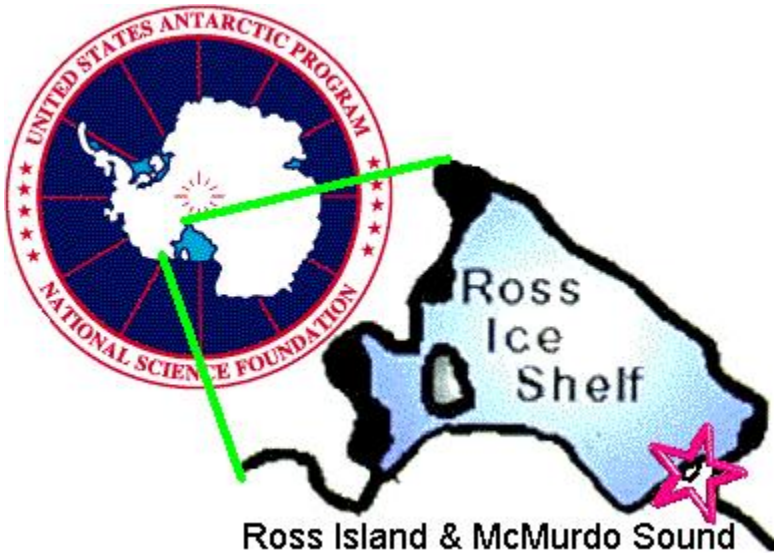
Echinodermata – Asteroidea: seastars

UNDERWATER FIELD GUIDE TO ROSS ISLAND & MCMURDO SOUND, ANTARCTICA

Peter Brueggeman

Photographs: Isidro Bosch, Peter Brueggeman, Canadian Museum of Nature (Kathleen Conlan), Paul Cziko, Shawn Harper, Adam G Marsh, Jim Mastro, Bruce A Miller, Rob Robbins, M Dale Stokes, & Norbert Wu



The National Science Foundation's Office of Polar Programs sponsored Norbert Wu on an Artist's and Writer's Grant project, in which Peter Brueggeman participated. One outcome from Wu's endeavor is this Field Guide, which builds upon principal photography by Norbert Wu, with photos from other photographers, who are credited on their photographs and above. This Field Guide is intended to facilitate underwater/topside field identification from visual characters. Organisms were usually identified from photographs with no specimen collection, though there were exceptions. Therefore can be some uncertainty in identifications solely from photographs.

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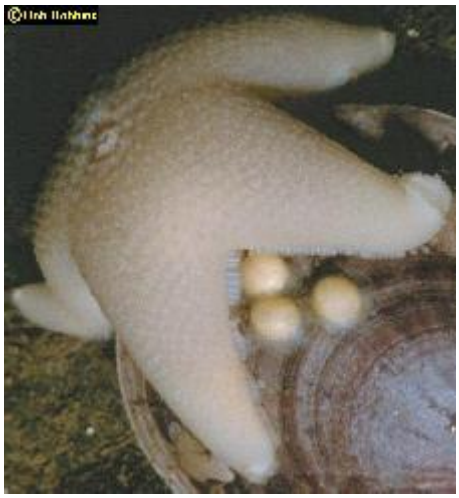

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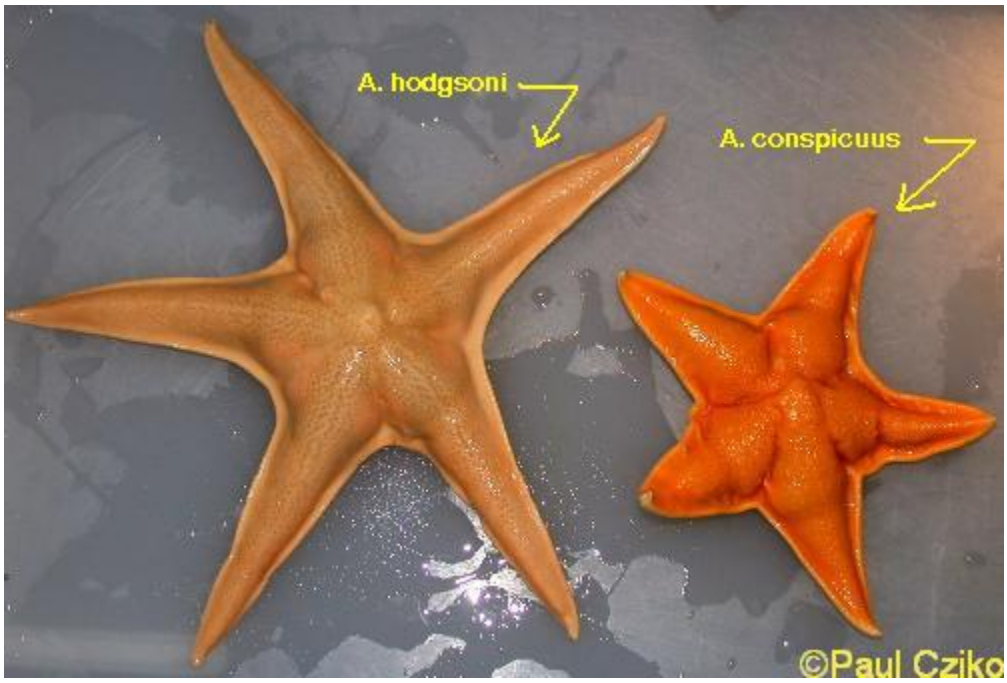
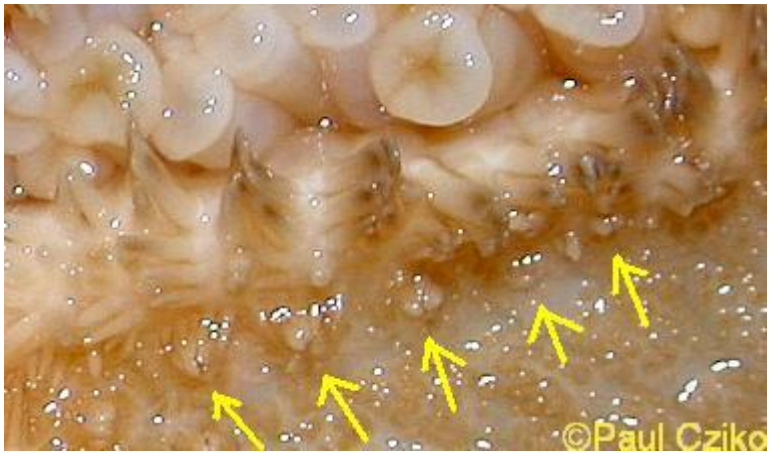
Feb 2017: Taxonomic names checked on World Register of Marine Species www.marinespecies.org

seastar *Acodontaster conspicuus*

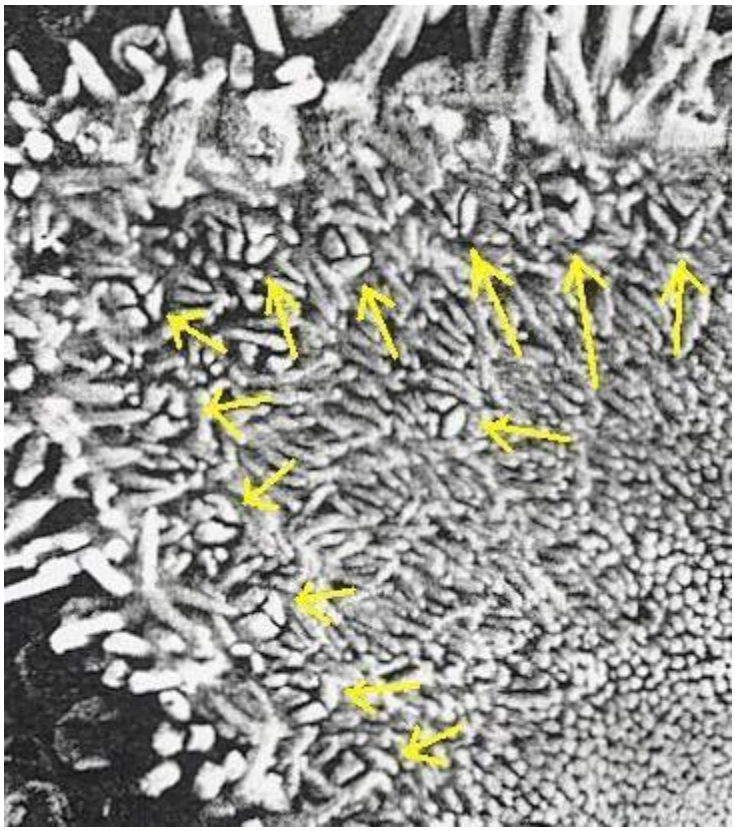
Acodontaster conspicuus is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, and South Georgia Island between 0 and 761+ meters depth [3,5,6,7]. *A. conspicuus* has been collected at sizes up to fourteen centimeters in radius from its center to the tip of an arm [4,6].



The color of *Acodontaster conspicuus* (shown on the right compared to *A. hodgsoni* on the left) has been recorded as pink, orange, pale orange, brown, and brownish yellow and it may be yellowish towards the edges [4,6]. *A. conspicuus* has a flattened disc with arms wide at their base and narrowing quickly with a thin edge [6].

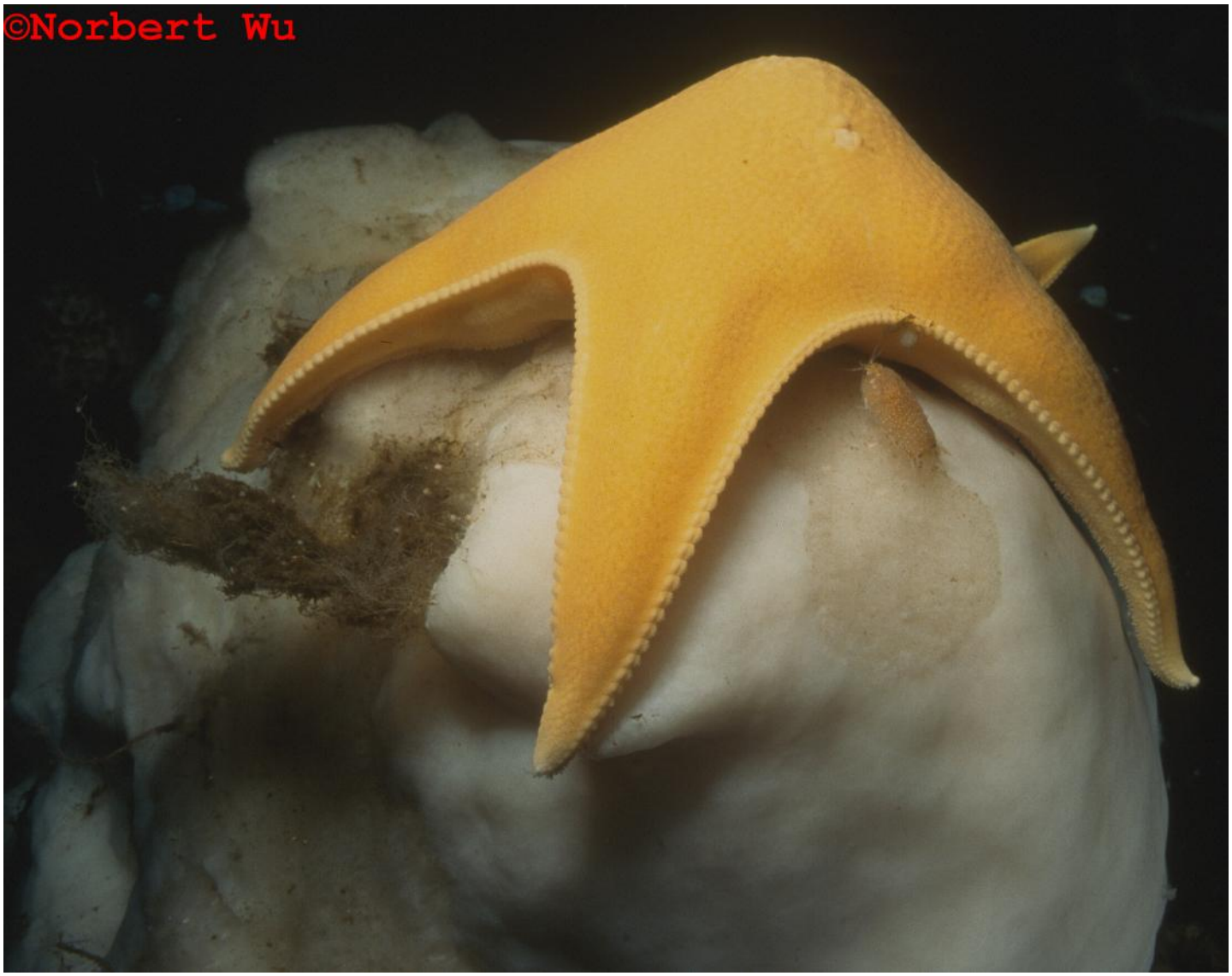


One way to distinguish *Acodontaster conspicuus* from the other Ross Sea *Acodontaster* species is by the presence of pincer-like pedicellariae on the underside of *A. conspicuus* [4].



A preserved specimen of *Acodontaster conspicuus* shows the pincer-like pedicellariae with greater clarity [4].

Pedicellaria keep the seastar's body surface clear of encrusting organisms by pinching or cutting their settling larvae.



