totaling about 2.7 million acres (110,000 km²) form an arc that separates the North Pacific Ocean from the Bering Sea. The chain arcs farther south than any point in Southeast Alaska, dipping below 52º latitude. Because the International Dateline runs north and south at 180º longitude through Amchitka Pass, the Aleutians include both the easternmost and westernmost points in the United States. The Aleutians contain five island groups: Fox Islands, Islands of Four Mountains, Andreanof Islands, Rat Islands, and Near Island (Figure 1). Most Aleutian Islands are part of the USF&W Alaska Maritime Wildlife Refuge. Further to the west of the Near Islands, the Commander Islands, Russia, continue the island arc and are biologically linked to the Kamchatka shelf and coast. On the southern edge of this submerged mountain range, of which the Aleutian Islands are the exposed peaks, is a curving submarine trench as deep as ~25,000 ft (7,600 m) extending across the North Pacific for ~2000 statute miles (3,200 km) from the Gulf of Alaska to Kamchatka Peninsula. Climatically the Aleutian Islands are located in a maritime zone, which exhibits heavy precipitation, extreme winds,
frequent storms, cool summers, and warm winters (Johnson, 2003). During the winter season, when the Aleutian Low is strong, an average of three to five storms move eastward along the Aleutian Chain (Johnson, 2003). In the summer, with periods of long daylight and high solar insulation, the Aleutian Low is generally weak and the weather relatively benign for this region. Due to their remoteness and their harsh environments, these islands, especially the central and western Aleutian Islands (west of Samalga Pass) and including nearshore marine habitats, have been studied only sporadically.

A team of research divers from the University of Alaska embarked on a mission in the remote Aleutian Islands in 2006 and 2007. Funded by the U.S. Environmental Protection Agency, the team sampled the nearshore region in contaminant-based investigation called the Alaska Monitoring and Assessment Program (AKMAP). AKMAP coastal surveys are based on the Environmental Protection Agency National Coastal Assessment procedures using a probabilistic sampling design featuring monitoring of select environmental indicators. In addition to surveying the benthic environment for various contaminants (e.g., PCBs, hydrocarbons, trace metals), numerous unknown plants and invertebrates were collected. Although many descriptions of the unknown species and range extensions are still underway, this paper summarizes the new species that have recently appeared in the peer-reviewed literature.

**Methods**

Most specimens were photographed in situ and collected during the AKMAP surveys of June and July 2006–07 (see Brewer et al., 2011 for additional photographs). Divers on open-circuit scuba made the collections from inflatable skiffs in depths <20 m. A total of 50 random sites were sampled across the five island groups (Figures 1 and 2). A few specimens were also taken during NOAA/NMFS trawl surveys in deeper waters.

![Figure 1. Five major island groups in the Aleutian Islands.](image)
To date, 19 new marine species from the Aleutian archipelago have been discovered and published. These include 17 sea stars, a sea anemone, and a brown alga.

**Results and Discussion**

*A new genus and thirteen new species of sea stars of the family Echinasteridae (Clark and Jewett, 2010)*

A new genus and 13 new species of echinasterid sea stars were described from nearshore waters of
the Aleutian Islands. Associations between echinasterids and sponges were also briefly discussed. A key to the shallow water (<20 m) Echinasteridae of the Aleutian Islands was provided. The new genus *Aleutihenricia* was distinguished from *Henricia* by the morphology and arrangement of the skeletal ossicles.

Feder's *Henricia* – *Aleutihenricia federi* (Figure 3)
**Diagnosis:** Large inflated Henricia-like; R to 14 cm; R:r 4.8:1; disc small; rays long, broad, relatively soft; ridges of abactinal plates with 8–15 stout spinelets; marginal plates indistinguishable from actinal plates; adambulacral plates with nine or ten spines, grading smaller distally; color in life yellow with irregular maroon mottling.
**Distribution:** Found from Stalemate Bank, west of Attu Island, east to Adak Island at 16 to 219 m.
**Etymology:** Named in honor of noted sea star biologist, Dr. Howard M. Feder, Professor Emeritus, Institute of Marine Science, University of Alaska Fairbanks.

