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A Field Guide to Alaskan Corals

by
B. L. Wing and D. R. Barnard

U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

This guide presents updated keys to genera and species of corals known from Alaskan waters. The keys rely on macroscopic characters as much as possible. Where microscopic examination is required to identify species, the identification is carried only to genus or group of genera. Keys to the Octocorals (soft corals, gorgonian corals, sea pens and sea whips), Scleracatinia (cup corals), and Antipatharia (black corals) are carried only to genera. The keys to Hydrocorals are to species. Photographs of representatives of each genus are used to assist in identification. Where possible, photographs of fresh specimens are included. A brief glossary defines specialized terms used to describe corals. We present a list of the 105 coral species reported from Alaska. Some of the reported species may be synonyms or misidentifications.

CONTENTS

INTRODUCTION

This field guide revises the preliminary guide for Alaskan corals assembled by of Wing and Barnard (2002). Additions include keys to the genera of black corals (Antipatharia) and the genera of sea pens and sea whips (Pennatulacea) reported from Alaska waters. We have added color photographs of fresh-caught specimens, which replace or supplement the photographs of dried specimens used in the earlier guide. The use of color photographs will aid field observers by showing the corals as they are most likely to be seen. Where possible, we have also included photographs of the corals in their natural habitat.

These keys provide a guide to the families and genera of coldwater corals found in Alaska waters. Identification of corals to species or even genus often requires examination of microscopic structures. The keys are designed for use by fisheries observers aboard vessels where microscopes may not be available. Scientific terminology describing corals and related animals is often highly specialized; therefore, we provide a short glossary of some technical terms (Appendix I), although we assume the user has basic knowledge of marine invertebrates and their anatomy. The authors have not seen representatives of several species described here and have developed these keys strictly from descriptions provided in the literature. Some species and subspecies were described from a single or very few specimens. Recent literature notes that several forms are known only from the type material.

The keys are designed for identification of Alaskan corals by using paired statements comparing observable characteristics. If the characteristics match a statement, the next appropriate pair of statements to be evaluated is indicated by the number at the end of the statement. Continuing this process will eventually lead to a final determination. Although the keys are arranged in dichotomous couplets, there are occasionally three choices when two or more species could not be distinguished on the basis of single characteristics. Often we have taken the identification only to genus because further identification requires microscopic examination.

As a caution, we remind those who use these keys that corals frequently have differing ecotypes or growth forms. These ecotypes are responses to the specific habitat and life history of the indi-

vidual polyp or colony. All field identifications should be considered tentative and representative material should be saved for later confirmation in the laboratory.

Seventy species and five subspecies of coral have been reported from Alaska waters (Appendix II). Additionally, about 25 species have been identified only to genus or family in the literature. Many of these may be undescribed species, providing additional justification for carrying identification only to genus in the field. The present key is subdivided into four sections representing the major classes of corals likely to be encountered by fisheries observers, field survey personnel, etc.

Key to Alaskan Octocorals (Anthozoan -- Soft Corals)

Octocorals are frequently referred to as soft corals. They have eight pinnately branched tentacles on each feeding polyp. The Alaskan octocorals include stolon corals (Stolonifera), Alcyonarian soft corals, gorgonians (Gorgonacea), and sea pens and sea whips (Pennatulacea). They are the most diverse of the Alaskan corals, the most poorly known, and the most difficult to identify. Several undescribed species and genera have been collected and are presently under investigation by National Museum of Natural History and California Academy of Sciences personnel.

This portion of the Alaskan coral guide has been abstracted in part from Bayer (1981) with the glossary taken from Bayer, Grasshof and Verseveldt (1983). The key for sea pens and sea whips is abstracted from Williams (1995).

Key to Alaskan Scleractinia (Solitary or Cup Corals)

The Scleractinia of Alaska are normally small, solitary cup corals; alive or fresh they resemble small sea anemones with a hard skeleton. This key has been abstracted from Cairns (1994) and is restricted to those species and genera listed for the Alaska-Aleutian biogeographical province. Cairns (1994) lists nine species from Alaska, and three others have been reported in the informal literature. Most are known from very few specimens. Any cup corals found by observers should be kept for reference and identification.

Key to Alaskan Hydrocorals

The hydrocorals are colonial hydroids that have limestone skeletons They may be either encrusting on rock and shell or form upright colonies that are variously branched. The colonies range from less the 1 cm in diameter or height to over 50 cm in height. Although the Alaskan hydrocorals do not have symbiotic algae their colors can be various shades of brown, cream, orange, pink, purple or yellow. More than 20 species from 7 genera have been reported from Alaska. This key seems to work well for identifying the genera we have examined, but it does not easily separate species in *Stylantheca* and *Stylaster*. One species recently described, *Cyclohelia lamellata* Cairns, 1991, is poorly known and several new undescribed species are noted in the informal literature. The three species of *Stylantheca* may be synonymous. Only *Stylantheca porphyra* has been reported from a wide geographic range (central California to Sitka Sound, Southeast Alaska). *Stylantheca pterograpta* is reported from Southeast Alaska and British Columbia. We have found *Stylantheca papillosa* reported only from the type specimen from Coal Harbor, Unga Island of the Shumagin Islands, Alaska.

Stylaster is a large genus that has proven frustrating to most authorities to identify to species. The genus has a worldwide distribution and is found from the intertidal to more than 2,000 m. Both fossil and recent (living) species are recognized. Cairns (1983) recognizes more than 70 species and subspecies of *Stylaster*. Ten species have been reported from Alaska. Of the Alaskan *Stylaster*, *S. campylecus* appears to be the most commonly collected species. Although four subspecies of *S. campylecus* have been designated (Fisher, 1938; Naumov, 1960; Clark, 1997; 1999), we question the validity of these subspecies and their identification. The geographic ranges and depth ranges of the subspecies are broadly overlapping. The characteristics of the subspecies are variable and not easily distinguished in most published photographs and drawings.

Key to Alaskan Antipatharia (Black Coral or Thorny Corals)

Black or thorny corals are known from the Gulf of Alaska and Aleutian Island areas, but are rare and are typically from very deep waters. They resemble hydroids and gorgonians with a black horny

skeleton. They differ by having six tentacles on each feeding polyp. The skeleton has thorn-like projections. The thorn-like projections may be quite small. Some large tropical black corals have thick, heavy skeletons that are used for jewelry. The Alaskan black corals are smaller and have thin flexible skeletons, which are brittle when dried. Any specimens encountered should be preserved and prepared for forwarding to the Smithsonian Institution. Distinguishing characteristics that can be used in the field are based on the form of branching. The Northeast Pacific black corals are very poorly known, with one species, *Chrysopathes speciosa* Opresko 2003, newly described and other potential new genera and species are currently under investigation.

Collection and Preservation of Coral Specimens

Cup corals, hydrocorals, black corals, gorgonians and the various soft corals are best preserved as dry specimens or in alcohol solutions. Dried specimens should be dried in the dark and not exposed to sunlight. Some gorgonians may be spread and flattened by placing the specimen between sheets of cardboard and waxed paper during the first stages of drying. Dried specimens should be stored in rigid containers that protect them from crushing during shipment. Small specimens and some flattened specimens may be permanently stored in Riker mounts typically used in insect collections or similar display cases.

Wet specimens are best preserved in 75% ethyl alcohol or 33-50% isopropyl alcohol (medicinal or rubbing alcohol). These alcohol solutions are made up with fresh water (tap water). Do not use seawater because the salts react with alcohol, causing an undesirable precipitate and resulting in poor fixation and preservation. Researchers studying coral genetics (mitochondrial and nuclear DNA) may request that portions of a sample be preserved in 95% ethyl alcohol. Because formaldehyde dissolves the calcified skeleton and spicules, formaldehyde solutions (i.e., 10% formalin in seawater) are not recommended except for special studies (e.g., histology of reproductive tissues).

A critical component of all collections is proper labeling and recording of collection data. Each specimen or lot of specimens should be separately labeled and packaged. Labels for wet specimens should be written on waterproof paper with a medium-hard pencil (2.5 H) or special waterproof ink

that does not fade in alcohol. Most ballpoint pens have inks that fade or dissolve in water or alcohol solutions. The Rite in the Rain and PIGMA MICRON Archival Ink pens have been satisfactory when available. The label needs to have the following information:
the date with the month written alphabetically or in Roman numerals to avoid confusing day and month of the year (e.g., 06 July 2004 or 06 VII 2004, not 06/07/04).

