

Mollusca – Gastropoda – Opisthobranchia: nudibranchs, pteropods

UNDERWATER FIELD GUIDE TO ROSS ISLAND & MCMURDO SOUND, ANTARCTICA

Peter Brueggeman

Photographs: Peter Brueggeman, Canadian Museum of Nature (Kathleen Conlan), Luke Hunt, Bruce A. Miller, Rob Robbins, M. Dale Stokes, and 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. This Field Guide 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 identified from photographs with no specimen collection. Therefore these identifications are to the taxonomic level possible from photographs, and there can be some uncertainty in identifications solely from photographs.

© 1998+; text © Peter Brueggeman; photographs © Peter Brueggeman, Canadian Museum of Nature (Kathleen Conlan), Luke Hunt, Bruce A. Miller, Rob Robbins, M. Dale Stokes, & Norbert Wu. Photographs may not be used in any form without the express written permission of the photographers. Norbert Wu does not grant permission for uncompensated use of his photos under any circumstances whatsoever; see his FAQ at www.norbertwu.com



probably dorid nudibranch *Bathydoris hodgsoni*

page 6



dorid nudibranch *Doris kerguelenensis*

page 7



aeolid nudibranch *Doto antarctica*

page 10



aeolid nudibranch *Notaeolidia depressa*

page 12



aeolid nudibranch *Notaeolidia gigas*

page 13



probably aeolid nudibranch *Notaeolidia schmekelae*

page 16



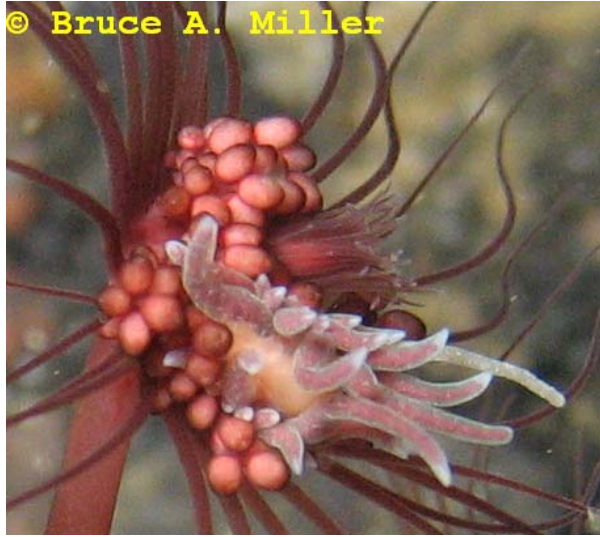
tritoniid nudibranch *Tritonia challengeriana*

page 18



dendronotid nudibranch *Tritoniella belli*

page 20



Unidentified nudibranch

Page 23



Unidentified nudibranchs

Page 24



notaspidean opisthobranch *Bathyberthella antarctica*

page 25



sea butterfly or pteropod *Clione antarctica*

page 27



shelled pteropod *Limacina (Limacina) helicina antarctica*

page 29

probably dorid nudibranch *Bathydoris hodgsoni*



Bathydoris hodgsoni has been found in Antarctica from 15 to 928 meters depth [1,2,3,4]. *B. hodgsoni* is up to twenty centimeters in length [2]. The color of *B. hodgsoni* can be dirty white to reddish or brownish; collected specimens have been found with more papillae than reported in the descriptive literature [1,2]. Prey items found in its stomach include sponge, crinoids, gorgonarians, alcyonarians, bryozoans, seastars, and bivalves [2].

References: **1:** Journal of Molluscan Studies 55(3):343-364, 1989; **2:** Journal of Experimental Marine Biology and Ecology 252:27-44, 2000; **3:** Journal of Molluscan Studies 53(2):179-188, 1987; **4:** Rob Robbins, personal communication, 2005. Fifteen meters @ Cinder Cones

dorid nudibranch *Doris kerguelenensis*



Doris kerguelenensis is found in Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Georgia Island, Falkland Islands, Shag Rock, Bouvet Island, Kerguelen Island, Macquarie Island, New Caledonia, Heard Island, southern Chile, southern Argentina, and near Rio de Janeiro, Brazil at depths from 0 to 740 meters [1,2,4,5,10,12]. The collection off Rio de Janeiro, Brazil at 740 meters depth with a water temperature of 5 degrees Celsius illustrates how Antarctic bottom water extends to the Equator at great depth [5].