Stripped *Henricia* – *Henricia lineata* (Figure 4)
**Diagnosis:** Relatively small, fairly rigid; R to 7 cm, R:r 5-6:1; disc small, rays moderately long, slender, tapering; abactinal plates close-set, forming a tight reticulation; very spinose; abactinal surface with three radial rows per ray of very tightly packed spinose plates forming conspicuous lines; similar rows of tightly packed or fused plates at ray arcs, forming internal septa; color in life red with lighter radial lines.
**Distribution:** Found throughout the Aleutians from Fox Islands (Avatanak Island) to Near Islands (Attu Island) at depths of 6–25 m. Also present at Bering Island, Commander Islands, Russia, and along the Kamchatka, Russia coast.
**Etymology:** Named for the brilliant red stripes on the rays.

*Henricia uluudax* (Figure 5)
**Diagnosis:** Relatively small, fairly rigid; R to 5.3 cm, r to 10 cm, R:r 5–5.3; disc small; rays moderately long, slender, tapering; abactinal plates small, close-set; some plates may form a single fine, faint medial line or ridge on the rays; adambulacral plates with 19–24 fairly stout, compressed spines.
**Distribution:** Found from Fox Islands (Avatanak Island) to Amchitka Island of the Rat Islands at depths to 12 m.
**Etymology:** The name is the Aleut native word for red; (pronounced ōō lōō thux).

*Henricia iodinea* (Figure 6)
**Diagnosis:** Relatively large, R to 16 cm, R:r 5.1:1; rough textured; disc relatively small; rays long, slender, tapering; abactinal plates small, irregular, forming a fairly open reticulation in small animals, but quite tight in larger individuals; plates crowned with tight bundles of blunt-tipped spinelets; marginals widely separated at base of rays; superomarginals slightly larger than abactinals, forming a distinctive ridge that curves up aborally at the base of the rays; adambulacrals with nine to 12 spines; color in life purple or violet abactinally, paler orally.
**Distribution:** Found from Fox Islands (Avatanak Island) to the Rat Islands (Rat Island) at depths of 5–20+ m.
**Etymology:** The name is from the Greek *iodes*, "violet-like in color", in reference to the vibrant purplish-violet or lavender abactinal coloration.
Figure 3. *Aleutihenricia federi* Clark and Jewett, 2010.

Figure 4. *Henricia lineata* Clark and Jewett, 2010.
Figure 5. *Henricia uluudax* Clark and Jewett, 2010.

Figure 6. *Henricia iodinea* Clark and Jewett, 2010.
Henricia rhytisma (Figure 7)
Diagnosis: Moderately large, robust, fairly rigid; R to 8.0 cm, R:r 5; disc broad, thick; rays thick, inflated at base, tapering to slender tips; abactinal plates with 8–30 short, thick thorny spinelets; adambulacral plates with 8 to 10 thick blunt spines, 1 or 2 at furrow edge largest and usually slightly compressed; color in life mottled, maroon on tan, cream, orange, yellow or lavender.
Distribution: Found from Fox Islands (Avatanak Island) to Tahoma Bank, SSE of Buldir Island at depths of 6–91 m.
Etymology: From the Greek noun, for patch, in reference to the aboral color pattern.

Henricia gemma (Figure 8)
Diagnosis: Small, inflated; R to 3.4 cm, R:r 3–4.3; disc large; rays relatively short, thick at base, tapering sharply to a slender tip; abactinal plates small, tightly spaced, bearing 6–18 thorny spinules; adambulacral with 4–5 large, thick, blunt spines near furrow edge (arranged 1+2–3+2), followed by 10–16 much finer spines in 3 irregular rows; oral plates with 5 thick marginal and 10–15 similar sub-marginal spines; color in life uniformly red or yellow.
Distribution: Found around Andreanof and Rat Islands at depths of 12–16 m.
Etymology: Name is from the Latin, for jewel, in reference to the color of the live animals.

Henricia echinata (Figure 9)
Diagnosis: Small, moderately inflated; R to 5.3 cm, R:r 4.8; abactinal skeleton irregular, open meshwork; abactinal plates with 5–11 blunt rather smooth spines; adambulacral with 8–11 slender, blunt spines, 1 at furrow edge, followed by 2 slightly shorter spines, and 2 irregular rows of 3–4 shorter shorter spines; oral plates with 4–5 marginal and 1 or 2 sub-oral spines; color in life, red.
Distribution: Found at Andreanof Islands, Adak Island at depths to 16 m.
Etymology: From the Latin, for prickly.