SPECIES : (if known)

LOCATION: (Place name or description of location in relation to a known geographic site)

LATITUDE:	LONGITUDE:
DEPTH:	GEAR:
DATE:	TIME:
COLLECTOR:	
VESSEL:	STATION No.:
ORIGINAL PRESERVATIVE:	
NOTES:	

Key to the Major Orders and Families

1a. Polyps embedded in a hard inflexible calcareous matrix: **Stony Corals**.....**2**

1b. Polyps embedded in a soft fleshy matrix. A hard but flexible skeleton may be under the fleshy coenenchyme: **Soft Corals** .....**Octocorals 3**

1c. Polyps embedded in a soft, almost watery, matrix over a black flexible horny skeleton: **Black Corals** .....**Antipatharia**

2a. Polyps large (5-30 mm diameter), solitary or in small clusters: **Cup Corals**.....**Scleractinia**

2b. Polyps small (< 5 mm diameter), numerous polyps in the colony: **Hydrocorals** ....**Stylasteridae**

3a. No hard skeleton under the fleshy matrix.....**4**

3b. Polyps embedded in a covering matrix, skeleton variously branched and calcified.....**5**

3c. Skeleton a single stiff rod, colony anchored in soft substrate by a fleshy peduncle: **Sea Pens** and **Sea Whips**.....**Pennatulacea**

4a. Polyps rising from a soft encrusting matrix (Fig. 1): **Stolon Corals** ..... **Clavulariidae**

4b. Polyps not rising from an encrusting base.....**Alcyoniidae**

5a. Skeleton composed of alternating calcareous (white) and horny (black) segments: **Bamboo Corals**.....**Isididae**

5b. Skeleton not in segments.....**6**

6a. Skeleton of a porous bone-like material, fleshy covering, thick, polyps can retract almost or completely in flesh (Fig. 6).....**Paragorgiidae**

6b. Skeleton non-porous, horny material which may be permeated with calcium carbonate.....**7**

7a. In the dried state, body embedded with fine, small sclerites that are not clearly visible (Figs. 8, 9, 10).....**Plexauridae**

7b. In the dried state, body consists of larger plate-like sclerites.....**Primnoidae**

Key to Genera and Species

1a. Polyps embedded in a hard inflexible calcareous matrix: **Stony Corals**.....**2**

1b. Polyps embedded in a soft fleshy matrix (coenenchyme), a hard but flexible skeleton may be under the fleshy coenenchyme: **Soft corals**.....**3**

1c. Polyps embedded in a soft matrix over a black flexible horny skeleton: **Black Corals**.....**40**

2a. Polyps large (5 to 30 mm diameter), solitary or in small clusters: **Cup Corals**.....**21**

2b. Polyps small (< 5 mm diameter), numerous polyps in the colony: **Hydrocorals**.....**27**

Soft Corals – Octocorals (Anthozoa)

3a. No hard skeleton under fleshy matrix.....**4**

3b. Polyps embedded in a covering matrix, skeleton variously branched and calcified.....**6**

3c. Skeleton a single stiff rod, colony anchored in soft substrate by a fleshy peduncle: **Pennatulacea**.....**15**

4a. Polyps rising from a soft encrusting base (Fig. 1): **Clavulariidae**.....***Clavularia* spp.**

4b. Polyps not rising from an encrusting base.....**5**

5a. Polyps in a tight, irregular fleshy mass (Fig. 2): **Alcyoniidae**.....***Gersemia* spp**.

5b. Polyps embedded in a mushroom-like base (Fig. 3): **Alcyoniidae**.....***Anthomastius* spp.**

6a. Skeleton composed of alternating calcareous (white) and horny (black) segments: **Isididae**.....**7**

6b. Skeleton not in segments.....**8**

7a. Skeleton branches from the calcareous (white) internodes (Fig. 4).....***Keratoisis* spp.**

7b. Skeleton branches from the horny (black) nodes (Fig. 5).....***Isidella* spp.**

7c. Skeleton not branched.....***Lepidisis* spp.**

8a. Skeleton of a porous bone-like material, fleshy covering thick, polyps can retract almost or completely into flesh (Fig. 6): **Paragorgidae**.....***Paragorgia* spp.**

8b. Skeleton non-porous, horny material, which may be permeated with calcium carbonate.....**9**

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9b. Polyps retract into a thick covering, not superficial “warts”: **Keroeididae**.....**10**

9c. Polyps not contractile.....**11**

10a. Polyps red.....cf. ***Ideogorgia*** **sp**.

10b. Polyps cream, yellow, gray, or brown.....***Alaskagorgia*** **sp.**

11a. In the dried state, body embedded with small sclerites (not clearly visible) (Figs. 8, 9, 10):
Plexauridae..... ***Euxplexaura***, ***Muriceides, Paramuricea*** and ***Swiftia*** **spp.**

11b. In the dried state, body consists of large plate-like sclerites: **Primnoidae**.....**12**

12a. Primnoidae with small polyps(< 3 mm) colonies bushy or pinnate, skeleton not calcified (Figs. 11, 12, 13, 14) **:Primnoidae Group I**.....***Amphilaphis, Parastenella, Plumarella***, and ***Thouarella*** **spp.**

12b. Primnoidae with medium to large polyps (> 3 mm), colonies often large, dichotomously branched.....**13**

13a. Primnoidae with large polyps, colonies frequently very large, base of skeleton may be calcified (Fig. 15).....***Primnoa*** **spp.**

13b. Primnoidae with polyps arraigned in distinct whorls, skeleton not calcified.....**14**

14a. Primnoidae with medium polyps in closely packed whorls, no points on polyps, candelabra appearance (Fig. 16).....***Fanellia*** **spp**.

14b. Primnoidae with large polyps, whorls may or may not be tightly packed, points on polyps (Fig. 17).....***Arthrogorgia*** **spp.**

Sea Pens and Sea Whips – Pennatulacea

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15b. Polyps arranged along the sides of the rachis **16**

16a. Polyps arranged singly or in rows along the rachis **17**

16b. Polyps in leaves on the rachis.....**18**

17a. Polyps in spiculated calyces (Fig. 18).....***Protoptilum*** **spp.**

17b. Polyps with out spiculated calyces.....***Anthoptilium*** **spp.**

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23b. Corallum delicate, generally less than 5 mm diameter.....***Leptopenus discus***

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Appendix Figure 1. Close-up of surface of *Cyclohelia lamellata* showing cyclosystems, gastropores, and dactylopores (D. Barnard).

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CITATIONS

Bayer, F. M. 1981. Key to the genera of Octocorallia, exclusive of Pennatulacea (Coelenterata: Anthozoa), with diagnoses of new taxa. Proc. Biol. Soc. Wash. 93(3):902-947.

Bayer, F. M., M. Grasshof, and J. Verseveldt. 1983. Illustrated trilingual glossary of morphological and anatomical terms applied to Octocorallia. E. J. Brill/Dr. W. Backhuys, Leiden. 74 p.

Cairns, S. D. 1983. A generic revision of the Stylasterina (Coelenterata: Hydrozoa), Part 1, descrip tions of the genera. Bull. Mar. Sci. 33(20):427-508.

Cairns, S. D. 1994. Scleractina of the Temperate North Pacific. Smithsonian Contributions to Zoology No. 557, 150 p.

Clark, R. N. 1997. Invertebrates of the Aleutian Islands. Unpublished guide. NOAA/ NMFS Alaska Fisheries Science Center, Resource Assessment and Conservation Engineering Division. 7600 Sand Point Way NE, Seattle, WA 98115. 2p. + 84 pl.

Clark, R. N. 1999. Gulf of Alaska invertebrates. Unpublished guide. NOAA/ NMFS Alaska Fisheries Science Center, Resource Assessment and Conservation Engineering Division. 7600 Sand Point Way NE, Seattle, WA 98115. 12 p. + 84pl.

Fisher, W. K. 1938. Hydrocorals of the North Pacific Ocean. Proc. U. S. Nat. Mus. 84:493-554, pls. 34-76.

Naumov, D. V. 1960. Hydroids and Hydromedusae of the USSR. Keys to the fauna of the USSR published by the Academy of Sciences of the USSR, No. 70: 600 p., 30 pls, 463 figs. (Translated from Russian by Israel Program for Scientific Translations, 1969).

Williams, G. C. 1995. Living genera of sea pens (Coelenterata: Octocorallia: Pennatulacea): illustrated keys and synopses. Zoological Journal of the Linnean Society 113:93-140.