The body of *Doris kerguelenensis* can be over twelve centimeters in length, and can be white, pale or bright yellow, with the gills and rhinophores often slightly darker [1,4,9]. Some white *D. kerguelenensis* have white pigment on the gills [1].



©Rob Robbins

Doris kerguelenensis is covered with tubercles of different size and form [1,4,9].



© Peter Brueggeman

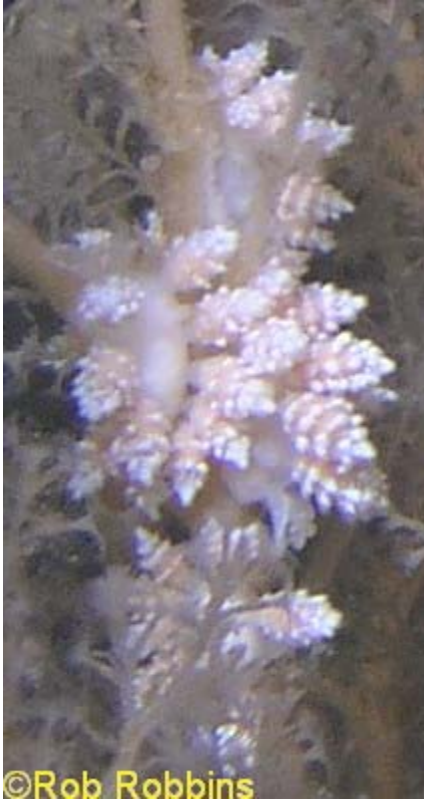
Doris kerguelenensis feeds on the sponges *Rossella racovitzae*, *Rossella nuda*, *Anoxycalyx (Scolymastra) joubini*, *Tetilla leptoderma*, *Haliclona dancoi*, *Mycale (Oxymycale) acerata*, *Polymastia invaginata*, *Haliclona tenella*, *Calyx arcuarius*, *Isodictya setifera*, *Ectyodoryx cf. ramilobosa*, and *Dendrilla antarctica* [2,3,4,6,7,8].

Taxonomic Note: The genus *Austrodoris* is a synonym for *Doris* [11]. *Austrodoris macmurdensis* is a synonym for *Doris kerguelenensis* [1].

References: **1:** Journal of Molluscan Studies 56:163- 180, 1990; **2:** Journal of Molluscan Studies 57:223-228, 1991; **3:** Marine Biology 100(4):439-441, 1989; **4:** Polar Biology 13(6):417-421, 1993; **5:** Journal of Molluscan Studies 53(2):179-188, 1987; **6:** Journal of Molluscan Studies 62(3):281-287, 1996; **7:** 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; **8**: Ecological Monographs 44(1):105-128, 1974; **9**: Bulletin de l'Institut Royal des Sciences Naturelles de Belgique / Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen. Biologie 66:29-40, 1996; **10**: Malacologia 43(1-2):237-311, 2001; **11**: Zoological Journal of the Linnean Society 136(4):535-636, 2002; **12**: Polar Biology 29(2):83-96, 2006

aeolid nudibranch *Doto antarctica*



Doto antarctica has been found in Antarctica and South Shetland Islands from 21 to 160 meters depth [1,2, 3,4].

D. antarctica is pale yellowish-white or yellowish-brown, and has 6-7 pairs of cerata with the tubercles on the cerata having whiter tips [1,2].



Several *Doto antarctica* are shown here on the hydroid *Ophiodes arboreus*, on which *Doto antarctica* feeds [5].