Henricia vermilion (Figure 10)
Diagnosis: Moderately large; R to 10 cm, R:r 5.8-8; disc somewhat inflated; rays fairly broad at base, long, tapering to slender points; abactinal skeleton fine, open meshwork; pseudopaxillae round or oval, bearing 16–27 very slender spinules with 1–3 apical thorns; actinal inter-radial series only about 75% of R; adambulacral with 10–16 rather slender spines, in 3 rows, 2 long spines at the furrow edge, followed by 2 lateral rows of 3–5, and a central row of 2–4; color in life bright vermilion or scarlet.
Distribution: Likely occurs in the eastern Aleutians, east of Samalga Pass. Type specimens were all from Unalaska Island, but it has been observed at Umnak, Akun and Avatanak islands at < 16 m.
Etymology: The name is the French term for a vivid red to reddish-orange color.

Henricia elachys (Figure 11)
Diagnosis: Small moderately inflated; R to 2.3 cm, R:r 3–3.2; disc relatively broad, rays broad at base, tapering to slender points; abactinal skeleton fine, open meshwork; pseudopaxillae round or oval, bearing 16–27 very slender spinules with 1–3 apical thorns; actinal inter-radial series only about 75% of R; adambulacral with 10–16 rather slender spines, in 3 rows, 2 long spines at the furrow edge, followed by 2 lateral rows of 3–5, and a central row of 2–4; color in life reddish, mottled with lighter colors.
Distribution: All three type specimens were taken at Rat Island, mixed with the similar appearing H. tumida, but it is probably wide spread in the Aleutians at depths <20 m. A specimen was found off Amchitka Island in 2011.
Etymology: From the Latin, meaning small.
Figure 7. *Henricia rhytisma* Clark and Jewett, 2010.

Figure 8. *Henricia gemma* Clark and Jewett, 2010.
Figure 9. *Henricia echinata* Clark and Jewett, 2010.

Figure 10. *Henricia vermilion* Clark and Jewett, 2010.
Figure 11. *Henricia elachys* Clark and Jewett, 2010.

Figure 12. *Henricia insignis* Clark and Jewett, 2010.
Henricia insignis (Figure 12)
**Diagnosis:** Relatively small star; R to 7 cm; disc small; rays relatively stout to moderately long R:r 4.5–5.8; rays with three rather faint, fine, longitudinal lines of close-set plates; skeleton thin, abactinal plates small, rounded, bearing 17–35 spinelets; length inferomarginals about 1.5 to 2 times width; adambulacrals, with 30–40+ spines; color, uniformly crimson.
**Distribution:** Found throughout the central Aleutians, from the Islands of Four Mountains (Chuginadak Island) to Rat Islands (Kiska Island) at depths to 210 m.
**Etymology:** The name is from the Latin and means remarkable, in reference to its brilliant red coloration.

Odontothenricia aurantia (Figure 13)
**Diagnosis:** Very large, slender-rayed, R to 17 cm, R:r 6.2:1; disc relatively small; rays very long, slender, tapering; abactinal plates small, forming a rather close reticulation and crowned with numerous short (to 0.8 mm) spinelets; marginal plates forming two prominent series; oral plates with a very large apical spine, bordered on each side by a similar smaller spine about 3/4 as large; color in life bright orange.
**Distribution:** Known from the type locality at Rat Island, east to the Islands of Four Mountains (Chuginadak Island) at depths of 7–17 m.
**Etymology:** From the Latin noun for orange, in reference to the bright orange coloration of living animals.

Ahearn's Henricia – Odontothenricia ahearnae (Figure 14)
**Diagnosis:** Large slender to moderately inflated; R to 13 cm, R:r 6.5:1; disc relatively small, rays moderately long, tapering to slender tips; abactinal plates forming a relatively tight reticulation; marginal plates widely separated at base of rays; oral plates with large, recurved, hyaline apical tooth, with six to eight marginal teeth on each side; color light orange with large red-orange or purple blotch on center of disc.
**Distribution:** Found from Islands of the Four Mountains (Carlisle Island) to Rat Islands (E of Kiska Island) at depths of 7–442 m.
**Etymology:** Named after the late Cynthia Ahearn, former echinoderm collections manager at the U. S. National Museum for her great enthusiasm and many contributions to the study of echinoderms.