Showing an *Acodontaster* sp. here, *Acodontaster conspicuus* is a predator of Rossellid sponges and the sponges *Homaxinella balfourensis*, *Anoxycalyx (Scolymastra) joubini* (shown here), *Antarctotetilla leptoderma*, *Haliclona scotti*, *Mycale (Oxymycale) acerata*, and *Kirkpatrickia variolosa* [1,2]. Observations suggest that a single *A. conspicuus* does not stay long on the sponge *Anoxycalyx (Scolymastra) joubini* but several accumulate, do not leave, and consume enough of the sponge to kill it [2]. In this image, see the isopod standing alongside *Acodontaster* sp. Some isopods shelter in sponges so it's possible that this isopod is inspecting a predatory visitor dining on its home.

Here’s a gang attack on an *Acodontaster* sp. by the predatory seastar *Odontaster validus*. Predators of *Acodontaster conspicuus* include the seastar *Odontaster validus* (shown here), the nemertean proboscis worm *Parborlasia corrugatus* (in foreground), and the anemone *Urticinopsis antarcticus* [2,3]. *A. conspicuus* would reach population densities destroying the sponge community if not kept in check by *O. validus* which preys upon the larvae, young and adult *A. conspicuus* [2]. A single *O. validus* climbs up onto an *A. conspicuus* armray, everts its stomach, and digests a hole into it. An attack by a single *O. validus* isn't fatal but nearby *O. validus* probably respond to the release of *A. conspicuus* coelomic fluid and join the attack [2].

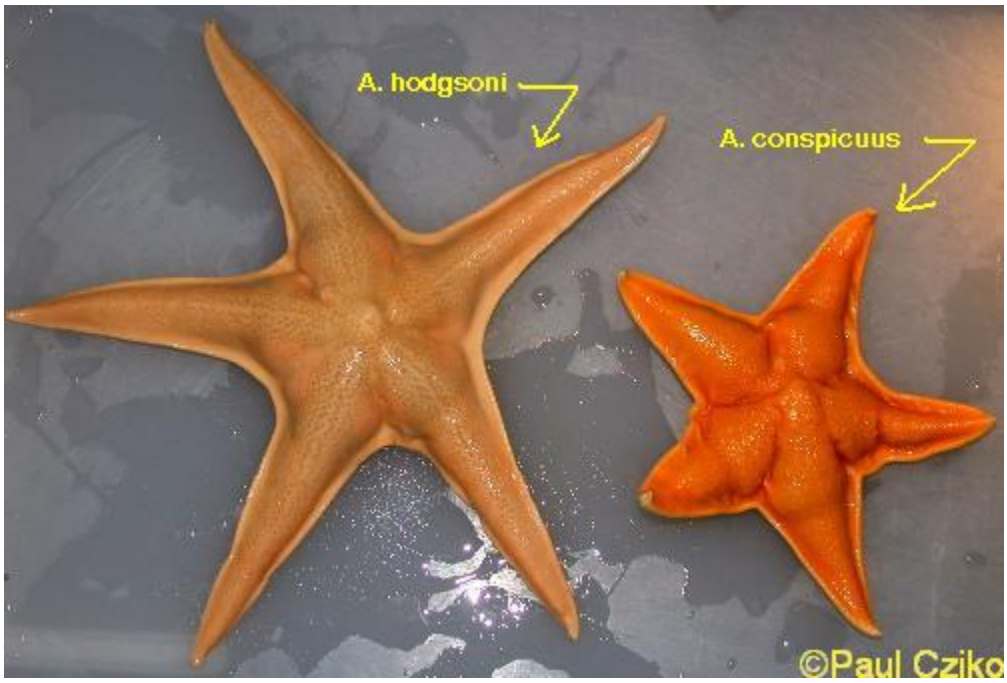
Showing an *Acodontaster* sp. here, a gang attack eventually slows the larger *Acodontaster conspicuus* seastar's movement, more *Odontaster validus* join the attack, and the large nemertean proboscis worm *Parborlasia corrugatus* joins in as well. *A. conspicuus* seastars can become completely buried under high piles of attacking *O. validus* seastars and *P. corrugatus* worms [2].

References: 1: Science 245:1484-1486, 1989; **2:** Ecological Monographs 44(1):105-128, 1974 (P. Dayton, personal communication, 2015: *Haliclona dancoi* observations are corrected to *H. scotti*; *Rossella racovitzae* observations are corrected to *R. podagrosa*); **3:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **4:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **5:** Polar Biology 20(4):229-247, 1998; **6:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **7:** U.S. National Museum of Natural History, Dept of Zoology, Invertebrate Zoology, Invertebrate Zoology Collections database

seastar *Acodontaster hodgsoni*

Acodontaster hodgsoni is found throughout Antarctica, the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, and South Georgia Island between 4 and 540 meters depth [2,3,4,5,6].

Acodontaster hodgsoni has been collected at sizes up to twenty centimeters in radius from its center to the tip of an arm [2].



Acodontaster hodgsoni is shown on the left compared to *A. conspicuus* on the right.

Acodontaster hodgsoni is a predator of the sponges *Haliclona scotti*, *Calyx shackletoni*, Rossellid sponges, and *Hemigellius fimbriatus* [1].

As shown here, *Acodontaster hodgsoni* lacks the pincer-like pedicellariae alongside its underside spines, which are present on *A. conspicuus* [2].

Predators of *Acodontaster hodgsoni* include the seastar *Odontaster validus*, the nemertean worm *Parborlasia corrugatus*, and the anemone *Urticinopsis antarcticus* [1]. Here's a gang attack on an *Acodontaster* sp. by the seastar *Odontaster validus* with the nemertean proboscis worm *Parborlasia corrugatus* in the foreground.

Showing an *Acodontaster* sp. here, a gang attack eventually slows the larger *Acodontaster* seastar's movement, more *Odontaster validus* join the attack, and the large nemertean proboscis worm *Parborlasia corrugatus* will join in the feeding as well.

References: 1: Ecological Monographs 44(1):105-128, 1974 (P. Dayton, personal communication, 2015: *Haliclona dancoi* observations are corrected to *H. scotti*; *Gellius tenella* corrected to *Hemigellius fimbriatus*; *Rossella racovitzae* observations are corrected to *R. podagrosa*); **2:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **3:** Bulletin de l'Institut Royal des Sciences Naturelles de Belgique. Biologie 63:175-184, 1993; **4:** Discovery Reports 20:115, 1941; **5:** U.S. National Museum of Natural History, Dept of Zoology, Invertebrate Zoology, Invertebrate Zoology Collections database; **6:** Polar Biology 38:799-813, 2015

seastar *Cuenotaster involutus*

Cuenotaster involutus is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Georgia Island, and Shag Rocks from 0 to 794 meters depth [1,2,4,5,6]. The disc of *C. involutus* may be flat or slightly convex, and is depressed between arms [3]. The arms of *Cuenotaster involutus* are long, slender, flexible, convex-surfaced, and blunt-tipped and may sometimes be coiled ventrally [3,4].

C. involutus has been collected at sizes up eleven centimeters in radius from its center to the tip of an arm [2,3,5].

The color of *Cuenotaster involutus* includes pink-brick, grey-brown, yellowish brown, white, greenish gray, and gray white [2,3,4,5].

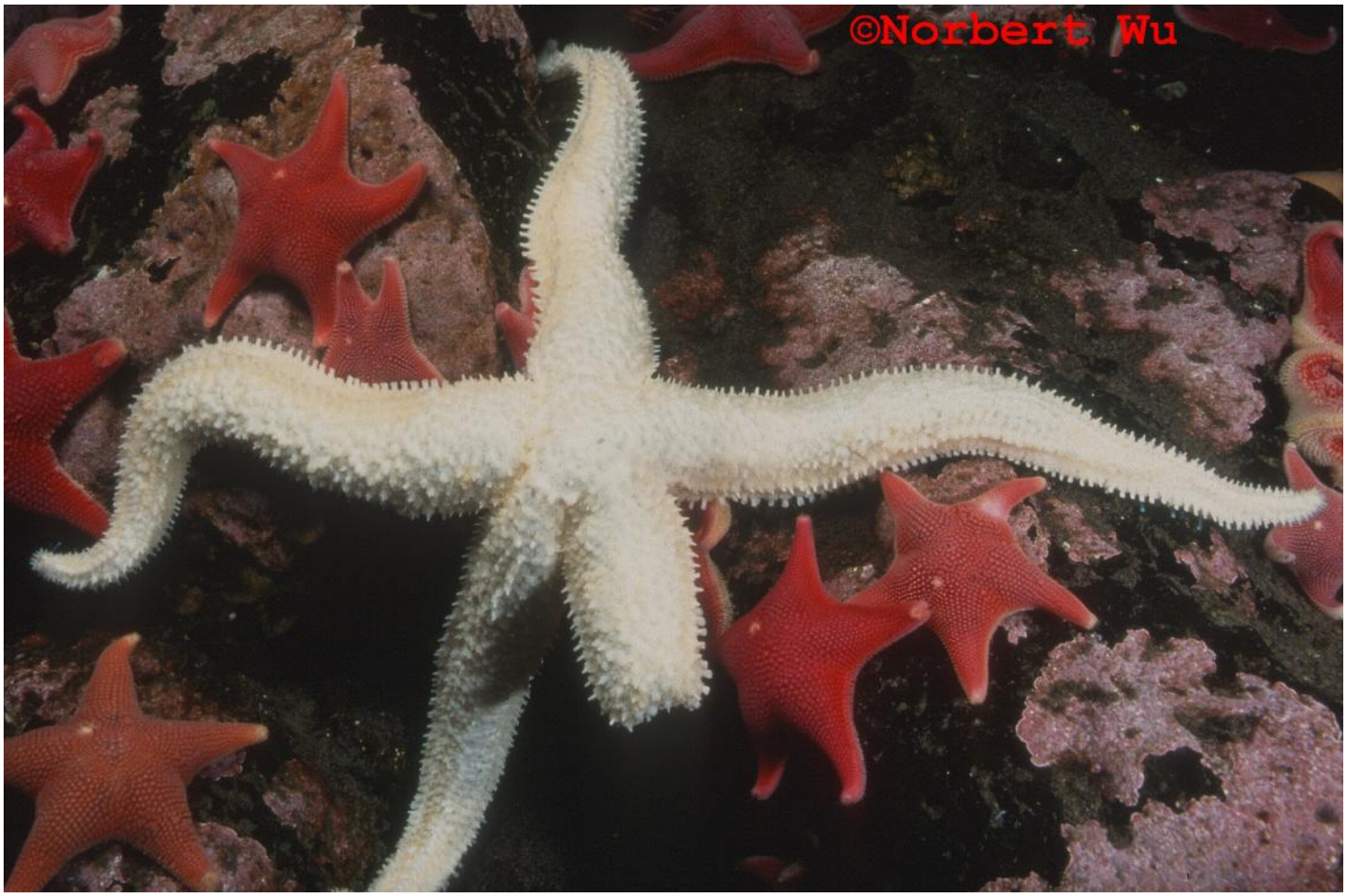
Closer view of the distinctive and unmistakeable bristling, well-spaced rosette-like paxillae along the disc and arms of *Cuenotaster involutus* [3,4,5].

C. involutus may be both an active predator and a scavenger [1].

References: 1: Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **2:** Fauna der Antarktis. J Sieg & JW Wagele, eds. Berlin : P. Parey, 1990; **3:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **4:** Discovery Reports 20:69-306 and plates, 1940; **5:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **6:** Polar Biology 38:799-813, 2015

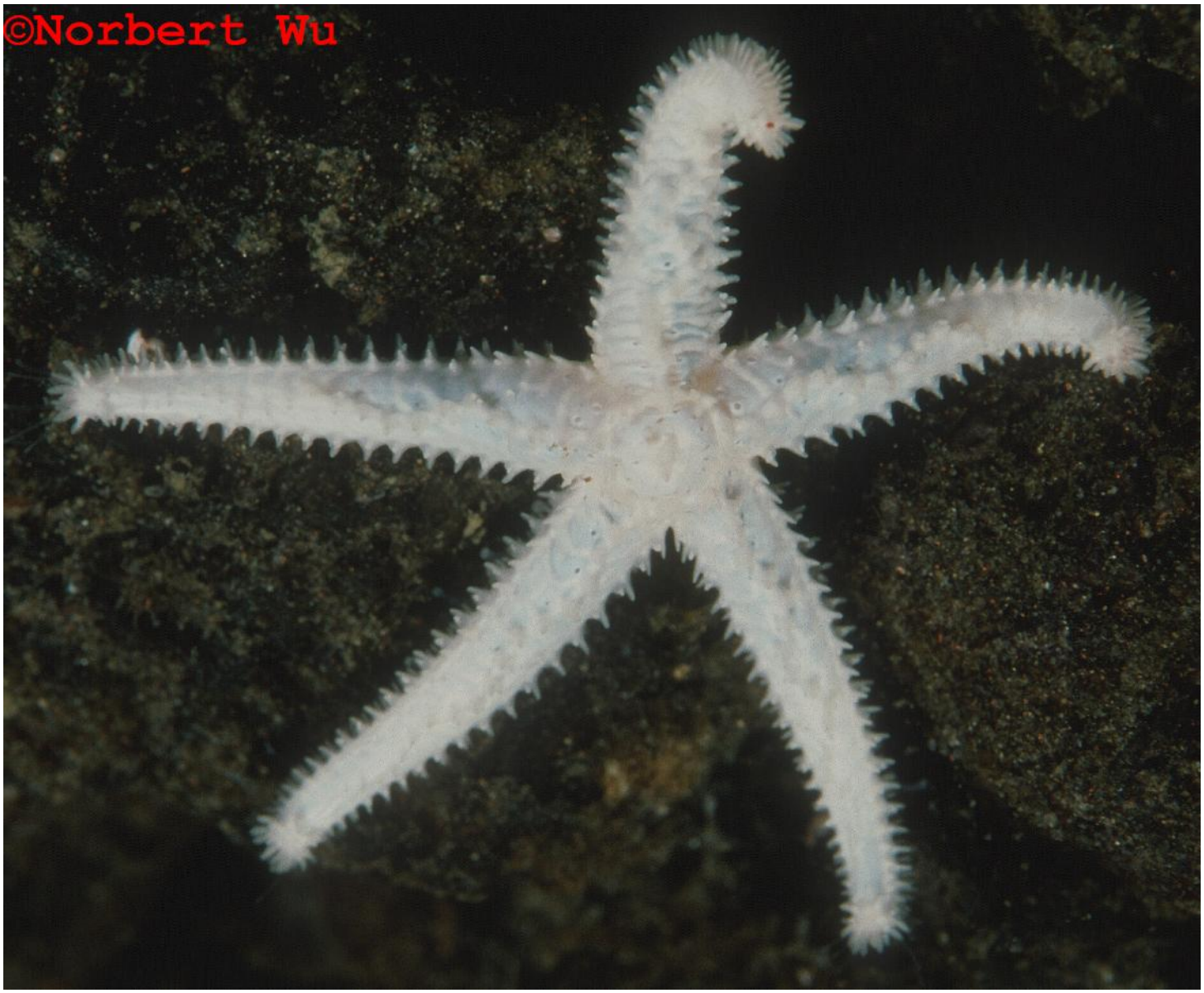
seastar *Diplasterias brucei*

Diplasterias brucei is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, and South Georgia Island (six-rayed forma) from 0 to 752 meters depth [3,6,7,8,9,10].