D. antarctica is up to eleven millimeters in length [1].

References: **1:** Mollusca. IV. Nudibranchiata. C Eliot. National Antarctic Expedition, 1901- 1904. Natural History. Volume II. Zoology (Vertebrata: Mollusca: Crustacea). London: British Museum, 1907; **2:** The Nudibranchiata. NHG Odhner. British Antarctic ("Terra Nova") Expedition, 1910. Natural history reports. Zoology. Volume VII. Mollusca. Polychaeta. Chaetognatha. London: British Museum, 1923-1935. pp. 229-309; **3:** Rob Robbins, personal communication, 2005; **4:** Deep Sea Research Part II: Topical Studies in Oceanography 50(10-11):1799-1819, 2003; **5:** Ecological Monographs 44(1):105-128, 1974

aeolid nudibranch *Notaeolidia depressa*



Notaeolidia depressa has been recorded in Antarctica and the Antarctic Peninsula and Bouvet Island from depths of 30 to 429 meters [1,2]. The body of *N. depressa* is translucent white and its brown or red digestive gland shows through the body wall and cerata [1]. *N. depressa* has been recorded at lengths up to 6.5 centimeters in fixed specimens [1].

Notaeolidia depressa has one to two longitudinal rows of cerata numbering about one hundred with the larger cerata of being innermost (*N. gigas* has at least 3 rows of cerata) [1]. *N. depressa* has white pigment on cerata tips, rhinophores and foot margin and sometimes the oral tentacles [1]. The genus *Notaeolidia* is known only from Antarctica [1].

Taxonomic Note: *N. rufopicta*, *N. robsoni*, *N. subgigas* (Odhner, 1944), *N. alutacea*, and *N. flava* were synonymized under *N. depressa* [1].

References: 1: Zoologica Scripta 19(3):309-330, 1990; 2: Polar Biology 29(2):83-96, 2006

aeolid nudibranch *Notaeolidia gigas*



Notaeolidia gigas has been recorded in Antarctica and the Antarctic Peninsula, South Shetland Islands, and South Orkney Islands at depths from 3 to 50 meters ^[1,2,3]. *N. gigas* can be up to eight centimeters long and has at least three rows of cerata numbering at least two hundred on each side ^[2,4]. The largest cerata (9-10 millimeters long) are located in the inner rows ^[4].



An orange colored digestive gland is visible through the body wall of *Notaeolidia gigas* ^[2]. The body of *N. gigas* is translucent to milky or opaque white ^[1,2,4].



Notaeolidia gigas has white pigment on cerata tips, rhinophores and the oral tentacles [1]. These are probably mating.

N. gigas has been observed feeding on large hydroids, including *Tubularia* sp. [3]. *N. gigas* is also a predator of the stoloniferan soft coral *Clavularia frankliniana* [5,6,7].





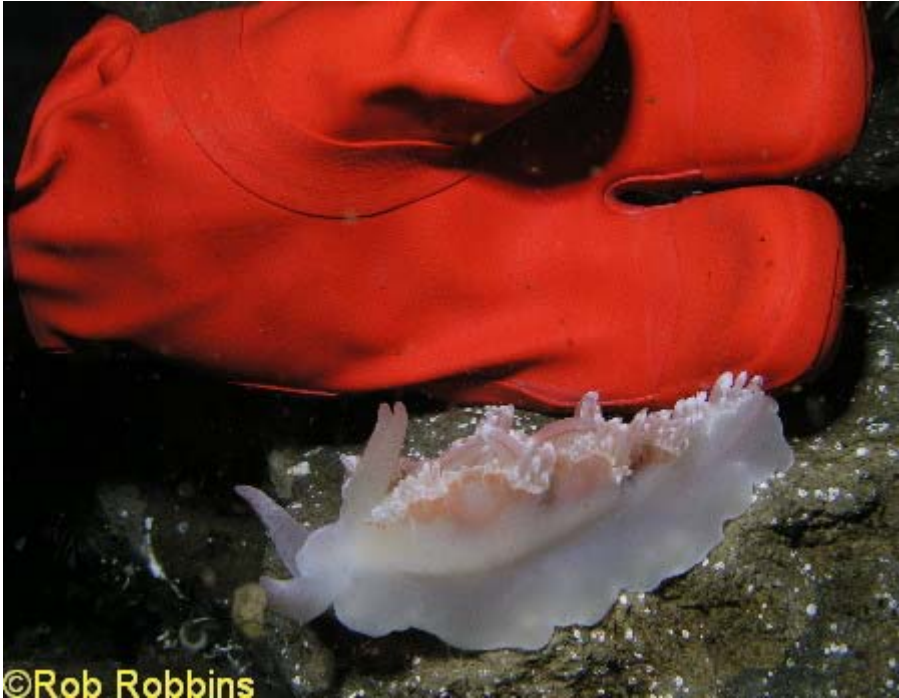
Eggs of *Notaeolidia gigas*.