Odontothenricia violacea (Figure 15)
**Diagnosis:** Large, slender stars; disc small; rays very long, slender, R to 21.3 cm, R:r 10.6:1; abactinal surface covered with a thick, cuticle-like epidermal layer; aboral plates small, close-set, bearing 6–12 pointed spinelets; color violet abactinally, pale yellow-cream actinally.
**Distribution:** Found around Rat and Andreanof Islands. Only known from two locations, the type locality, south of Amatignak Island and the north side of Rat Island at depths of 14–95 m.
**Etymology:** Named for the beautiful violet aboral coloration.

A new sea star of the genus Hippasteria (Goniasteridae) (Clark and Jewett, 2011)
A new species of goniasterid sea star, Hippasteria aleutica was described from the Aleutian Islands, and compared to H. phrygiana (Parelius, 1768) from the North Atlantic–Arctic, as well as its congeners from the North Pacific. Distribution was discussed and a key to the described species of Hippasteria in Alaskan waters was presented.

Hippasteria aleutica (Figure 16)
**Diagnosis:** Large, broad, relatively rigid; R to 11 cm, R:r 1.7–1.8; disc very broad, rays short, sharply tapering; abactinal and marginal plates surrounded by pointed granules or thorns, bearing relatively short, thick, blunt, cylindrical spines; abactinal surface also profusely covered with small,
bivalve to quadravalve pedicellaria; adambulacral plates with two thick, blunt furrow spines, the adoral spine often more compressed than the aboral one, behind which are one or two very thick, blunt subadambulacral spines, and several bluntly pointed granules; color in life orange to red-orange abactinally, actinal side pale yellow-cream.

**Distribution**: Found from SSW of Buldir Island to Krenitzin Islands (subset of Fox Islands), Unimak Pass, N of Tigalda Island, at depths of 15–250 m.

**Etymology**: Named for its distribution in the Aleutian Islands.

Figure 13. *Odondohericia aurantia* Clark and Jewett, 2010.
Figure 14. *Odontohenricia ahearnae* Clark and Jewett, 2010.

Figure 15. *Odontohenricia violacea* Clark and Jewett, 2010.
Three new sea stars (Solasteridae and Pterasteridae) (Clark and Jewett, 2011)
Two new Solaster sea stars of the family Solasteridae and one new Pteraster sea star of the family Pterasteridae were described from the nearshore waters of the Aleutian Islands and compared to congers from the region. Solaster hexactis and S. spectabilis, and Pteraster willsi were distinguished by the characteristics of the paxillar, marginal and adambulacral spines, and (in Solaster) the number of rays. The distributions of the new species and keys were provided.

Solaster hexactis (Figure 17)
Diagnosis: Six rays, R to 41 mm, R:r 1:2.7; adambulacral plates with two furrow spines and a transverse actinal series of six to eight spines. Solaster hexactis is the first member of this genus found to brood its young under the disc, a behavior shared by several members of the echinasteriid genus Henricia and the asteriid genus Leptasterias, but to our knowledge unknown amongst the Solasteridae.
Distribution: Found from West of Buldir Island to Seguam Pass at depths of 8–384 m.
Etymology: From the Greek hex meaning six, in reference to the number of rays.

Solaster spectabilis (Figure 18)
Diagnosis: Ten to eleven rays, R to 135 mm, R:r 3.1; adambulacral plates with three furrow spines and a transverse actinal series of seven to eight spines.
Distribution: Central Aleutian Islands, from Islands of Four Mountains (Chuginadak Island) to near Kiska Island at depths of 7–212 m.
Etymology: The name spectabilis is Latin and means notable or showy, in regards to the many spectacular color morphs.
Wills’s Pteraster – *Pteraster willsi* (Figure 19)

**Diagnosis**: Five rays, R to 30 mm, R:r 1.36; supradorsal membrane thin, firm, papillose; adambulacral plates with L-shaped series of five to seven spines; actinolateral spine flattened; actinolateral membrane defining the edge of the rays.