Diplasterias brucei color can be light blue-green on top with white spines and a whitish border to the disc and arms with the arm tips blood-red; other recorded colors are pale grey to blue-grey, pale orange or pale blue-grey with a red eye spot at each arm tip, light brown, creamy white with red blotches [7,10].

The disc of *Diplasterias brucei* is small and convex; its arms taper gradually to blunt tips [7]. *Diplasterias brucei* has been collected at sizes up to 23.7 centimeters in radius from its center to the tip of an arm [6,7,10].



These are juvenile *Diplasterias brucei*.

As shown here, *Diplasterias brucei* specializes on molluscan prey; it is a significant predator of the bivalve mollusc *Limatula hodgsoni* which can comprise almost all of its diet [2,3]. *Diplasterias brucei* also eats the muricid gastropod *Trophonella longstaffi*, and is a scavenger on dead material [2,3].

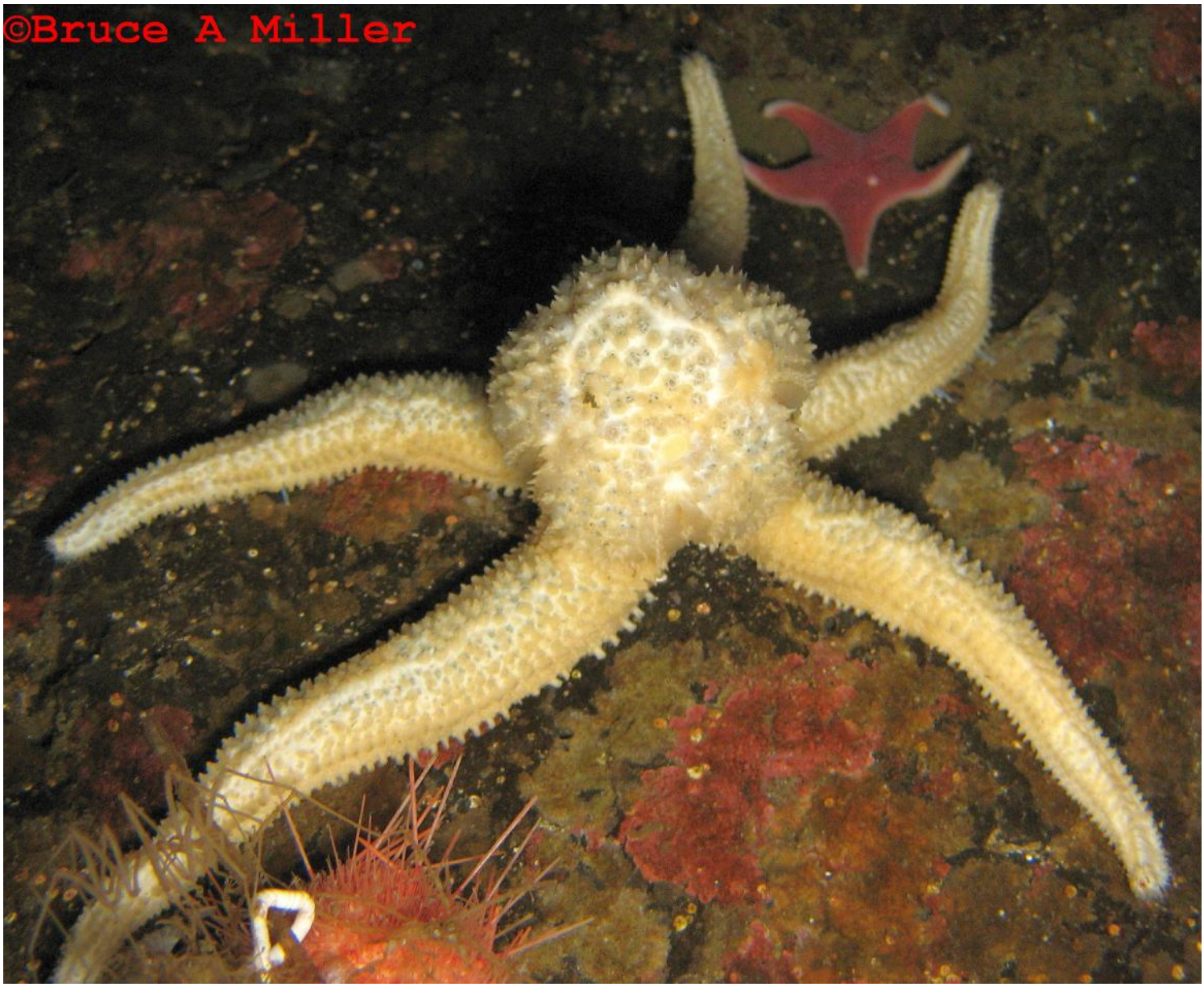
Diplasterias brucei is a prey item for the anemone *Urticinopsis antarctica* [2].

Here is *Diplasterias brucei* on anchor ice.

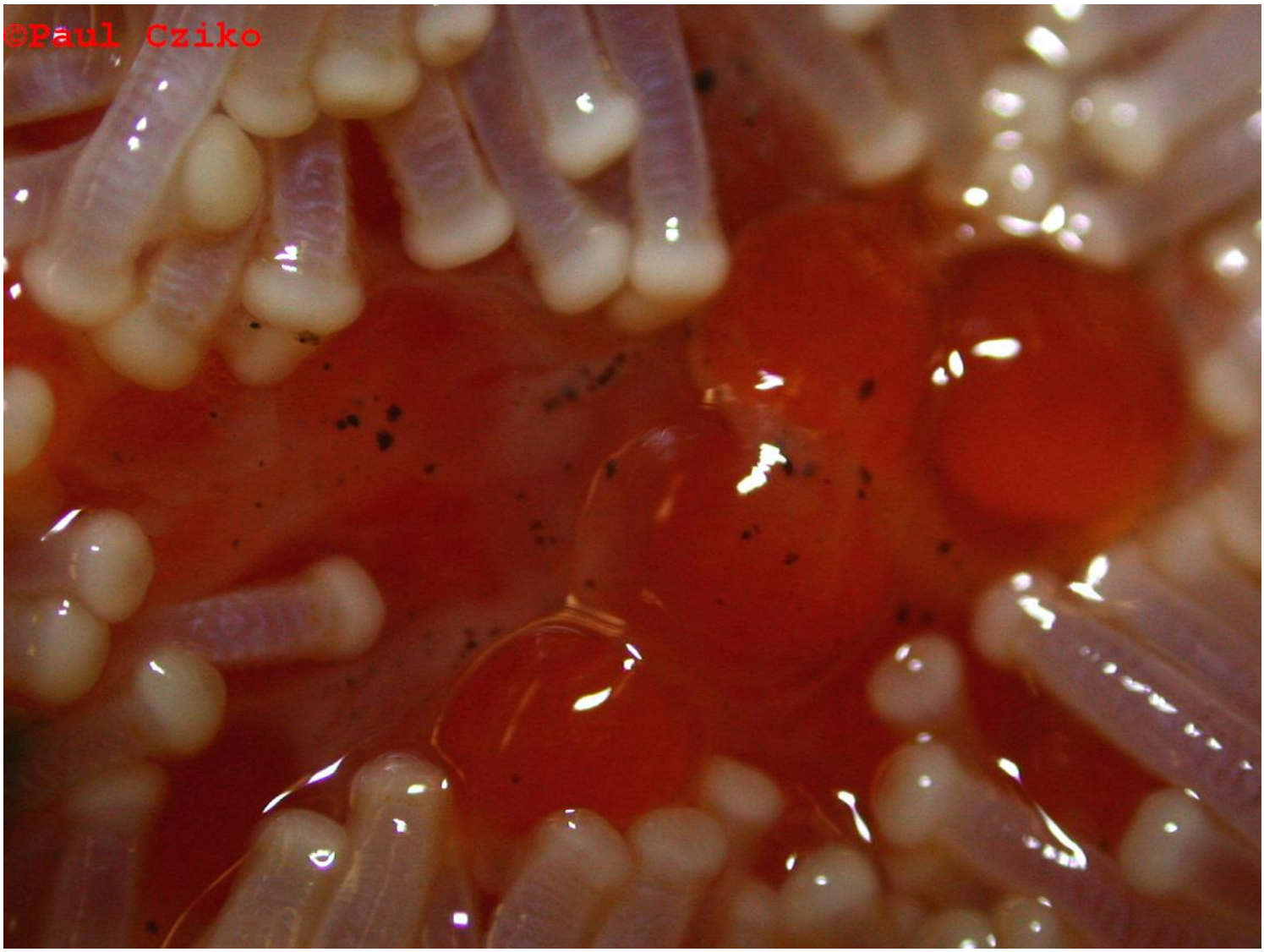
Here *Diplasterias brucei* is humped up and brooding its young in a pocket formed by the underside of its body [1]. Ripe females have been observed year round [5].

Closer view of the eggs being brooded by *Diplasterias brucei*, as seen from its underside, the ventral side of the seastar.

Brood protection occurs quite commonly among Antarctic marine invertebrates [4].



A *Diplasterias brucei* is humped up and brooding its young.



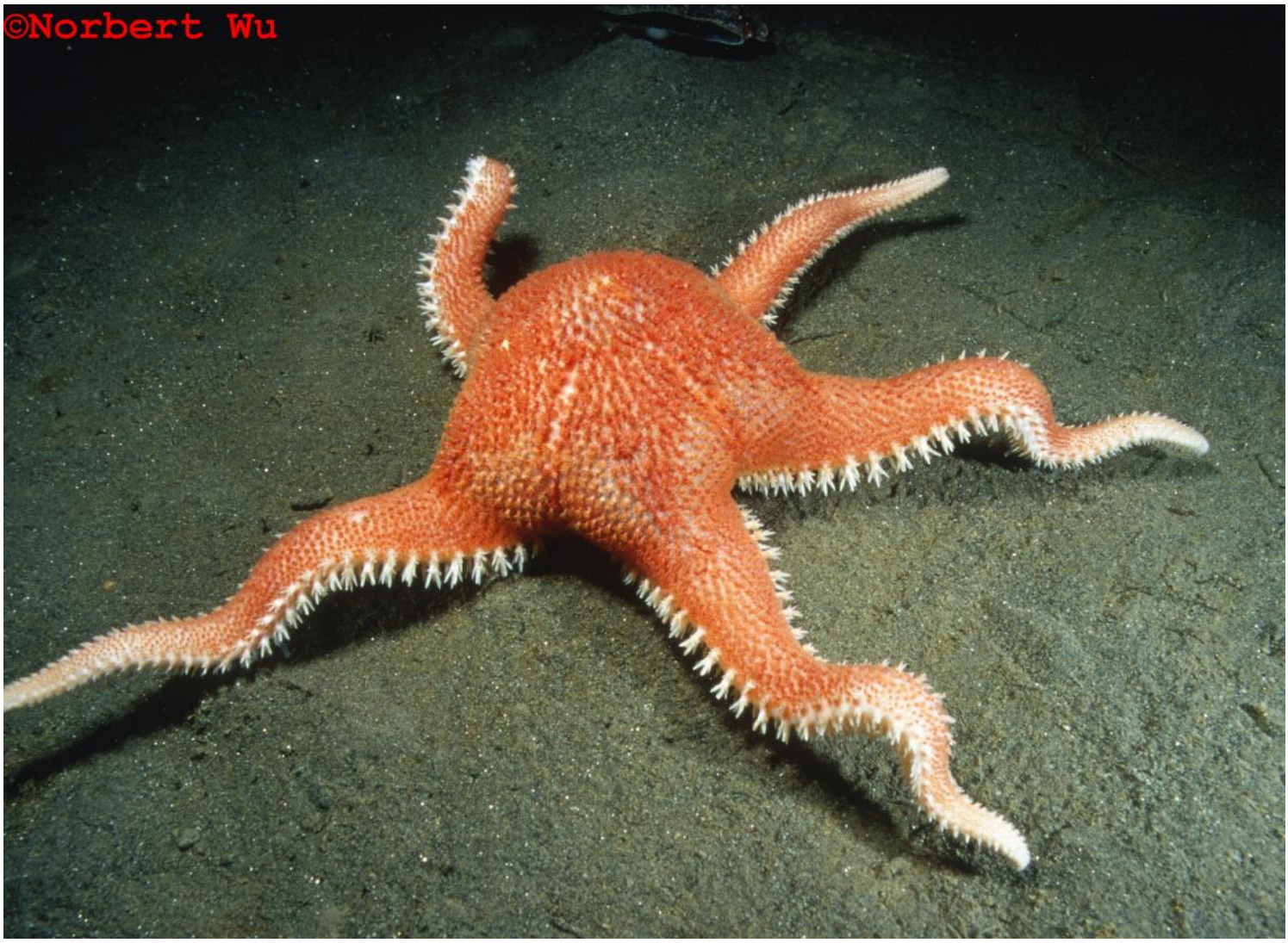
Yolky eggs of *Diplasterias brucei*.