Wing, B. L., and D. R. Barnard. 2002. Preliminary keys to the Alaskan corals. Alaska Department of Fish and Game, 211 Mission Road, Kodiak, AK 99615. 22 p.

SUPPORTING REFERENCES

Bayer. F. M. 1952. Two new species of *Arthrogorgia* (Goronacea [sic]: Primnoidae) from the Aleutian Islands region. Proc. Biol. Soc. Wash. 65:63-70, pls. 2-3.

Bayer, F. M. 1982. Some new and old species of the Primnoid genus *Callogorgia* Gray with a revision of the related genus *Fanellia* Gray (Coelenterata: Anthozoa). Proc. Biol. Soc. Wash. 95:116-160.

Bayer, F. M. 1996. The gorgonian genus *Arthrogorgia* (Octocorallia: Primnoidae). Proc. Biol. Soc. Wash. 109(4):605-628.

Broch, H.H. 1935. Oktocorallen des nordlichsten Pazifischen Ozeans und ihre beziehungen zur atlantischen fauna. Avhandl. Norske Videnskaps Akad. Oslo (matem.-Naturavid. Klasse 1935 (1): 1-53, figs. 1-21.

Cairns, S. D. 1991. *Cyclohelia lamellata*, a new genus and species of Stylasteridae (Cnidaria: Hydrozoa) from the Bering sea. Pac. Sci. 45:4383-388.

Dall, W. H. 1884. On some Hydrocorallinae from Alaska and California. Proc. Biol. Soc. Wash. 2:111-115.

Kessler, D. W. 1985. Alaska's saltwater fishes and other sea life. Alaska Northwest Publishing Co., Anchorage, AK, 358 p.

Nutting, C. C. 1909. Alcyonaria of the Californian coast. Proc. U. S. Nat. Mus. 35:681-727, pls. 84-91.

Nutting, C. C. 1912. Descriptions of the Alcyonaria collected by the U. S. Fisheries Steamer "Albatross," mainly in Japanese waters, during 1906. Proc. U. S. Nat. Mus. 43:1-104, pls. 1021.

Opresko, D. M. 2003. Revision of the Anthipatharia (Cnidaria: Anthozoa). Part III. Cladopathidae. Zool. Med. Leiden 77(31):495-536, figs. 1-19.

Resource Assessment and Conservation Engineering Division (RACE). 2002. A working field guide to trawl caught animals based on D. W. Kessler's *Alaska's Saltwater Fishes and Other Sea Life*. Vol. 2 (Miscellaneous Invertebrates). NOAA/ NMFS Alaska Fisheries Science Center, Resource Assessment and Conservation Engineering Division. 7600 Sand Point Way NE, Seattle, WA 98115.

Sanchez, J. A., and S. D. Cairns. In Press. An unusual new gorgonian coral (Anthozoa: Octocorallia) from the Aleutian Islands, Alaska. Zool. Med. Leiden78, 00, iii, 2004:000-000, figs. 1-8.

Verrill, A. E. 1878. Description of a new species of *Paragorgia* from Jervis Inlet, B.C. Can. Nat. 8:476.

Williams, G. C. 1999. Index Pennatulacea: Annotated bibliography and indexes of the sea pens (Coelenterata: Octocorallia) of the world 1469-1999. Proc. Cal. Acad. Sci. 51(2):19-103, 14 pls., 1 fig.

APPENDIX I - GLOSSARY

ANASTOMOSES: The connections of separate parts of a branching system to form networks, as veins in leaves.

ANTHOCODIA: The distal part of an octocoral polyp, bearing the mouth and tentacles.

ANTHOSTELE: The proximal, rigid part of some octocoral polyps, often stiffened by sclerites and into which the anthocodia may be withdrawn; equivalent to calyx.

BUSHY: Colonies with abundant branches arising immediately above the holdfast and not forming an obvious main stem.

CALCAREOUS: Composed of or containing calcium carbonate (limestone); chalky.

CALCIFIED: Stony or chalky from the deposition of calcium salts.

CALYX (pl. CALYCES): Cup-like structure containing an octocoral polyp.

CALICE: The cup-shaped skeleton of scleractinians.

COENENCHYME: The soft tissue covering the skeleton or forming the body of cnidarians.

COLUMELLA: A small column-like structure forming a cental axis in a scleractinian chalice.

CONTRACTILE POLYP: A polyp that can diminish in size without introversion or retraction.

CORALLUM: The skeleton of an entire colony.

CORNUTE: Shaped like a horn, chalice, or cup.

CYCLOSYSTEMS: Cluster of hydrocoral polyps in which the gastropore is surrounded by a group of dactylopores.

DACTYLOPORES: Small pores housing defensive hydrocoral polyps.

DENDRITICAL: Shaped like a tree, branching.

DICHOTOMOUS BRANCHED: Branched colonies in which the branching pattern is a repeated bifurcation.

DISCOIDAL: Having a flat circular form; disk-shaped.

ENCRUSTING: Colonies consisting of a thick fleshy layer covering a hard substrate.

FABELLATE: Fan-shaped.

GASTROPORE: Pores in the hard skeleton of a hydrocoral that accommodate the feeding polyps.

GASTROSTYLE: Small central support column of the feeding polyps of a hydrocoral .

HORNY: Resembling the material that makes up horns of cattle.

INTERNODE: The hard calcareous segment of some octocorals in the family Isididae.

LAMELLA: Thin plate or leaf-like forms.

LID: A cap-like structure covering the gastropore of some hydrocorals. .

MATRIX: The formative cells or tissue of an organism.

NODE: The flexible horny joint in corals of the family Isididae.

PALMATE: Having a shape similar to a hand with fingers extended.

PEDUNCLE: The base of the stalk or stem of sea whips and sea pens.

PINNATE: Branched colonies in which the branching patten is feather-like, with the branchlets in one plane.

PINNULES: Smallest branchlets of an antipatharian colony, relatively uniform in size and arrangement.

POINTS: The eight rows of chevron-shaped sclerites in the distal part of an octocoral anthocodia.

POLYP: Any individual of a cnidarian colony regardless of anatomical structure; a cylindrical body and an oral opening usually surrounded by tentacles.

RACHIS: The terminal or distal portion of the pennatulacean colony, which bears the feeding polyps.

RETRACTILE POLYP: A polyp in which the ANTHOCODIA can invert into the ANTHOSTELE or into the COENENCHYME.

ROBUST: Powerfully built, sturdy.

SCLERITE: A calcareous plate or spicule found in Octocorals

SEPTA: The calcareous partitions of sclaractinian chalices.

SPICULE: A small needle-like structure of silicate or calcium supporting soft tissue (=SPICULE).

SUMMIT: The highest part or point, the top.

SYMPODIAL: Dichotomous branching of secondary branches in which the cyclostems are on alternate branches giving a zigzag appearance.

UNIPLANAR: Occurring in one plane.

WHORL: An arrangement of three or more branches or polyps radiating from a single node.

APPENDIX II – CORAL SPECIES REPORTED FROM ALASKA

This list includes the "corals" currently known to have been identified from Alaskan waters. The list has been drawn from published and unpublished sources. The validity of identification in some of these sources is not known, especially for the non-peer reviewed reports and unpublished data files. In many cases, the names are from field identifications and voucher specimens were not kept; therefore, the identifications could not be confirmed by acknowledged taxonomists. Additionally, the status of some of the names has not been resolved. Thus, this list undoubtly includes synonyms as well as misidentifications. Several genera and species tentatively identified by the senior author have been excluded from the list because we have not received confirming identification from authorities for those specific groups.

PHYLUM CNIDARIA (= COELENTERATA)

CLASS ANTHOZOA

Subclass Alcyonaria

Order Alcyonacea (Soft Corals)

Suborder Stolinifera (Stolon Corals)

Family Clavulariidae

Clavularia cf. *Evagorga incrustans* Brock, 1936.....**Figure 1**

Clavularia moresbii Hickson, 1915

Clavularia sp.

Suborder Alcyoniina (True Soft Corals)

Family Alcyoniidae

Anthomastus japonicus Nutting, 1912

Anthomastus cf. *japonicus* Nutting, 1912

Anthomastus ritteri Nutting, 1901

Anthomastus sp.....**Figure 3**

Family Nephtheidae

Gersema rubiformis (Ehrenberg, 1834).....**Figure 2**

Gersemia sp.

Order Gorgonecea

Suborder Scleraxonia[1]

Family Paragorgiidae

Paragorgia arborea (Linnaeus, 1758).....**Figure 6**

Paragorgia pacifica Verrill, 1878 (possibly a diminutive subspecies of *P. arborea*)

Paragorgia sp.