The genus *Notaeolidia* is known only from Antarctica ^[1].

Taxonomic Note: *N. subgigas* (Wagele, 1988) and *N. purpurea* were synonymized under *N. gigas* ^[1].

References: **1:** Zoologica Scripta 19(3):309-330, 1990; **2:** Journal of Molluscan Studies 61:209-213, 1995; **3:** Journal of Molluscan Studies 62(3):281-287, 1996; **4:** Bulletin de l'Institut Royal des Sciences Naturelles de Belgique / Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen. Biologie 66:29-40, 1996; **5:** Ecological Monographs 44(1):105-128, 1974; **6:** Antarctic Ecology, Volume 1. MW Holdgate, ed. NY: Academic Press, 1970. pp.244-258; **7:** Marine Biology 122(3):461-470, 1995

probably aeolid nudibranch *Notaeolidia schmekelae*



Shown here against a diver's dry-gloved hand, a large specimen (about ten centimeters long) is probably *Notaeolidia schmekelae* but without a genital dissection, a big *Notaeolidia gigas* cannot be excluded ^[1]. Typical for *N. schmekelae* is large size with only few rather short cerata and compared to other *Notaeolidia* species the rather short oral tentacles.



Notaeolidia schmekelae has been recorded in the Weddell Sea at depths from 249 to 481 meters ^[2]. *N. schmekelae* ranges in length between 4 and 13.5 centimeters and its body, oral tentacles, and cerata are milky white ^[2]. *N. schmekelae* lacks a penis; the vas deferens runs into a flaplike structure on its right side, which seems to be part of the genital papilla ^[1].



Cerata are arranged in two to four longitudinal rows [2]. The rhinophores of *N. schmekelae* have a tint of yellow; the cerata tips and oral tentacles have white pigment [2]. A brown digestive gland shows through the skin of the cerata but is less visible in the body [2].

The genus *Notaeolidia* is known only from Antarctica [2].

References: 1: H Waegele, personal communication, 1999, 2005; 2: Zoologica Scripta 19(3):309-330, 1990

tritoniid nudibranch *Tritonia challengeriana*



Tritonia challengeriana is found in Antarctica and the Antarctic Peninsula, South Shetland Islands, South Georgia Island, Falkland Islands, Bouvet Island, and southern Chile and Argentina, at depths from 1 to 481 meters ^[1,2,3,4,5,6]. In one study, *T. challengeriana* was studied at depths from 5 to 36 meters and was most abundant around 7 meters in red algae communities ^[1]. Specimens of *T. challengeriana* have been recorded at lengths up to 6.5 centimeters ^[2,4].

Here *T. challengeriana* is perched on the soft coral *Alcyonium antarcticum*. The two white spots on the right side of the body are the genital (upper) and anal (lower) openings ^[2].



The color of *Tritonia challengeriana* is milky white to transparent with no opaque white pigment in the body, sometimes yellowish to pinkish to orange to brownish, with yellowish or rose colored viscera shining through the body wall ^[2,6]. Opaque white pigment is present on the gills, notal margin, rhinophore tips and sheath margins, velar tentacles, and papillae of the oral veil ^[2]. Small white stripes radiate across the notum from the bases of gills, and gills number up to 30 ^[2,6].



The oral veil of *T. challengeriana* has 10-18 digitiform processes (shown here), with the outermost ones grooved [6]. Zooids of *Cephalodiscus* were observed in the digestive tract of one specimen of *Tritonia challengeriana* [2]. *Cephalodiscus* is a worm-like invertebrate (pterobranch hemichordate) living in secreted tubes organized into a colonial structure.