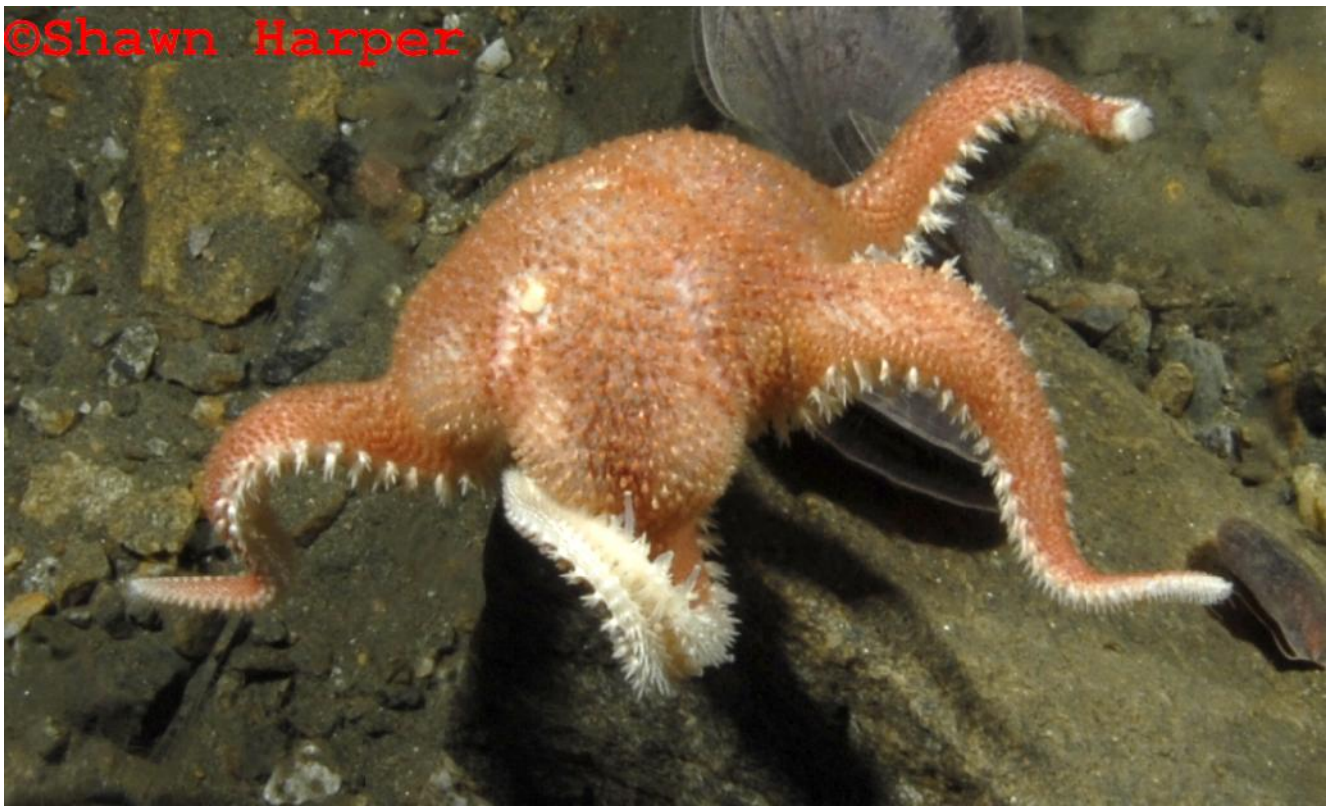
Brood protection helps larvae avoid the stresses of the environment and predation [4]. Brooding helps larvae avoid the dangers of being eaten if the larvae were planktonic in a strong seasonal planktonic cycle as seen in Antarctic waters [4].

References: 1: Ecological Monographs 44(1):105-128, 1974; **2:** Antarctic Ecology, Volume 1. MW Holdgate, ed. NY: Academic Press, 1970. pp244-258; **3:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **4:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.135-157; **5:** Marine Biology 104: 41-46, 1990; **6:** Fauna der Antarktis. J Sieg & JW Wagele, eds. Berlin : P. Parey, 1990; **7:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **8:** AM Clark. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **9:** Discovery Reports 20:69-306 and plates, 1940; **10:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970

seastar *Lophaster gaini*

Lophaster gaini is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, and Adelaide Island at depths from 23 to 578 meters [1,3]. *L. gaini* has been collected at sizes up to 17.5 centimeters in radius from its center to the tip of an arm [1].

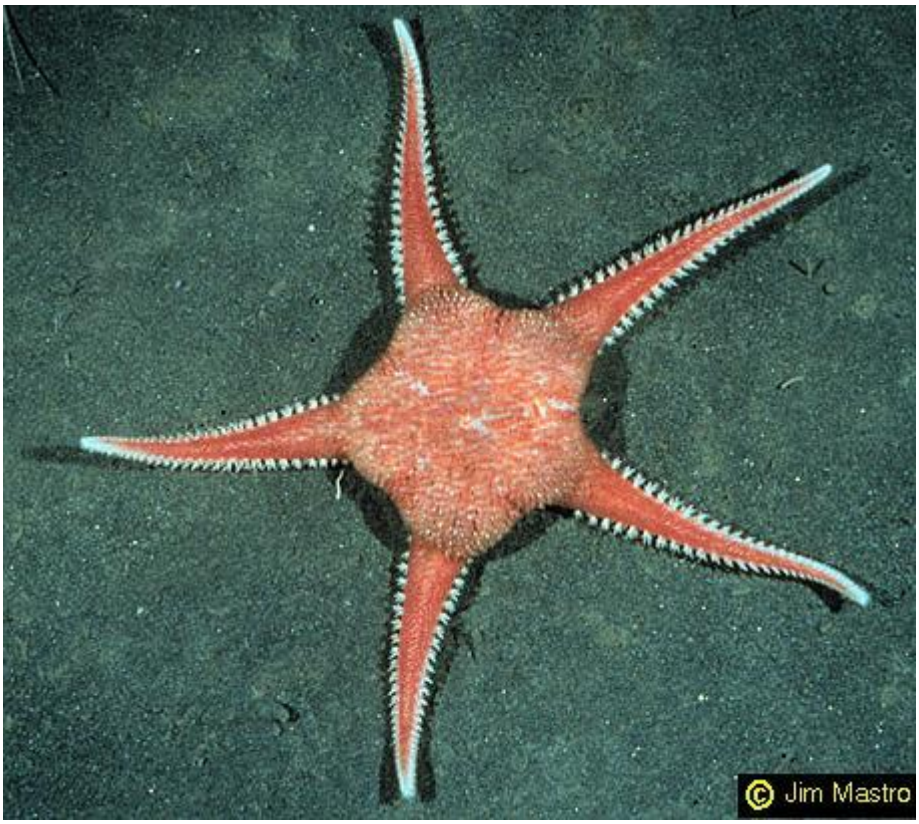




Lophaster gaini has a broad disc which is slightly concave in the center; its arms are broad at the base and taper evenly to blunt tips protected by small square plates [1].

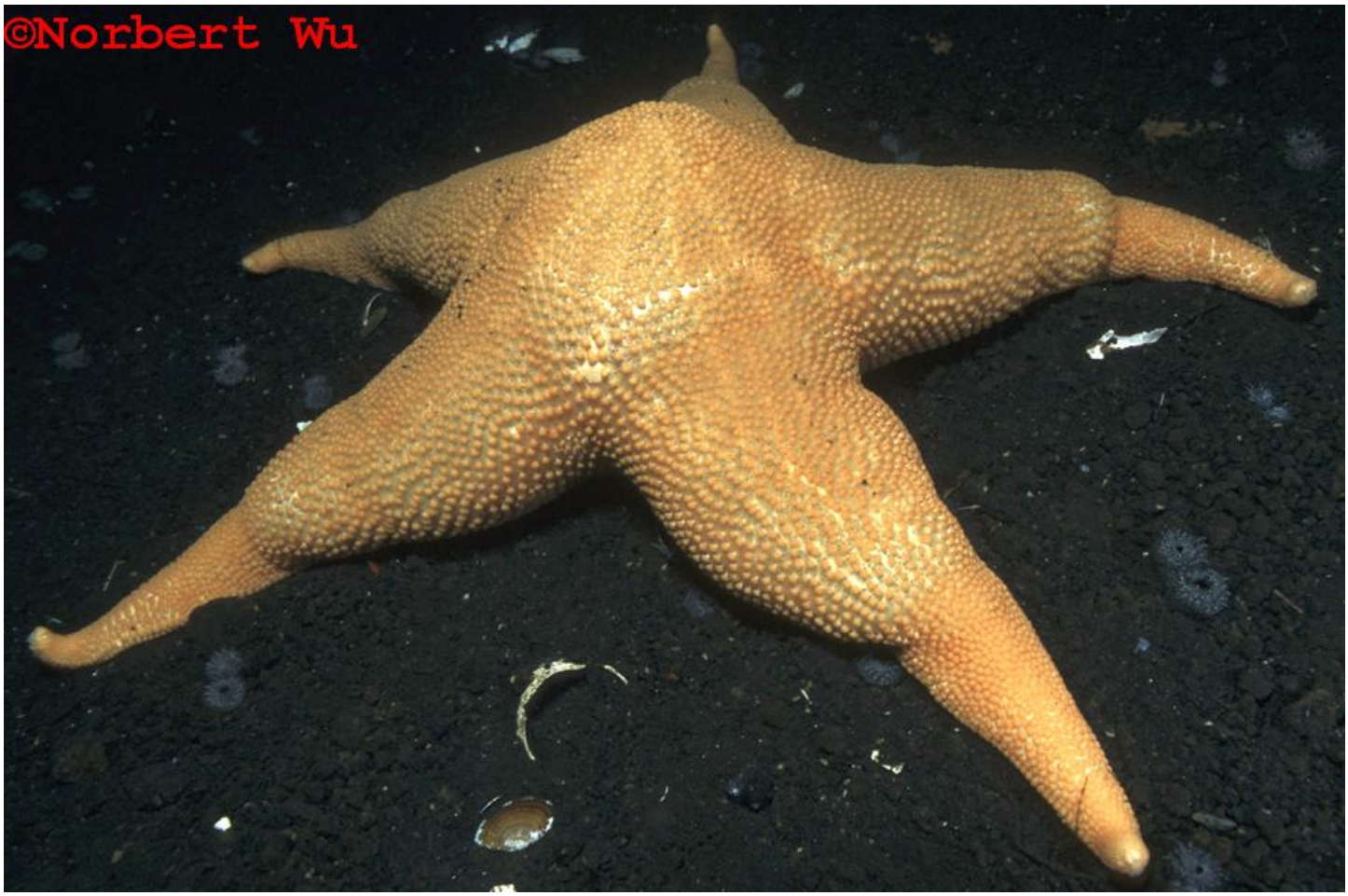
The dorsal (abactinal) color of *Lophaster gaini* may be red to orange to light bluish purple or slightly purple [1,2,5].

One prey item of *Lophaster gaini* is the Antarctic scallop *Adamussium colbecki* [4].