Family Coralliidae

Corallium sp. (Not included in key)

Suborder Holaxonia (Horny Corals)

Family Acanthogorgiidae

Calcigorgia beringi (Nutting, 1912)

Calcigorgia spiculifera Broch, 1935.....**Figure 7**

Calcigorgia sp.

Family Keroeidididae

cf. *Ideogorgia* sp.

Family Plexauridae

Alaskagorgia aleutiana Sanchez and Carins, 2004

Euplexaura marki K kenthal,1913

Euplexaura sp.

Muriceides cylindrica Nutting, 1912

Muriceides cf. *cylindrica* Nutting, 1912

Muriceides nigra Nutting, 1912..... **Figure 8**

Muriceides sp.

[1]The order Gorgonacea of many classifications has been divided into the suborders Scleraxonia, Holaxonia and Calaxonia.

Family Isididae

Isidella paucispinosa (Wright and Struder, 1889)

Isidella sp.....**Figure 5**

Keratoisis profunda (Wright and Struder, 1889)

Keratoisis sp.....**Figure 4**

Lepidisis sp. (This may be just a small unbranched *Isidella* sp)

Suborder Pennatulacea (Sea Pens and Sea Whips)

Family Umbellulidae

Umbellula lindahli (Kolliker, 1880)

Family Protoptilidae

Protoptilum sp.....**Figure 18**

Family Anthoptilidae

Anthoptilum grandiflorum (Verrill, 1879)

Anthoptilum murrayi K lliker, 1880

Family Virgulariidae

Halipteris californica (Moroff, 1902)

Halipteris willemoesi K lliker, 1870.....**Figure 20**

Halipteris sp.

Stylatula elongata (Gabb, 1862)

Stylatula gracilis Verrill, 1864

Virgularia sp.

Family Pennatulidae

Pennatula phosphorea (Linneaus, 1758)

Ptilosarcus gurneyi Gray, 1860.....**Figure 19**

Subclass Zoantharia

Order Scleractina (**Stony Corals**)

Family Dendrophylliidae

Balanophyllia elegans Verrill, 1864

Family Caryophylliidae

Caryophyllia alaskensis (Vaughan, 1941).....**Figure 22**

Caryophyllia arnoldi Vaughan, 1900

Caryophyllia sp.

Crispatotrochus foxi (Durhan and Barnard, 1952).....**Figure 23**

Paracyanthus stearnsii Verrill, 1869

Family Flabellidae

Flabellum sp.....**Figure 24**

Javania borealis Cairns, 1994.....**Figure 21**

Javania cailleti (Duchassaing and Michelotti, 1864)

Family Fungiacyathidae

Fungiacyathus marenzelleri (Vaughn, 1906)

Family Micrabaciidae

Leptopenus discus Moseley, 1881

Order Antipatharia (Black or Thorny Corals)

Family Cladopathidae

Chrysopathes speciosa Opresko, 2003.....**Figure 34**

Family Schizopathidae

Bathypathes alternata Brook, 1889

Bathypathes patula Brook, 1889.....**Figure 35**

Bathypathes sp.

Dendrobathypathes sp. (not included in key)

FIGURES

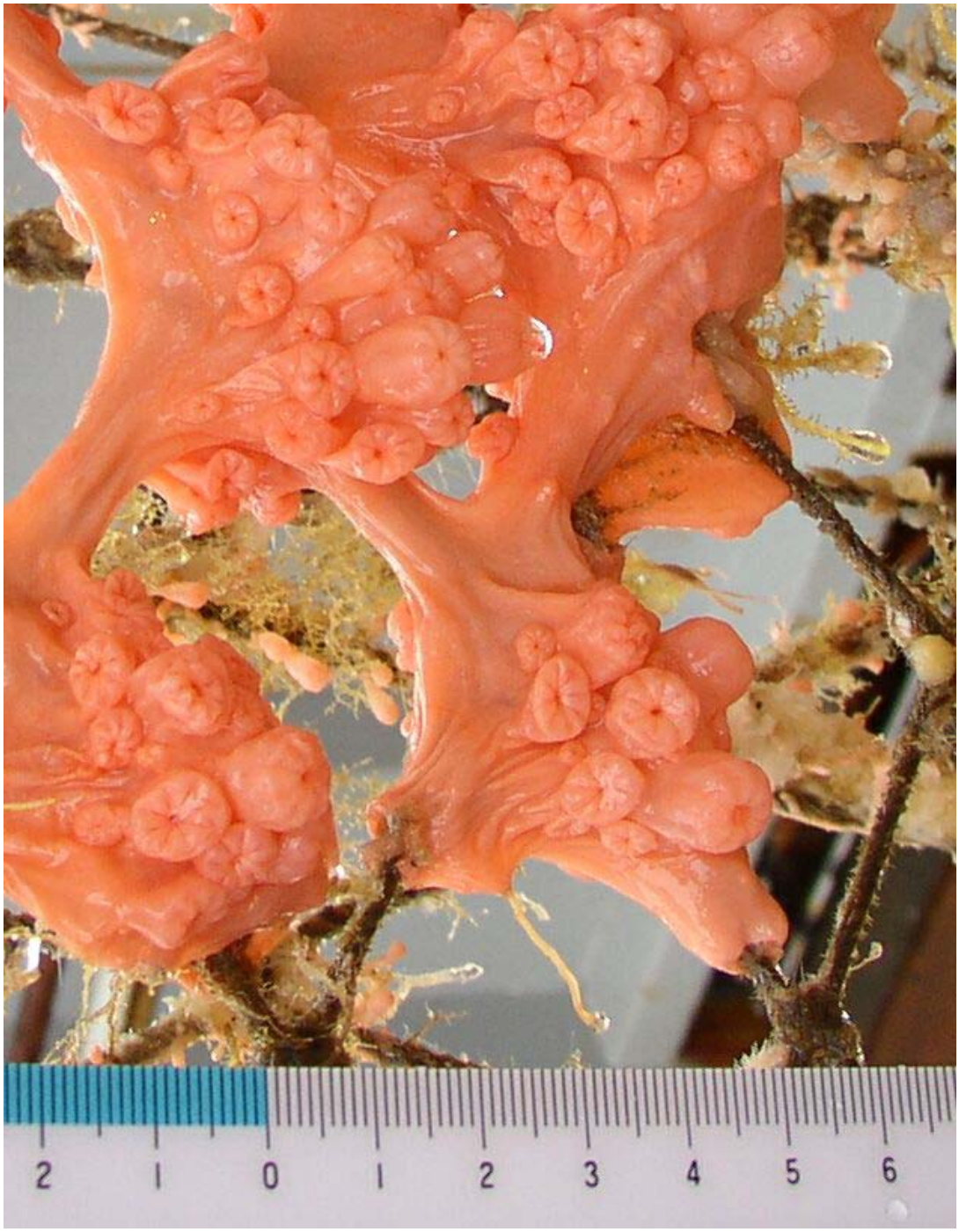

Figure 1-- *Clavularia* sp. – This stolon coral encrusts as a thin layer over hard surfaces. Orange, pink, or white when fresh (D. Barnard).

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Figure 2. -- *Gersemia* sp. – Brain-like shape when contracted; white, red or purple color; no hard skeleton; can expand to considerable size when undisturbed. (P. Malecha).