Taxonomic Note: An older name *Tritonia antarctica* is a synonym of *Tritonia challengeriana* [4]

References: **1:** Journal of Molluscan Studies 62(3):281-287, 1996; **2:** Zoological Journal of the Linnean Society of London 113(1):21-46, 1995; **3:** Polar Biology 24(2):105-112, 2001; **4:** Sea slugs of southern South America: systematics, biogeography and biology of Chilean and Magellanic Nudipleura (Mollusca, Opisthobranchia). Michael Schrödl. Hackenheim, Germany: ConchBooks, 2003; **5:** Polar Biology 29(2):128-136, 2006; **6:** Marine Benthic Fauna of Chilean Patagonia. V Haussermann, G Forsterra. Puerto Montt, Chile: Nature in Focus, 2009. p. 535

dendronotid nudibranch *Tritoniella belli*



Tritoniella belli is found in Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Georgia Island, Shag Rock, and Kerguelen Island at depths from 7 to 699 meters [1,6,7,8,9]. *T. belli* has a longitudinal ridge along its back and can be up to eight centimeters in length [1].

T. belli can have two morphological types: (1) tubercle-covered body with a yellow to orange color and a ridged margin; found predominately along the Antarctic Peninsula; (2) milky-white to transparent body with few tubercles and a serrated margin sometimes with small finger-shaped processes; prevails in the Weddell Sea and Signy Island (South Orkney Islands) [1]. Both morphs can be found elsewhere in Antarctica [1].



A study noted that *T. belli* feeds primarily on the stoloniferan soft coral *Clavularia frankliniana*, occasionally eats hydroids and anemones, and probably eats tunicates on which its eggs can be found [2,3,5]. *T. belli* has been observed feeding on the octocoral *Ascolepis* sp [6].



One study found *Tritoniella belli* primarily on bare rock surfaces or upon the hydroid *Ophiodes arboreus*, with smaller numbers of *T. belli* found on the bush sponge *Homaxinella balfourensis* and the soft corals *Alcyonium antarcticum* and *Clavularia frankliniana* [7]. This suggests that *T. belli* is feeding on these organisms and also on growth on rock surfaces; gut contents include benthic diatoms [7].



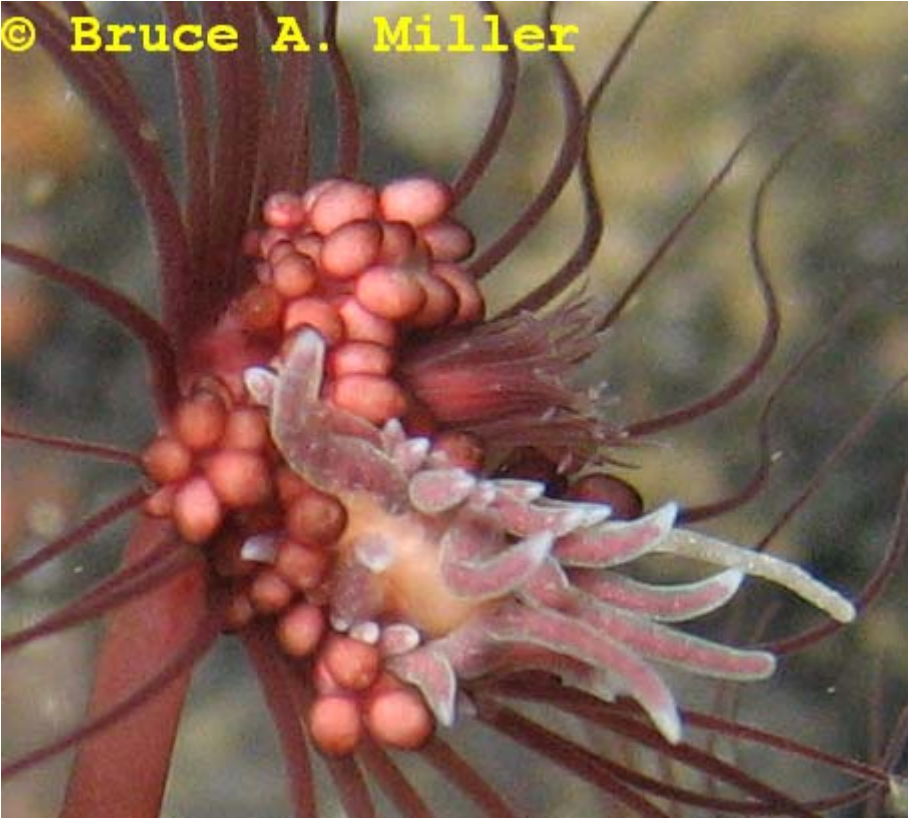
Egg ribbons of *Tritoniella belli* have been observed on bare rock surfaces, on the hydroid *Ophiodes arboreus*, and on the bush sponge *Homaxinella balfourensis* [7].