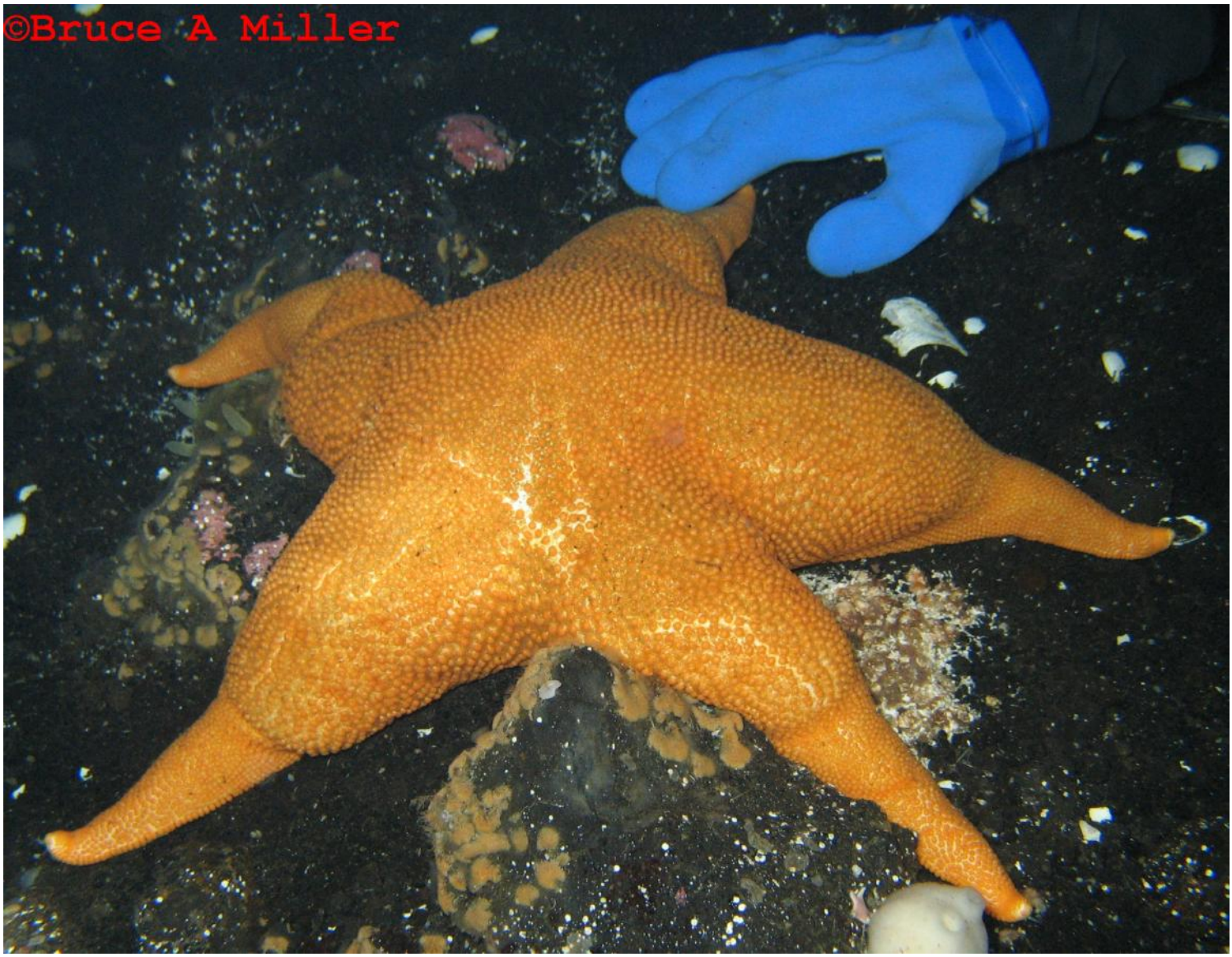
References: 1: The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **2:** Isidro Bosch, 1999, personal communication; **3:** Jim Mastro, personal communication, 1999 (New Harbor, 23 meters); **4:** Ecology of the Circumpolar Antarctic Scallop, Adamussium colbecki (Smith, 1902). Paul Arthur Berkman. Ph. D. Dissertation, University of Rhode Island, 1988; **5:** Echinodermes (Asteries, Ophiures et Echinides). R Koehler. Deuxieme Expedition Antarctique Francaise (1908-1910) commandee par le Dr Jean Charcot. Sciences Naturelles. Documents Scientifiques. Paris : Masson et Cie, 1912

seastar *Macroptychaster accrescens*

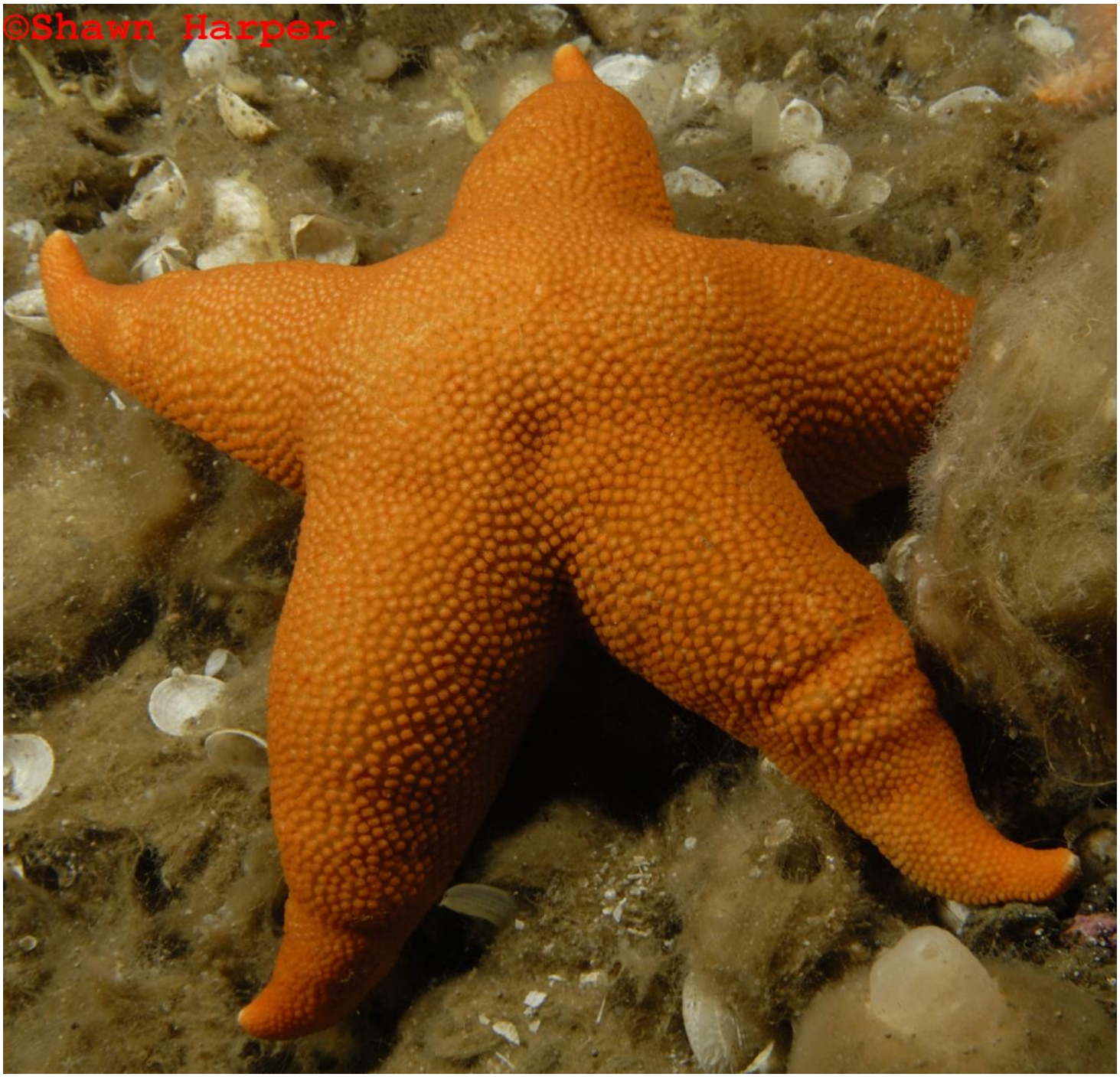


Macroptychaster accrescens is found throughout Antarctica and the Antarctic Peninsula, South Georgia Island, and Bouvet Island at depths from zero to 655 meters [1,2,4,5]. *Macroptychaster accrescens* is uncommonly seen [4].

Macroptychaster accrescens color has been recorded as orange with darker brown transverse bands across the arms and brown markings on the central disc [1].



Macroptychaster accrescens has been collected at sizes up to 26 centimeters in radius from its center to the tip of an arm [1].



Like other seastars in the Astropectinidae, *Macroptychaster accrescens* lacks sucking discs on its tube feet indicating a preference for soft or muddy environments [1].

Macroptychaster accrescens is a predator of the seastar *Odontaster validus*, the sea urchin *Sterechinus neumayeri*, gastropod molluscs, bivalves, and brittle stars [3,4].

Females of *Macroptychaster accrescens* are presumed to spawn their eggs by broadcasting them into the water where they develop into non- feeding larvae [2]. This pelagic (open ocean) non-feeding larval development is common among McMurdo Sound seastars [2]. Their larvae develop on stored yolk (lecithotrophic) which is probably an adaptation to low food levels [2]. Seastars in temperate and tropical shallow waters typically have feeding larvae [2].

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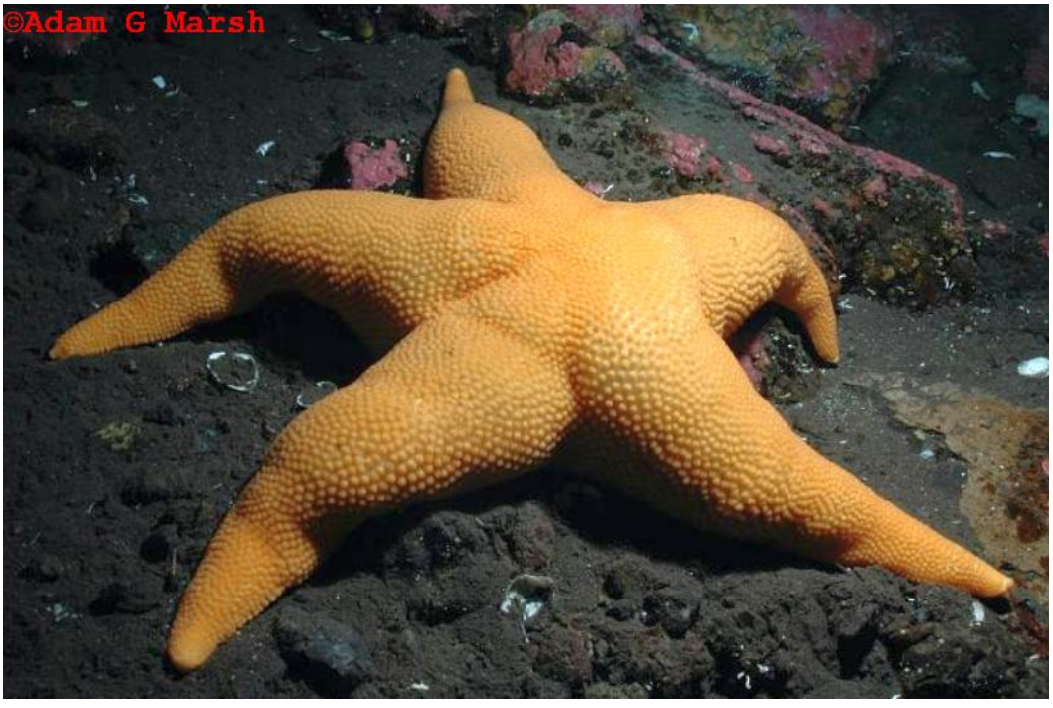
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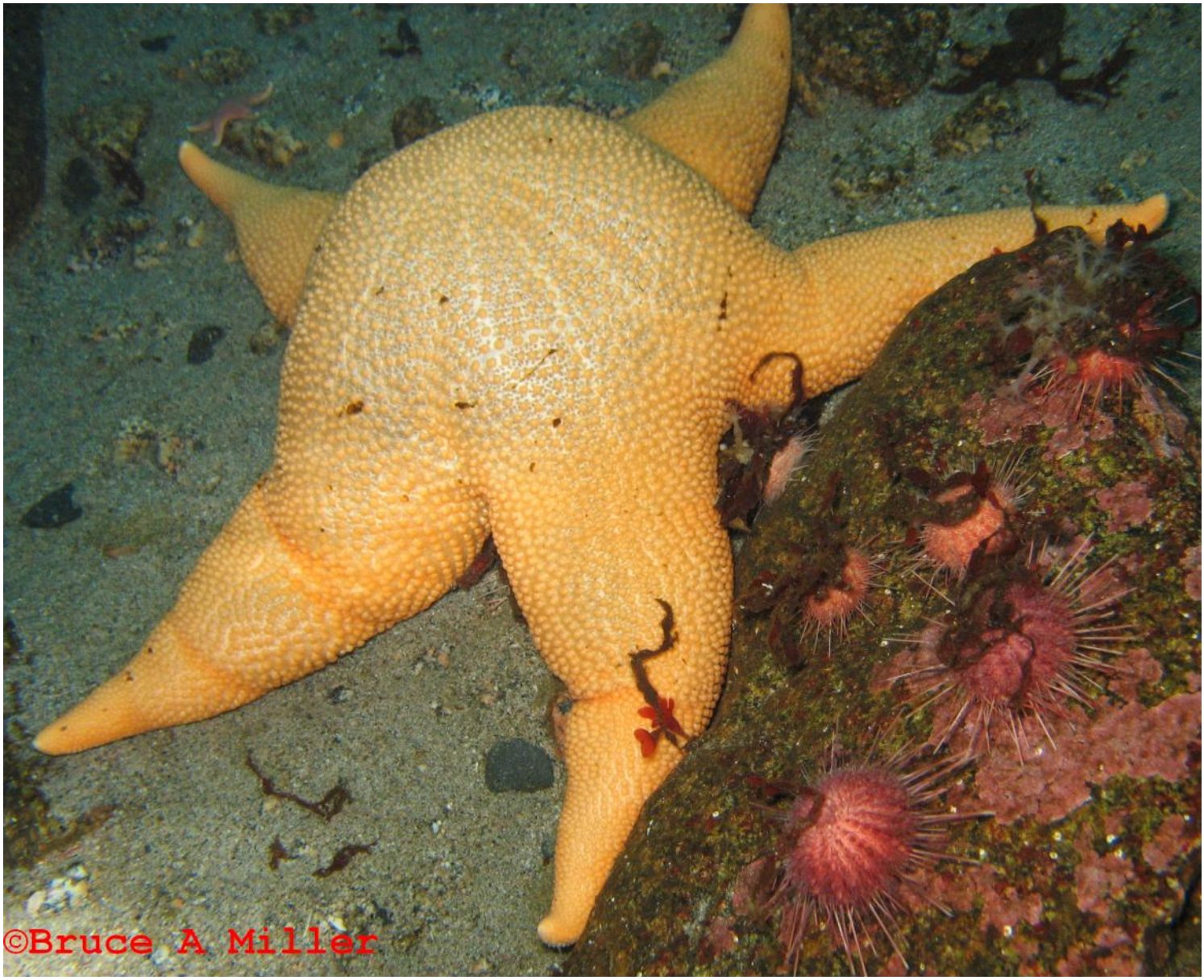


References: 1: The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **2:** Marine Biology 104:41-46, 1990; **3:** Ecological Monographs 44(1):105-128, 1974; **4:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **5:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970

astropectinid sea star, probably *Macroptychaster accrescens* or *Leptychaster* sp.