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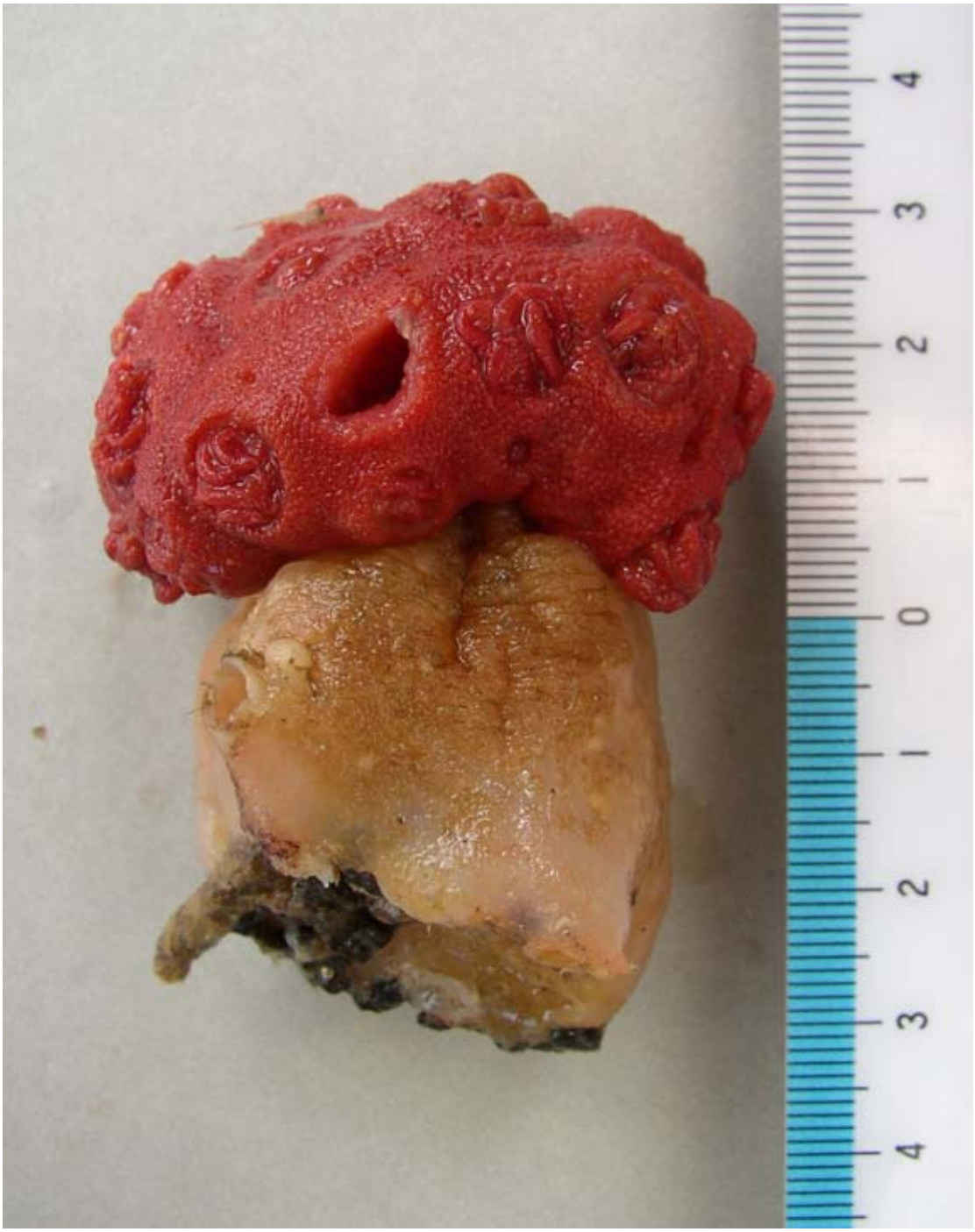

Figure 3. -- *Anthomastus* sp. – Rather small mushroom-shaped colonies with a thick stalk and broad, hemispherical cap; cap bearing large retractable polyps; color red, pink, yellow, or tan, polyps may be lighter or darker than cap (D. Banard).

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Figure 4. -- *Keratoisis* sp. – Corallum white, bone-like, segmented; calcareous internodes joined by dark brown horny nodes: branching from calcareous internodes. Living polyps are red to bright orange (P. Malecha).

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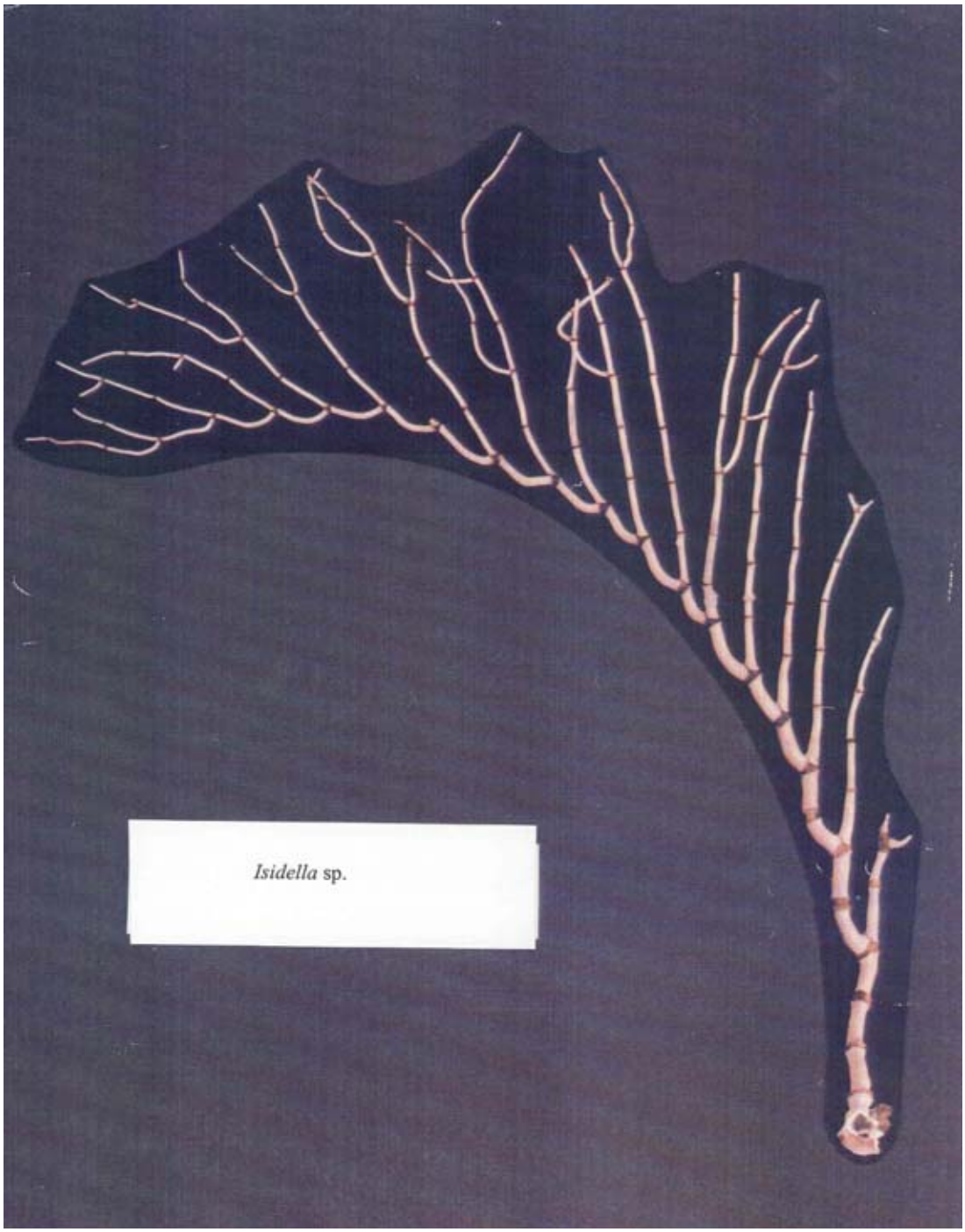

Figure 5. -- *Isidella* sp . – Corallum white, bone-like, segmented; calcareous internodes joined by dark, horny nodes; branching from horny nodes. Living polyps are red to orange (R. Clark).