Here *Tritoniella belli* is crawling across the predatory seastar *Odontaster validus*. Extracts of *T. belli* and the soft coral *Clavularia frankliniana* have chimyl alcohol in common. *O. validus* shows feeding deterrence to *T. belli* mantle tissue and to chimyl alcohol ^[3]. *T. belli* probably defends itself chemically against predators using chimyl alcohol that it obtains from the soft coral *Clavularia frankliniana*. *T. belli* mantle tissue is also noxious to the sea urchin *Sterechinus neumayeri*, several other seastars and two species of fish ^[4].

References: **1:** Polar Biology 9(4):235-243, 1989; **2:** Ecological Monographs 44(1):105-128, 1974; **3:** Journal of Chemical Ecology 20(12):3361-3372, 1994; **4:** Polar Biology 11(8):623-629, 1992; **5:** Marine Biology 100(4):439-441, 1989; **6:** Journal of Molluscan Studies 62(3):281-287, 1996; **7:** Marine Biology 132:259-265, 1998; **8:** Tethys 6(3):631-653, 1974; **9:** Polar Biology 24(2):105-112, 2001

© Bruce A. Miller



**unidentified
nudibranch**



This photo shows its rather cryptic appearance on the athecate hydroid *Monocaulus microrhiza*

© Bruce A.
Miller



Unidentified nudibranchs

© Bruce A. Miller

notaspidean opisthobranch *Bathyberthella Antarctica*



Bathyberthella antarctica is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, South Georgia Island, and Bouvet Island at depths from 120 to 2,080 meters [1,2,3,5,6,7,8]. *B. antarctica* has an oval body with a prominent gill on the right side and an internal large oval uncalcified shell covering the visceral mass [1,4].



The mantle/notum of *Bathyberthella antarctica* can be unpigmented or scattered with grey blotches and adults are opaque white, creamy-grey, or dirty white, often with black pigment in depressions [2,4]. The mantle/notal surface of *B. antarctica* is smooth or with small groups of low pustules [2].



The foot of *B. antarctica* is large and thick with the front margin divided into upper and lower lips [2,4]. *B. antarctica* can be up to seventeen centimeters long [2].

References: **1:** Bulletin de l'Institut Royal des Sciences Naturelles de Belgique / Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen. Biologie 66:29-40, 1996; **2:** Zoologica Scripta 23(4):313-324, 1994; **3:** Polar Biology 14(4):261-268, 1994; **4:** Veliger 29(3):292-302, 1987; **5:** Fauna der Antarktis. J Sieg & JW Wagele, eds. Berlin : P. Parey, 1990; **6:** US National Museum Polar Invertebrate Catalog at <http://www.nmnh.si.edu/iz/usap/usapdb.html>; **7:** Biodiversity and Systematics of Antarctic Deep Water Opisthobranchia. M SchrodL. IN: ANDEEP, Cruise Report ANT- XIX/3 and ANT-XIX/4 (ANDEEP I and II), ANtarctic Benthic DEEP-sea Biodiversity (ANDEEP): Colonisation History and Recent Community Patterns. Zoological Institute and Zoological Museum, University of Hamburg, Germany. pp. 62-63. www.biologie.uni-hamburg.de/zim/niedere2/cruise_report.pdf; **8:** Polar Biology 29(2):83-96, 2006

sea butterfly or pteropod *Clione antarctica*



Clione antarctica is found throughout Antarctic and subantarctic waters and can be found northward to about 36 degrees in some areas [5,8]. In McMurdo Sound, *C. antarctica* is commonly found near the undersurface of the sea ice and is sparse in water deeper than twenty meters [5]. Localized population density down to twenty meters depth

may be as high as 300 per cubic meter [7].



C. antarctica is a free-swimming shell-less pteropod mollusc up to 4.2 centimeters long [5]. *C. antarctica* swims with less than two wing strokes per second and orients itself head up [5].