These sea stars get very large and massive; this animal is probably a juvenile or young adult [1]. Several characters place it in the *Leptychaster* - *Leptoptychaster* - *Macroptychaster* complex which isn't taxonomically well-defined; the species in these genera are fairly common on the Antarctic Shelf but variable in their morphology [1].

References: 1: John Dearborn, personal communication, 1999

seastar *Notasterias armata*

Notasterias armata is found throughout Antarctica and the Antarctic Peninsula and South Shetland Islands from 15 to 752 meters depth [1,2,7]. The disc of *N. armata* is small and its arms taper to blunt tips [2].

The color of *Notasterias armata* can be orange, creamy white, red, and mottled red with creamy areas [2,3]. *N. armata* has been collected at sizes up to thirteen centimeters in radius from its center to the tip of an arm [2,3].

The diet of *Notasterias armata* includes the Antarctic scallop *Adamussium colbecki* (shown here) as well as the bivalve *Limatula hodgsoni* [1,6].

Notasterias armata broods its young in a brooding posture with a strongly convex disc and supporting itself on bent arms [2]. Ripe females have been observed from August to February [5]. Brood protection occurs quite commonly among Antarctic marine invertebrates [4]. Brood protection helps larvae avoid the stresses of the environment and predation [4]. Brooding helps larvae avoid the dangers of being eaten if the larvae were planktonic in a strong seasonal planktonic cycle as seen in Antarctic waters [4].

References: 1: Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **2:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **3:** Fauna der Antarktis. J Sieg & JW Wagele, eds. Berlin : P. Parey, 1990; **4:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.135-157; **5:** Marine Biology 104: 41-46, 1990; **6:** Ecology of the Circumpolar Antarctic Scallop, Adamussium colbecki (Smith, 1902). Paul Arthur Berkman. Ph. D. Dissertation, University of Rhode Island, 1988; **7:** Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut 89:239- 259, 1992

seastar *Odontaster meridionalis*

Odontaster meridionalis is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Sandwich Islands, South Georgia Island, Straits of Magellan, Marion and Prince Edward Islands, Kerguelen Island, Shag Rocks, and Heard Island from zero to 647 meters depth [1,2,5,6,7,8,9,10,12,14].

Odontaster meridionalis color is variable and includes yellow-white, dirty yellow, orange yellow, bright orange, pale brown, and a grey center grading to white at arm tips [2,7].

Odontaster meridionalis has been collected at sizes up to nine centimeters in radius from its center to the tip of an arm [2].

Odontaster meridionalis has a flattened disc with its arms narrowing down on the latter half of their length [8].

Odontaster meridionalis is an important predator of the sponge *Homaxinella balfourensis* and also eats Rossellid sponges and the sponges *Haliclona scotti*, *Mycale (Oxymycale) acerata*, *Polymastia invaginata*, *Hemigellius fimbriatus*, *Isodictya setifera* (above and at left), and *Pachychalina pedunculata* [3,4].

Above and below, *Odontaster meridionalis* eating the bush sponge *Homaxinella balfourensis*.

Odontaster meridionalis is preyed upon by the anemone *Urticinopsis antarcticus* and the seastar *Macroptychaster accrescens* [5].

Odontaster meridionalis is generally pale brown or yellowish white on the dorsal surface and lighter on the ventral surface [11].

Odontaster validus is usually bright to dull red on the dorsal (abactinal) surface and yellowish white to pale pink on the ventral (actinal) surface [11].

A classification key for these *Odontaster* species was published in 2010 [13].

Odontaster meridionalis eating the sponge *Isodictya setifera*.

Female *Odontaster meridionalis* spawn their eggs by broadcasting them into the water where they develop into feeding larvae [1]. This differs from the more common tendency of McMurdo Sound seastars to have pelagic (open ocean) non-feeding larval development [1].

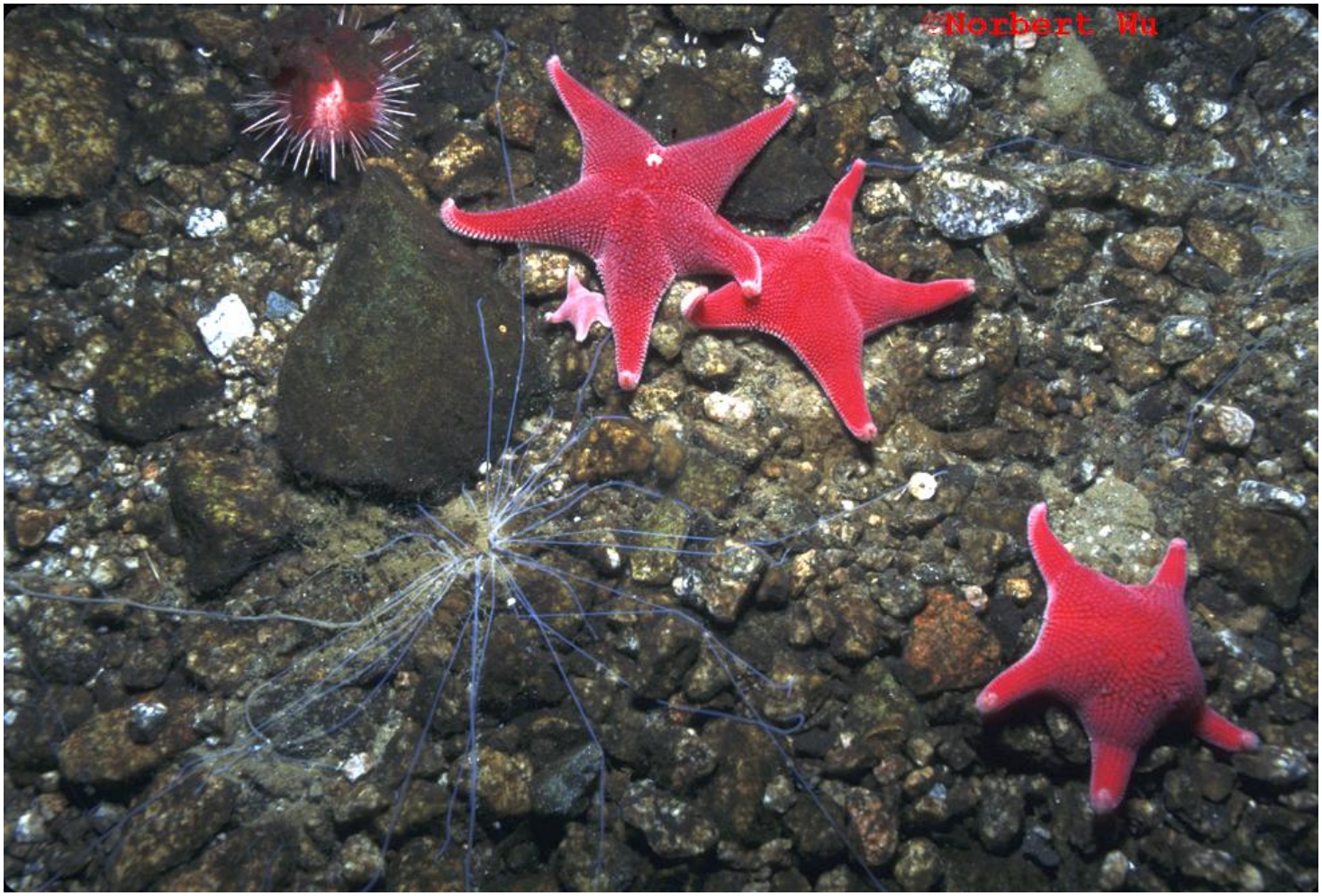
References: 1: Marine Biology 104:41-46, 1990; **2:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **3:** Science 245:1484-1486, 1989; **4:** Ecological Monographs 44(1):105-128, 1974 (P. Dayton, personal communication, 2015: *Haliclona dancoi* observations are corrected to *H. scotti*; *Gellius tenella* corrected to *Hemigellius fimbriatus*; *Rossella racovitzae* observations are corrected to *R. podagrosa*); **5:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **6:** AM Clark. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **7:** Discovery Reports 20:69-306 and plates, 1940; **8:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **9:** South African Journal of Antarctic Research 23(1-2):37- 70, 1993; **10:** Scientia Marina 63(Supplement 1):433-438, 1999; **11:** John Dearborn, personal communication, 2001; **12:** Revista Ciencia y Tecnología del Mar 29(1):91-102, 2006; **13:** Integrative and Comparative Biology 50(6):981-992, 2010; **14:** Polar Biology 38:799-813, 2015

seastar *Odontaster validus*

Odontaster validus is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, South Georgia Island, Shag Rocks, Marion and Prince Edward Islands, and Bouvet Island at depths from 0 to 914 meters [7,10,11,12,14]. *Odontaster validus* is the most abundant seastar in the shallow shelf waters of Antarctica and is most abundant from 15 to 200 meters [9].

Odontaster validus has a broad disc and short arms tapering to blunt tips [7]. *O. validus* varies in color including dark brown, purple, purple-red, orange, red-orange, red, brick red, dark carmine, and pink; it may have light colored arm tips [7,11,14]. *O. validus* has a characteristic position with its arm tips slightly raised [7].

Odontaster validus is usually bright to dull red on the dorsal (abactinal) surface and yellowish white to pale pink on the ventral (actinal) surface [16]. *Odontaster validus* can be differentiated from *Odontaster meridionalis* which is generally pale brown or yellowish white on the dorsal surface and lighter on the ventral surface [16]. A classification key for these *Odontaster* species was published in 2010 [18].

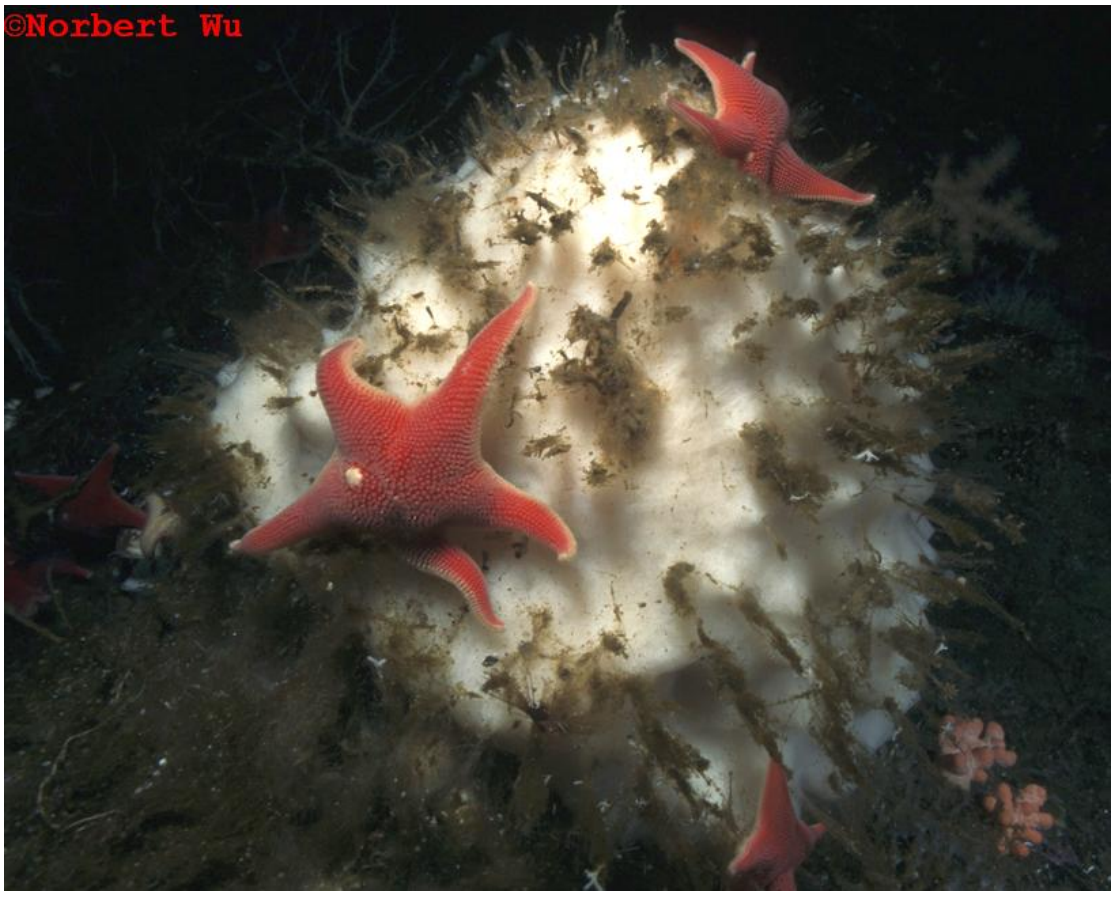


Odontaster validus has been collected at sizes up to seven centimeters in radius from center to arm tip [7,11].