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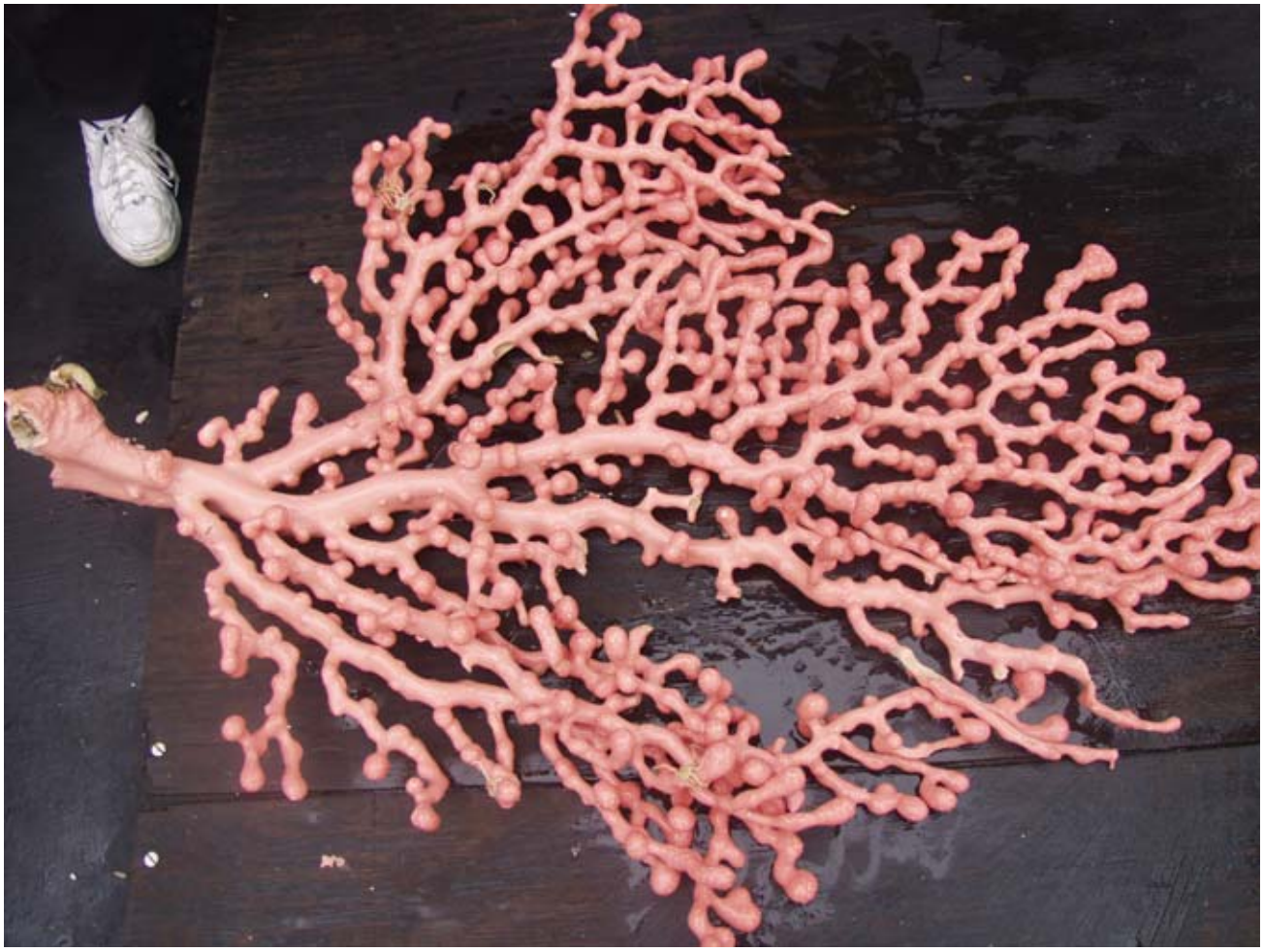

Figure 6. -- *Paragorgia arborea* – Tree-like colony, branching in several planes; polyps small, rosette-shaped, well-spaced, evertible; branches massive, rounded, brick red, orange, yellow, or cream-colored; skeleton soft, easily broken (P. Malecha).

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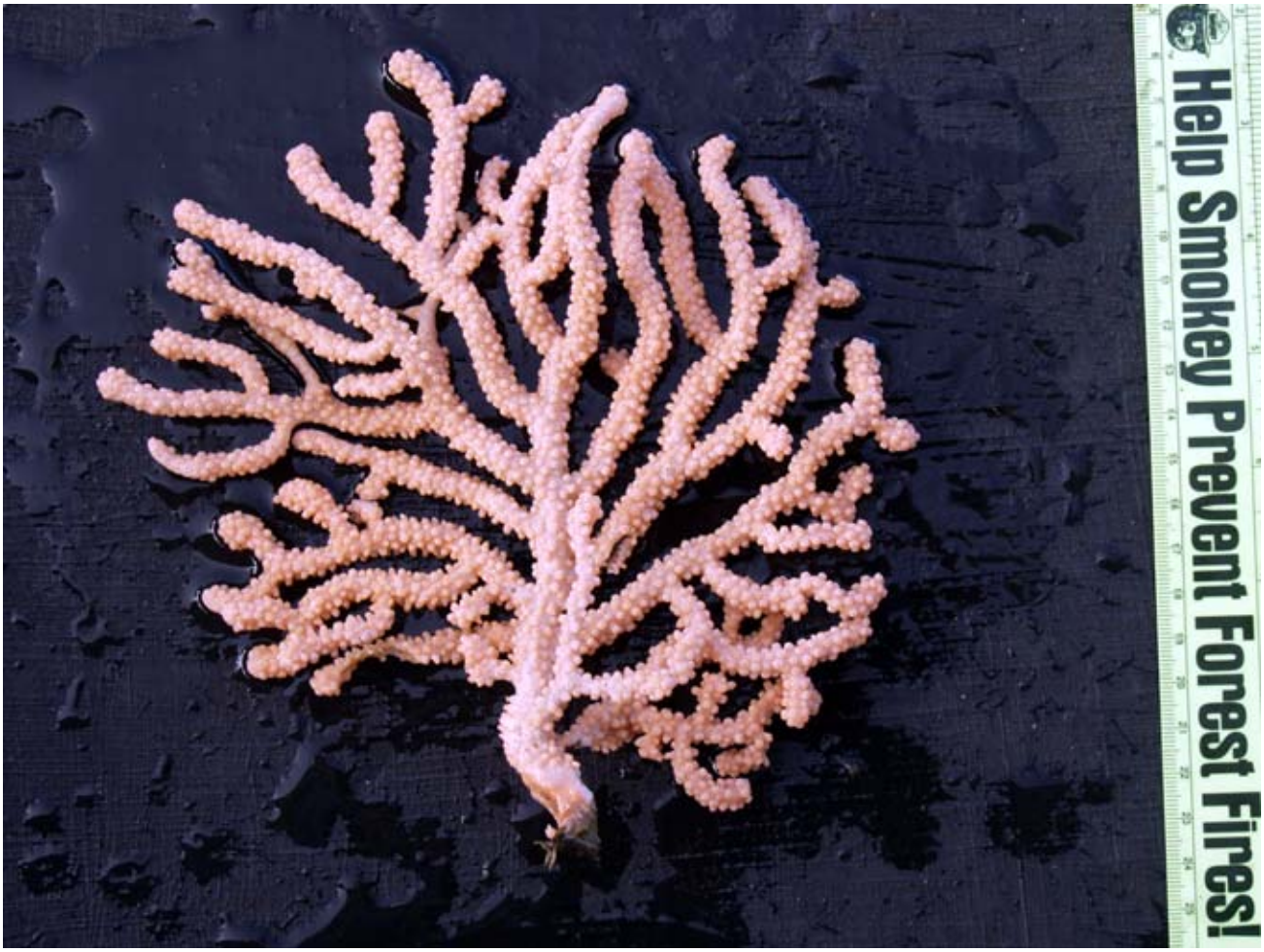

Figure 7. -- *Calcigorgia spiculifera* – Tree-like colony, branching in many planes; live polyps pink to white (A. Simpson).

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Figure 8.-- *Muriceides nigra* – Tree-like colony, branching in several planes; live polyps brown on a greenish yellow base (A. Simpson).

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Figure 9. -- *Swiftia pacifica* – Small, rubbery-appearing sea fans; branches forming net-like reticulations; color bright red in life (P. Malecha).