**Distribution**: Found in central and western Aleutians, Kanaga Island to near Attu Island at 11–166 m.

**Etymology**: Named in honor of Dr. Irvin A. Wills (deceased) of John Brown University, Siloam Springs, Arkansas. For nearly four decades Dr. Wills served JBU as Professor and Head of the Department of Biology where he mentored thousands of biology students, including Stephen C. Jewett.

**Swimming Sea Anemone – Ptychodactis aleutiensis (Eash-Loucks et al., 2010)** (Figure 20)

A new species of ptychodactiarian sea anemone was described, *Ptychodactis aleutiensis*, and the family Ptychodactiidae and the previously monotypic genus *Ptychodactis* were redefined to accommodate *P. aleutiensis*. Many specimens were found detached, adrift in the water. It is the fourth species of ptychodactiarian described. *Ptychodactis* is the only genus of suborder Ptychodacteae with more than one species.
Figure 18. *Solaster spectabilis* Clark and Jewett, 2011.

Figure 19. *Pteraster willsi* Clark and Jewett, 2011.
Figure 20. Ptychodactis aleutiensis Eash-Loucks et al., 2010.

**Diagnosis:** The species differs from the only other member in its genus, Ptychodactis patula, in having more tentacles, tentacles only at the margin, frilled structures associated with only two siphonoglyphs, infertile primary mesenteries, oral stomata, holotrichous nematocysts of two size classes in the tentacles, actinopharynx, and mesenterial filaments, and by the morphology of the holotrichs and spirocysts.

**Distribution:** Found around all five major Aleutian Island groups.

**Etymology:** Ptychodactis aleutiensis is named for the place in which it occurs, the Aleutian Islands.

**Golden V Kelp – Aureophycus aleuticus (Kawai et al., 2010)** (Figure 21)
This brown alga was observed attached in two patches in the central Aleutians off southern Kagamil Island in 2006. When revisited in 2007 only one patch remained; a landslide buried the other. This kelp was not located elsewhere despite an extensive search around the island, including nearby Carlisle Island, or at any of the approximately four-dozen other sites that were sampled across the Aleutian chain. Kagamil Island is part of a volcanic island group known as the Islands of Four Mountains in the central Aleutians. Due to the remarkably clear waters at Kagamil Island (up to 30 m visibility), this new kelp (new genus and species) was discovered by simply peering into the water from a small skiff cruising the shoreline.

**Diagnosis:** The species can be easily distinguished from any known laminarialean alga: the erect sporophytic thallus is composed of a thin lanceolate blade attaining 2 m in height and 0.50 m in width, without midrib, and the edge of the blade at the transition zone is thickened to form a V-shape; the stipe is solid and flattened, slightly translucent, attaining 1 m in length; the holdfast is semidiscoidal and up to 0.15 m in diameter. The edges are brilliant sulfur-yellow edges.

**Distribution:** Found off Kagamil Island in the Islands of Four Mountains in the central Aleutians.

**Etymology:** Aureophycus aleuticus is named for the place in which it occurs, the Aleutian Islands.
In addition to the described new species, work is ongoing to describe several potential new species and range extensions from the Aleutian Archipelago. These include the following:

a. 52 range extensions of benthic marine algae;

b. 15 new species of benthic marine algae;

c. 9 of the new species of benthic marine algae are endemic to the Aleutian Islands;

d. 2 new species of sponges;

e. 1 new species of sea anemone;

f. 4 new species of gastropods;

g. 1 new genus of chiton;

h. 5 new species of chitons; and

i. several new species of bryozoa.

In spite of the numerous new species being described in remote and adverse environments, an international panel of experts recently warned that marine species are at risk of entering a phase of extinction unprecedented in human history (Rogers and Laffoley, 2011). The report from a 'State of the Oceans' workshop in April 2011 was the first ever to consider the cumulative impact of all pressures on the oceans. Considering the latest research across all areas of marine science, the workshop examined the combined effects of pollution, acidification, ocean warming, over-fishing and hypoxia (deoxygenation).

Figure 21. *Aureophycus aleuticus* Kawai et al., 2010.

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