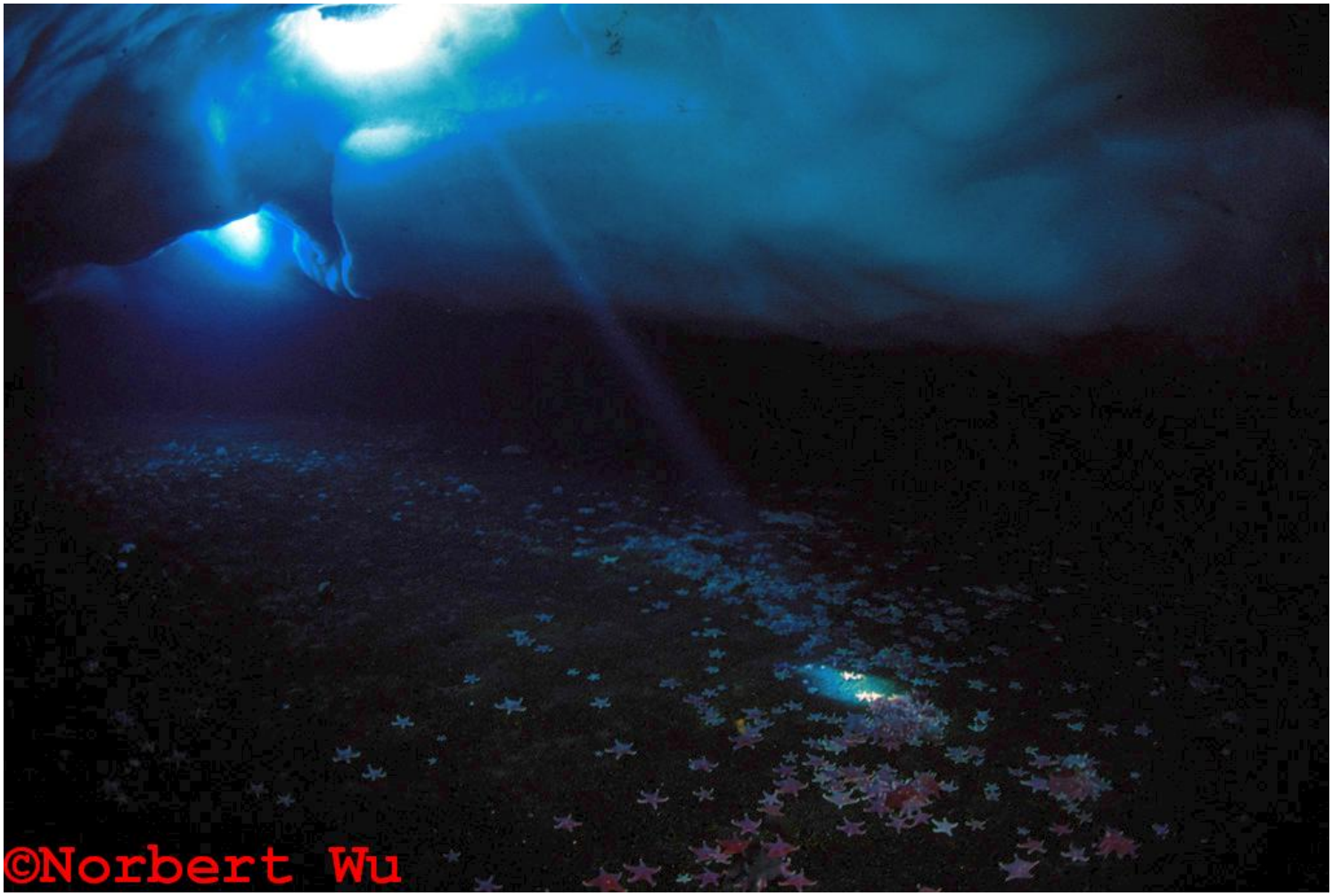
Here's a juvenile and adult of *Odontaster validus*. Size-frequency distribution of *O. validus* can vary with location and is a reflection of the general level of productivity of a habitat: at McMurdo Station, their size and number decrease with depth; at Cape Evans, they are more numerous and generally smaller; and, at East Cape Armitage, they are less numerous and very small [3]. *O. validus* is slow growing; well-fed individuals need about nine years to reach thirty grams wet weight which is near the mean size of shallow-water individuals at McMurdo Station [3]. Based on its growth rate, collected sizes, and knowledge from other seastars, *O. validus* may live beyond one hundred years of age, with very low turnover in a population [17].

Here *Odontaster validus* is ganging up and eating the sea urchin *Sterechinus neumayeri*; little red amphipods are stealing food in the process. *O. validus* appears voracious to the diver, being very numerous in some areas and piled up in feeding groups; one study found that almost 50% of *O. validus* in the study area were engaged in feeding with their everted stomach [13].

Odontaster validus is omnivorous, capable of filter-feeding and eating a varied diet: detritus, small crustaceans including amphipods and the isopod *Glyptonotus antarcticus*, seastars, molluscs (scallop *Adamussium colbecki*, gastropods, bivalves *Laternula elliptica* and *Limatula hodgsoni*), hydroids (including *Hydrodendron arboreum*), bryozoans, sponges (Rossellid sponges, *Homaxinella balfourensis* [shown above], *Scolymastra joubini*, *Tetilla leptoderma*) , ostracods, sea urchin *Sterechinus neumayeri*, polychaete worms, carrion (dead Weddell seals), feces (Weddell seals), diatoms, and algae [shown above] [5,8,9,13,15].



Above, *Odontaster validus* seastars feeding on a dead Weddell seal pup. *O. validus* has been observed feeding on the detrital film on the surface of the sponge *Cinachyra antarctica* [at left] [13].



Odontaster validus seastars piled up feeding on Weddell seal feces under ice holes used by Weddell seals to enter and exit the water through the thick sea ice.

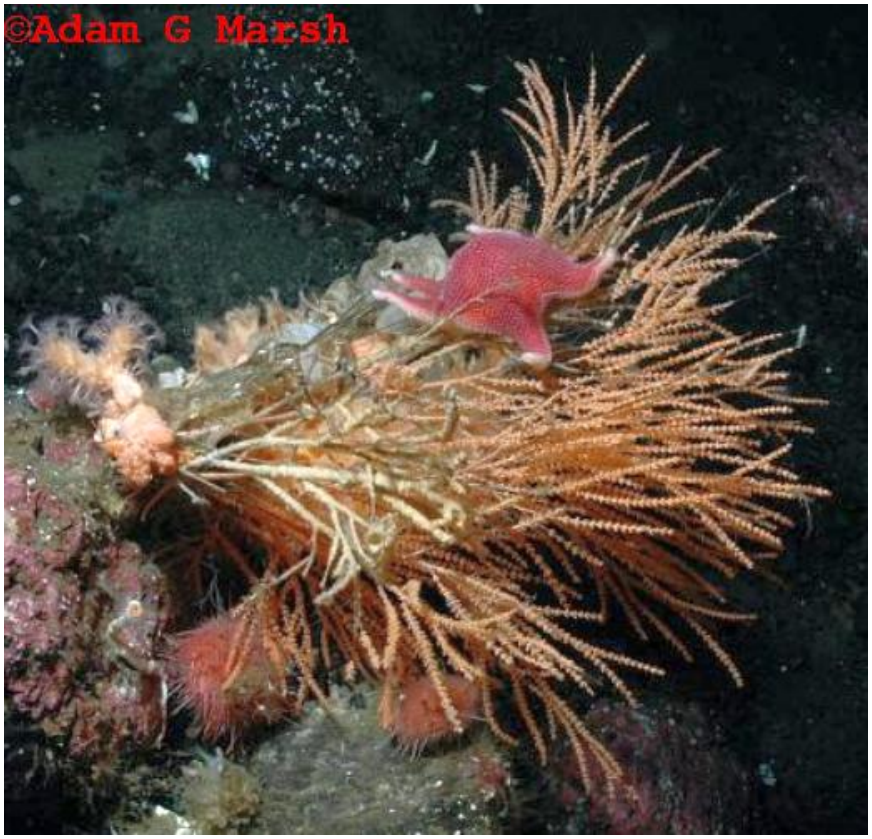
Odontaster validus is a prey item of the seastar *Macroptychaster accrescens* [5] and of the anemone *Urticinopsis antarcticus* (shown at left) [6].

O. validus broadcast-spawns larvae which feed on bacteria and algae and have a low metabolic rate (which predicts long-term larval survival); larvae of a comparable temperate seastar eat only algae and have a higher metabolic rate [1,2].

The seastars *Odontaster validus* and *Acodontaster conspicuus* are the two greatest predators on McMurdo sponges [5]. *Odontaster validus* is a foundation species in the McMurdo sponge-dominated benthic ecosystem and is the keystone to the interaction between the rossellid sponges and one of their primary predators, the large Antarctic seastar *Acodontaster conspicuus* [4]. *A. conspicuus* would reach population densities destroying the sponge community if not kept in check by *O. validus* which preys upon its larvae, young and adults [5]. Here's a gang attack on *Acodontaster* sp. A single *O. validus* climbs up onto an *Acodontaster conspicuus* ray, everts its stomach, and digests a hole into it. An attack by a single *O. validus* isn't fatal but nearby *O. validus* probably respond to the release of coelomic fluid from *A. conspicuus* and join the attack [5].

Showing an *Acodontaster* sp. seastar here, eventually the larger *Acodontaster conspicuus* seastar's movement is slowed, and more *Odontaster validus* seastars attack. *Acodontaster conspicuus* seastars can become completely buried under high piles of attacking *Odontaster validus* seastars and *Parborlasia corrugatus* worms [5].

Odontaster validus seastars attack an urchin.



Odontaster validus seastar eating a gorgonian

References: 1: Antarctic Journal of the United States26(5):170-172, 1991; **2:** Antarctic Journal of the United States 26(5):163-165, 1991; **3:** Marine Biology 99(2):235-246, 1988; **4:** Colloquium on Conservation Problems in Antarctica, Sept. 10-12, 1971, Blacksburg, VA, Proceedings. BC Parker, ed. Lawrence, Kansas, Allen Press, 1972. p.81-96; **5:** Ecological Monographs 44(1):105-128, 1974 (Paul Dayton, personal communication, 2015: *Rossella racovitzae* observations are corrected to *R. podagrosa)*; **6:** Antarctic Ecology, Volume 1. MW Holdgate, ed. NY: Academic Press, 1970. pp244-258; **7:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **8:** Science 245:1484- 1486, 1989; **9:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. GA Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **10:** AM Clark. BANZ Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **11:** Discovery Reports 20:69-306 and plates, 1940; **12:** South African Journal of Antarctic Research 23(1-2):37-70, 1993; **13:** New Zealand Antarctic Record 9(2):34-52, 1989; **14:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **15:** Antarctic Science 12(1):64-68, 2000; **16:** John Dearborn, personal communication, 2001; **17:** Australian Natural History 16(7):234-238, 1969; **18:** Integrative and Comparative Biology 50(6):981-992, 2010

seastar *Perknaster aurorae*

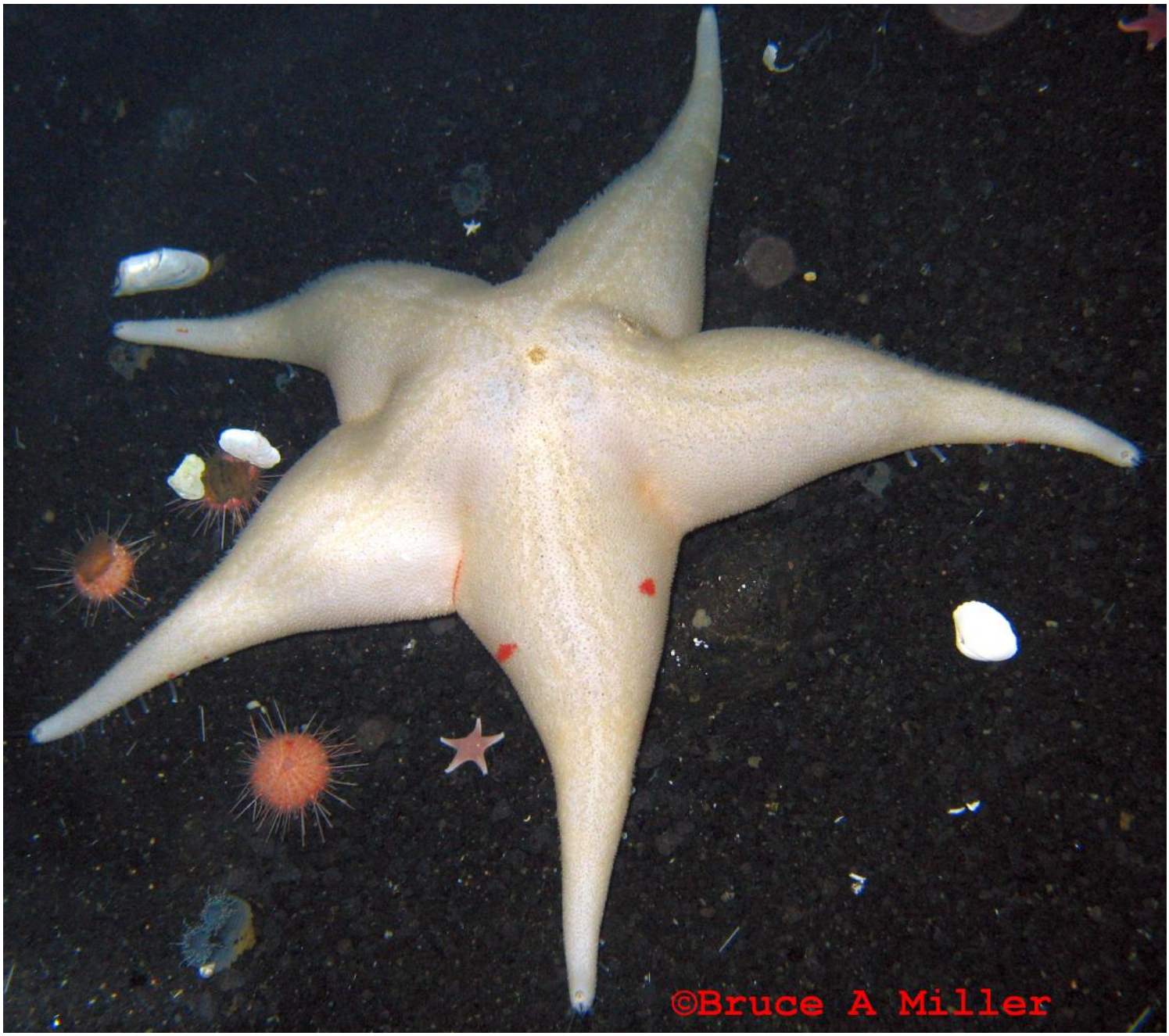
Perknaster aurorae is found in the Antarctic Peninsula, South Shetland Islands, South Sandwich Islands, South Georgia Island, and Shag Rocks, and probably throughout Antarctica, from 18 to 310 meters depth [1,4,5]. *P. aurorae* has a large convex disc and long arms that are wide at the base [1]. *P. aurorae* has been collected at sizes up to fourteen centimeters in radius from its center to the tip of an arm [1,3]. The dorsal color of *P. aurorae* ranges from brick with dark red markings to beige with brick bands along the arms and on the disc; the ventral color is pale yellow, with dark red interradial bands that reach the oral region [1,2].