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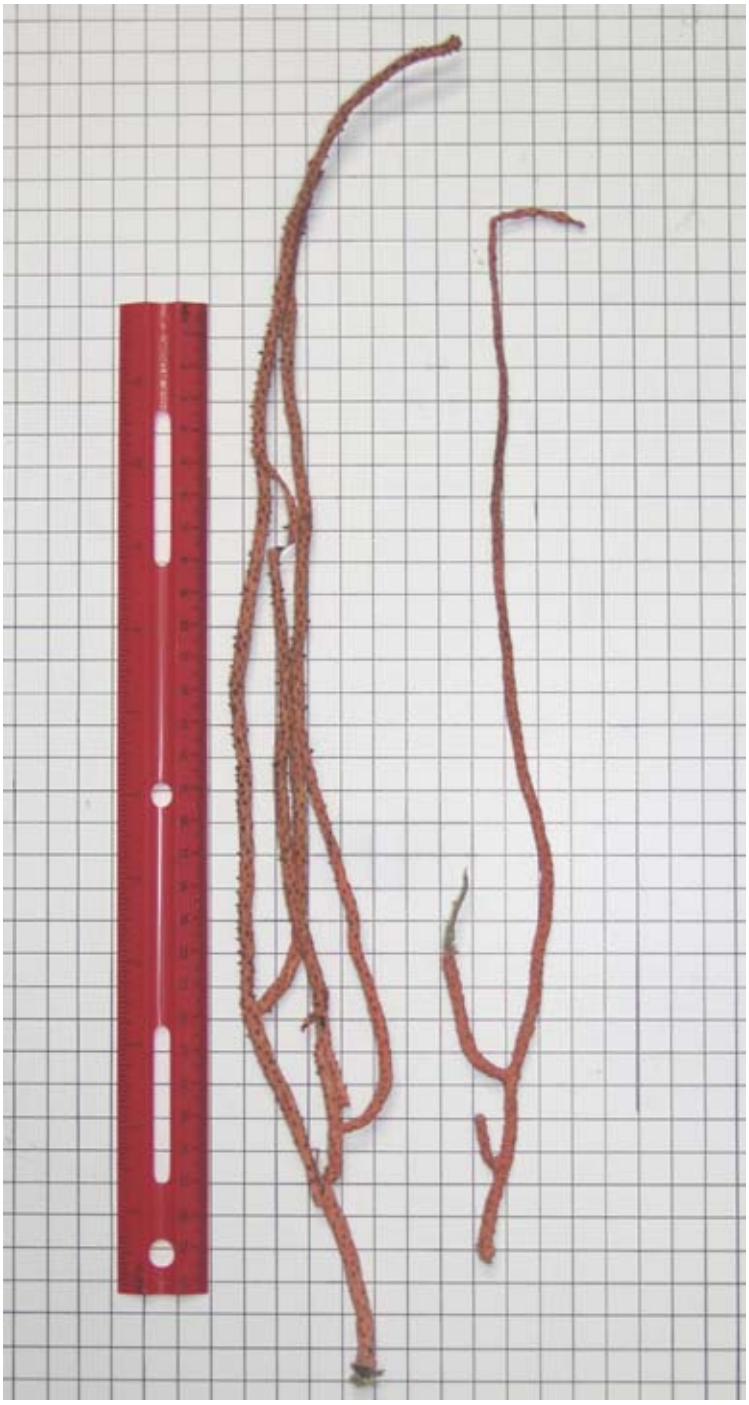

Figure 10. -- *Swiftia simplex* – A tall slender species with few branches; brick-red color in life (P. Malecha).

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Figure 11. -- *Amphilaphis* sp. – Fan-like colony, small orange polyps (D. Barnard).

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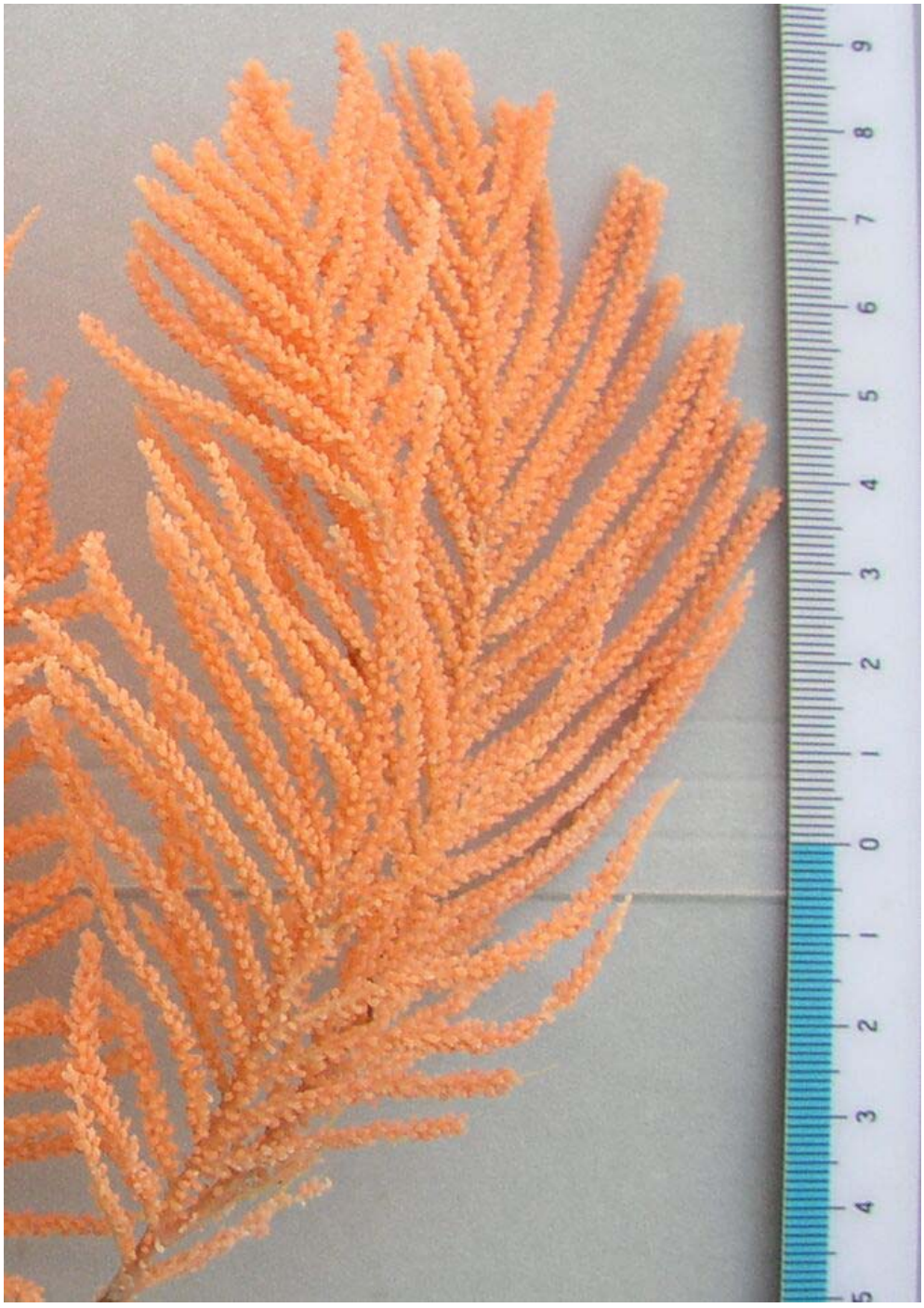

Figure 12. -- *Plumarella* sp. – Fan-like colony; live polyps white to pink (D.Barnard).

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Figure 13. -- *Thouarella* sp. – Bushy, tree-like colony, branching in many planes; live polyps golden brown (D. Barnard).

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Figure 14. -- *Thouarella superba* – Closely packed thick fan-like colony, white to orange or red color (A. Simpson).

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Figure 15. -- *Primnoa pacifica* – Large tree-like colony, live polyps orange to red (J. Andersen).

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Figure 16. -- *Fanellia compressa* – Candelabra-like colony, live polyps pink to orange (P. Malecha).

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Figure 17. -- *Arthrogorgia utinomii* – Tree-like colony, branches in a single plane; segments large and strongly angular, color orange (P. Malecha).

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Figure 18. -- *Protoptilum* sp. – Small to medium sea pen, white with widely spaced polyps. (P. Malecha).