Clione antarctica deposits a free-floating, gelatinous egg mass, with spawning taking place from November through January [5].

In Antarctic waters, *C. antarctica* eats a planktonic shelled pteropod mollusc *Limacina helicina* which it extracts from its shell; further north, it feeds on *L. retroversa* as well [5].

The medusa *Diplulmaris antarctica* eats *C. antarctica* [2,3].



A hyperiid amphipod *Hyperiella dilatata* grabs *Clione antarctica* from the water and holds it to itself as a chemical defense against predation [1,4,7]. Predatory fish won't eat the amphipod/*C. antarctica* combination or *C. antarctica* itself which has a chemical, pteroenone, which deters feeding [1,4,6,7]. The prey species *Limacina helicina* of *C. antarctica* doesn't have pteroenone so it appears that *C. antarctica* synthesizes it as part of its metabolic processes [6,7].

Taxonomic Note: van der Spoel's classic pteropod work arranged *C. antarctica* under subspecies or forms of *C. limacina* [9]. Later it was reestablished to *C. antarctica* [5]

References: **1:** Journal of Organic Chemistry 60(3):780-782, 1995; **2:** Pelagic Scyphomedusae (Scyphozoa: Coronatae and Semaestomeae) of the Southern Ocean. Ronald J. Larson. Washington, DC : American Geophysical Union, 1986; **3:** Polar Biology 11(1):19-25, 1990; **4:** Nature 346(6283):462-464, 1990; **5:** American Malacological Bulletin 8(1):67-75, 1990; **6:** Antarctic Journal of the United States 29(5):151-153, 1994; **7:** Marine Biology 122:271-277, 1995; **8:** Journal of Molluscan Studies 64(3):345-354, 1998; **9:** Pseudothecosomata, Gymnosomata and Heteropoda (Gastropoda). S van der Spoel. Utrecht : Bohn, Scheltema & Holkema, 1976

shelled pteropod *Limacina (Limacina) helicina antarctica*



Limacina (Limacina) helicina antarctica is most abundant in Antarctic waters between Antarctica and the Antarctic Convergence (aka Antarctic Polar Front) and is less common in subantarctic waters of the Antarctic Circumpolar Current (aka West Wind Drift); its northern limit is coincident with the Subtropical Convergence [2,7].

L. helicina antarctica has also been found north to 10°S in the Brazil Current and at 30°S near South Africa

[2].

Limacina helicina antarctica is a notable component of the McMurdo zooplankton [9].



Limacina (Limacina) helicina antarctica has two formas *antarctica* and *rangii* [1]. The two formas are distinct in range and characters but there are intermediates between the two formas and the intermediates are only found between the areas of both formas [1].

L. helicina antarctica filter feeds on phytoplankton [9]. The carnivorous pteropod *Clione antarctica* eats *L. helicina antarctica* which it extracts from its shell [3,8,9]. Other predators include medusas (*Diplulmaris antarctica*, *Solmundella bitentaculata*) and nototheniid fish (*Pagothenia borchgrevinki*, *Trematomus bernacchii*, *T. hansonii*, *T. centronotus*) [4,5,6,8,10,11].

References: **1:** Euthecosomata. A Group with Remarkable Developmental Stages. (Gastropoda, Pteropoda). S van der Spoel. Gorinchem: J Noorduijn, 1967; **2:** Oceanic Micropalaeontology. ATS Ramsay. London : Academic Press, 1977; **3:** American Malacological Bulletin 8(1):67- 75, 1990; **4:** Environmental Biology of Fishes 36(3):313-318, 1993; **5:** Pelagic Scyphomedusae (Scyphozoa: Coronatae and Semaestomeae) of the Southern Ocean. RJ Larson. Washington, DC: American Geophysical Union, 1986; **6:** Polar Biology 11(1):19-25, 1990; **7:** Bulletin of Malacology, Republic of China. Bulletin of the Malacological Society of China 5:1-22, 1978; **8:** Antarctic Journal of the United States 23(5):135-136, 1988; **9:** Polar Biology 8(1):41-48, 1987; **10:** Polar Biology 8(1):49-54, 1987; **11:** Antarctic Science 12(1):64-68, 2000