Here's a closer view of *Perknaster aurorae*.

References: 1: Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **2:** Isidro Bosch, personal communication, 1999; **3:** AM Clark. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **4:** Discovery Reports 20:69-306 and plates, 1940; **5:** Tethys 6(3):631-653, 1974

seastar *Perknaster fuscus antarcticus*

Perknaster fuscus antarcticus is found throughout Antarctica south of sixty degrees in depths of 0 to 457 meters [5,8].



Perknaster fuscus antarcticus has been collected at sizes up to fourteen centimeters in radius from its center to the tip of an arm [7].

Color of *Perknaster fuscus antarcticus* ranges from shades of red with darker spots or stripes to a yellow or light orange background with red markings [7].

P. fuscus antarcticus has a color morph at Turtle Rock due to its diet of urchins and *Odontaster validus* [6].

A small *Perknaster fuscus antarcticus* is shown here, with a radius of four centimeters [10].

Juvenile *Perknaster fuscus antarcticus* are important predators of the sponge *Homaxinella balfourensis* (shown here) and also eat the sponges *Tetilla leptoderma*, *Haliclona scotti*, *Mycale (Oxymycale) acerata*, *Polymastia invaginata*, and *Kirkpatrickia variolosa* [1,2].

Here the sea urchin *Sterechinus neumayeri* is crawling across an adult *Perknaster. fuscus antarcticus*. Adult *Perknaster fuscus antarcticus* are food-specific predators of the sponges *Tetilla leptoderma*, *Anoxycalyx (Scolymastra) joubini*, and *Mycale (Oxymycale) acerata* [2,3].

Below three *Odontaster validus* seastars is a juvenile *Perknaster fuscus antarcticus* eating the bush sponge *Homaxinella balfourensis*.

Perknaster fuscus antarcticus can be an opportunistic scavenger on dead material [5]. Here *P. fuscus antarcticus* is scavenging on something with the proboscis worm *Parborlasia corrugatus*.

A juvenile *Perknaster fuscus antarcticus* eating the bush sponge *Homaxinella balfourensis*.

Perknaster fuscus antarcticus is eaten by the anemone *Urticinopsis antarcticus* [4]. *P. fuscus antarcticus* appears to be chemically defended from most predators [9].

TAXONOMIC NOTE: World Register of Marine Species lists the *Perknaster fuscus antarcticus* subspecies as an alternate representation (an accepted name though slightly less preferred) of *Perknaster fuscus*, stating "maintained as subspecies of *Perknaster fuscus* Sladen, 1889 by Bernasconi (1967) without reference to A.M. Clark (1962)" [11].

References: 1: Science 245:1484-1486, 1989; **2:** Ecological Monographs 44(1):105-128, 1974 (P. Dayton, personal communication, 2015: *Haliclona dancoi* observations are corrected to *H. scotti*); **3:** Biologie des Spongiaires, Sponge Biology. C Levi and N Boury-Esnault, eds. Colloques Internationaux du Centre National de la Recherche Scientifique Number 291. Paris : Centre National de la Recherche Scientifique, 1979. pp.271-282; **4:** Antarctic Ecology, Volume 1. MW Holdgate, ed. NY: Academic Press, 1970. pp244-258; **5:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **6:** P Dayton, personal communication, 1998; **7:** The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **8:** Tethys 6(3):631-653, 1974; **9:** Antarctic Ecosystems : Models for Wider Ecological Understanding. W Davison, C Howard-Williams, P Broady, eds. Christchurch, NZ : New Zealand Natural Sciences, 2000. pp. 158-164; **10:** Paul Cziko, personal communication, 2004; **11:** Mah, C. (2009). Perknaster fuscus antarcticus. In: Mah, C.L. (2016). World Asteroidea database. Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p=taxdetails&id=172754 on 2017-02-22.

seastar *Glabraster antarctica*

Glabraster antarctica is found in Antarctica and South Shetland Islands, South Sandwich Islands, South Georgia Island, Shag Rocks, Marion and Prince Edward Islands, Marquarie Island, Heard Island, Bouvet Island, Crozet Island, Kerguelen Island, Falkland Islands, Chile, Uruguay, and Argentina from 0 to 3,200 meters depth [3,4,6,8,9,10,13,14,15]. *G. antarctica* has been collected at sizes up to 9.7 centimeters in radius from its center to the tip of an arm [5,9,14].

Glabraster antarctica varies in coloration as shown here. The color of *G. antarctica* can include off white, deep scarlet, pink, red purple, brick red, reddish orange, dark orange, bluish white, purplish white, bluish-grey, yellowish white, grey, pale orange, pale red and has also been described as various tints of dark red [6,8,9,10,13,15].

Glabraster antarctica is a ciliary-mucous feeder consuming the small organisms, diatoms, and detritus that shower down on its back by passing them along to its mouth [1,2].

Glabraster antarctica occasionally is an active predator on larger prey and is a scavenger [2].

Here is a spiny form of *Glabraster antarctica* [7,10]. Adult *Glabraster antarctica* have well developed dorsal spines or tubercles [1,2,4,9,10]. However this distinction is not so distinct in some specimens [4,6].

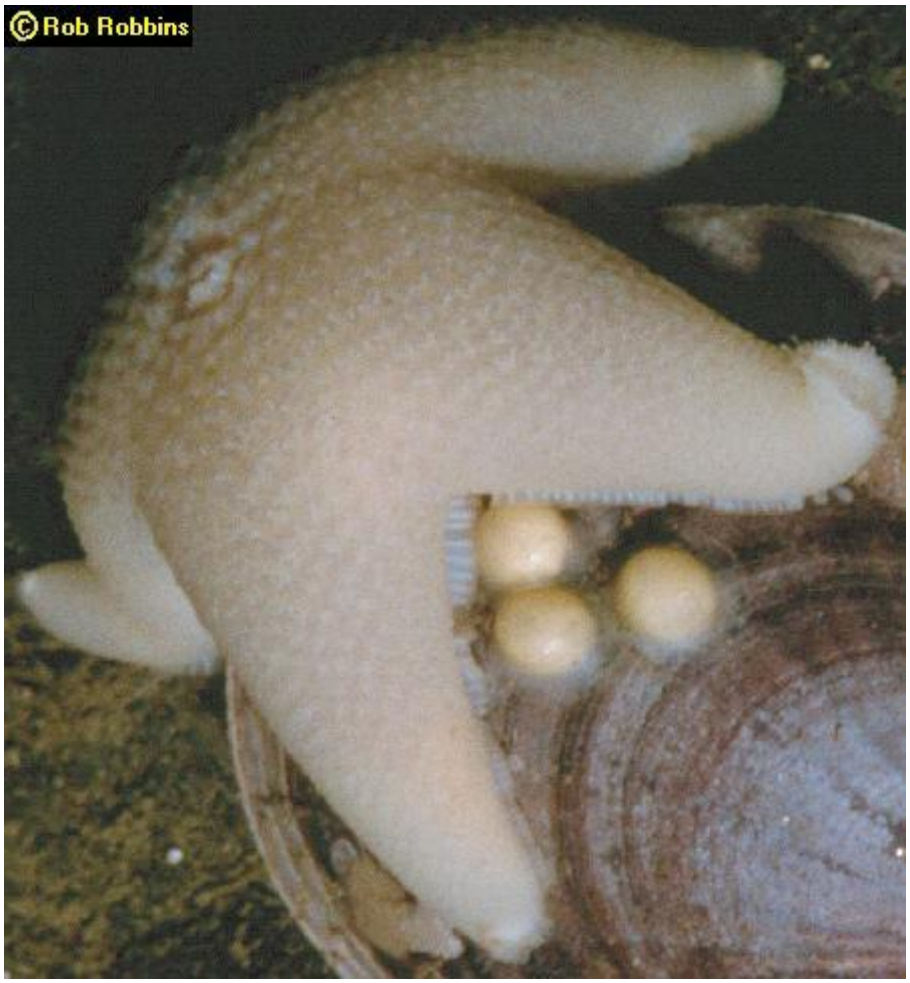
Taxonomic Note: *Porania antarctica* assigned to *Glabraster* genus and subspecies *glabra* was synonymized [11,13].

References: 1: The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **2:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **3:** Los Equinodermos Colectados por el "Walther Herwig" en el Atlantico Sudoeste. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Hidrobiologia 3(3):287-334 and plates, 1973; **4:** AM Clark. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **5:** Biological Bulletin 177(1):77-82, 1989; **6:** Discovery Reports 20:69-306 and plates, 1940; **7:** Isidro Bosch, personal communication, 1999; **8:** South African Journal of Antarctic Research 23(1-2):37-70, 1993 ; **9:** Asteroidea with a Survey of the Asteroidea of the Chilean Shelf. FJ Madsen. Lunds Universitets Arsskrift. Ny Foljd, Avd. 2. Bd 52. Nr 2. Kungliga Fysiografiska Sallskapet Handlingar. Ny Foljd, Bd 67, Nr 2. Reports of the Lund University Chile Expedition 1948-49. Number 24. Lund : CWK Gleerup, 1956; **10:** Memoirs of Museum Victoria 57(2):167-223, 1998; **11:** AM Clark & ME Downey. Starfishes of the Atlantic. Chapman & Hall Identification Guides, 3. London: Chapman & Hall 1992; **12:** W. Percy Sladen. Zoology Part 51. Report on the Asteroidea (Starfish) collected by H.M.S. Challenger during the years 1873-1876. Report on the Scientific Results of the Voyage of HMS Challenger during the Years 1873-76. Zoology, Vol 30, Text. London, HMSO: 1889. pp 360-362; **13:** Zootaxa 3795(3): 327-372, 2014; **14:** Fauna der Antarktis. J Sieg & JW Wagele, eds. Berlin: P Parey, 1990; **15:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970

seastar *Psilaster charcoti*

Psilaster charcoti is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, South Georgia Island, Bouvet Island, and Macquarie Island from 10 to 3,900 meters depth [1,3,4,5,6]. The dorsal surface of *P. charcoti* is slightly convex; its arms are wide at the base, have steeply vertical sides, and taper evenly from its broad disc to the sharp arm tips [1,4]. *P. charcoti* has a central anus, long slender tube feet without distinct sucking discs, and its oval madreporite is between arms and nearer the edge than center [1]. The lack of distinct suckers on the tube feet of *P. charcoti* indicates a preference for a muddy environment [1]. *P. charcoti* has been collected at sizes up to sixteen centimeters in radius from its center to the tip of an arm [2,4]. The color of *P. charcoti* is reddish brown, brown yellow, light tan, bright or pale pink, purplish, or violet and its edges may be lighter; young may be pale yellow [1,4,6]. *Psilaster charcoti* has been collected with its stomach filled with mud, fecal material, the remains of a polychaete worm, and, pieces of a colonial ascidian; it has also been captured with hooks baited with fish chunks [3]. Thus *P. charcoti* is an active predator on some invertebrates and ingests mud to eat organisms therein; it also scavenges on feces and dead organisms [3]. *P. charcoti* is noted as being slimy, suggesting ciliary-mucus feeding [3].

References: 1: The Fauna of the Ross Sea, Part 3, Asteroidea. HES Clark. New Zealand Department of Scientific and Industrial Research Bulletin 151, New Zealand Oceanographic Institute Memoir 21, 1963; **2:** Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie 63:175-184, 1993; **3:** Adaptations within Antarctic Ecosystems : Proceedings of the Third SCAR Symposium on Antarctic Biology. George A. Llano, ed. Washington : Smithsonian Institution ; Houston, Tex. : distributed by Gulf Pub. Co., 1977. pp.293-326; **4:** Equinodermos Antarticos. II. Asteroideos. 5. Asteroideos de la Extremidad Norte de la Peninsula Antartica. I Bernasconi. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" e Instituto Nacional de Investigacion de las Ciencias Naturales. Zoologia (aka Ciencias Zoologicas) 9(10):211-281 and plates, 1970; **5:** Tethys 6(3):631-653, 1974; **6:** Memoirs of Museum Victoria 57(2):167-223, 1998



possibly the seastar *Pteraster affinis*

This seastar was photographed at New Harbor at about twelve meters depth [2].

Taxonomic Note: *Pteraster affinis* reported by AM Clark [1]. John Pearse said it looked like the *aculeatus* subspecies based on photo identification [3]. That subspecies has been synonymized into the parent species [4].

References: 1: AM Clark. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports, Series B (Zoology and Botany) Volume 9, Asteroidea. Adelaide : BANZAR Expedition Committee, 1962; **2:** Rob Robbins, personal communication, 2000; **3:** John Pearse, personal communication, 2000; **4:** Mah, C. (2014). Pteraster affinis Smith, 1876. In: Mah, C.L. (2014) World Asteroidea database. Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p=taxdetails&id=172780 on 2014-09-03