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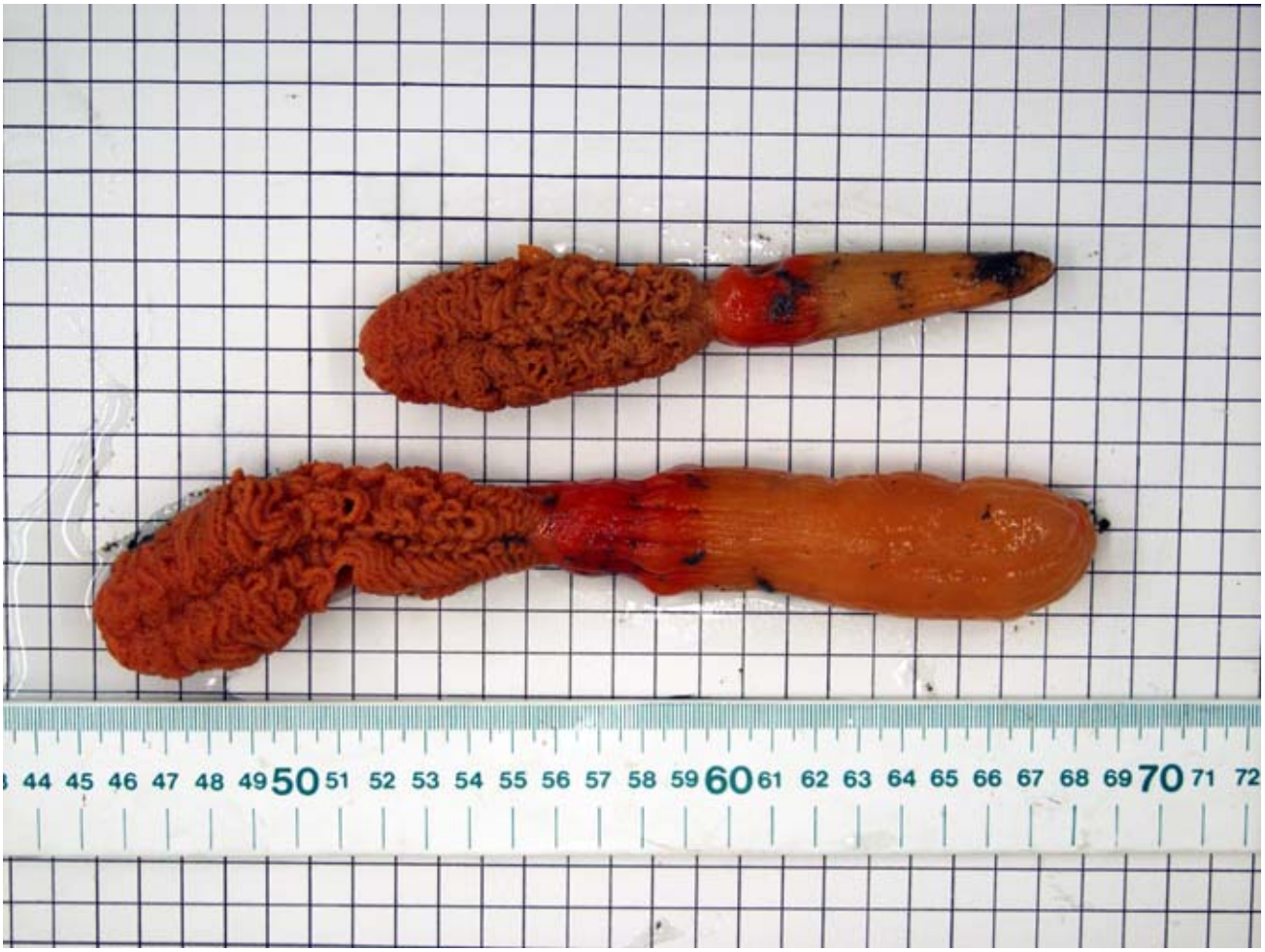

Figure 19. -- *Ptilosarcus gurneyi* – Stout sea pens with relatively large leaves (P. Malecha).

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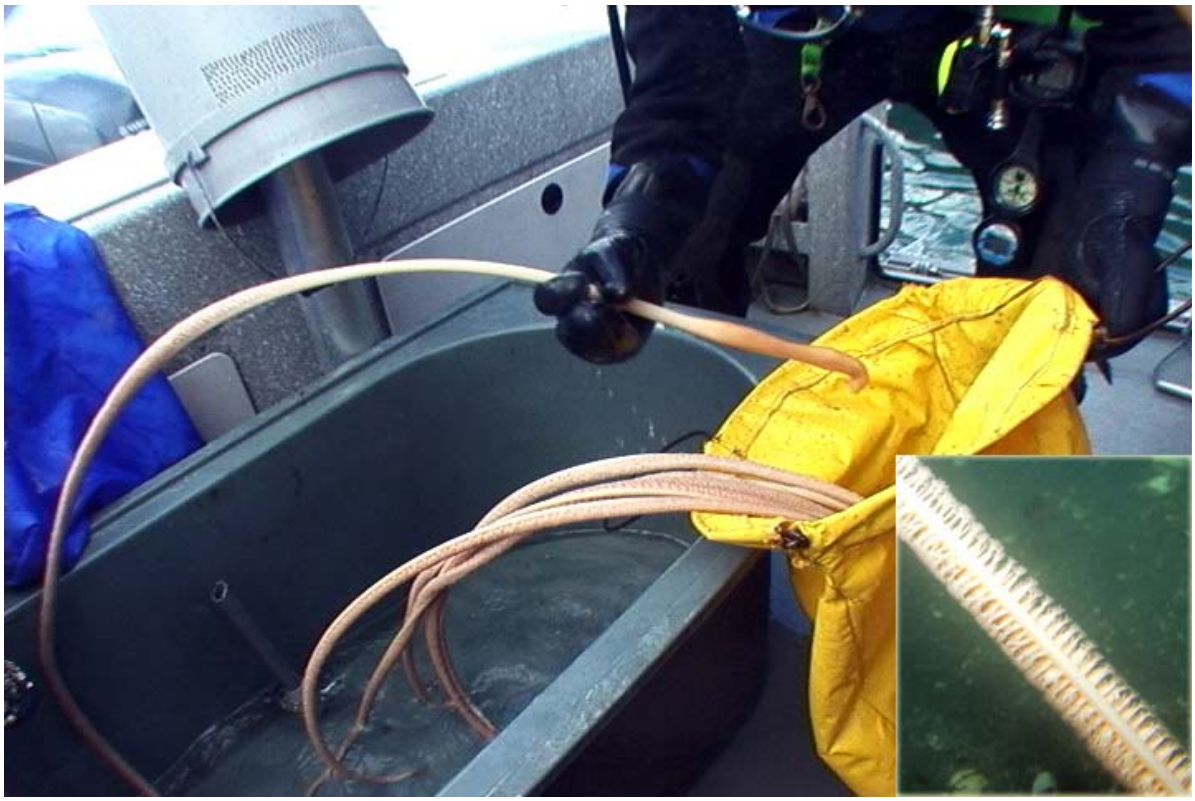

Figure 20. -- *Halipterus willemoesi* – Large sea whip with relatively small dense leaves (see inset) (P. Malecha).

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Figure 21. -- *Javania borealis* – Often large, distinctly oval chalice (A. Simpson).

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Figure 22. -- *Caryophyllia alaskensis* – Calice small, relatively robust, cone-shaped; septa numerous, center of calice with large bundle of columella; animal pale orange, pink, or red (D. Barnard).

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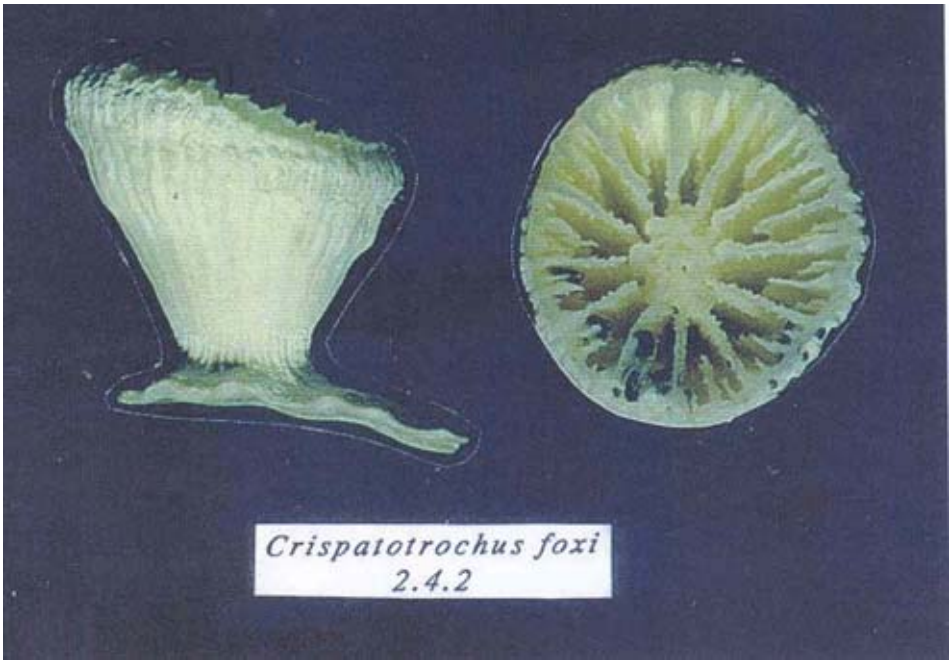

Figure 23. -- *Crispatotrochus foxi* – Similar to *Caryophyllia alaskensis*, but smaller, fewer septa, and smaller bundle of columella (R. Clark).

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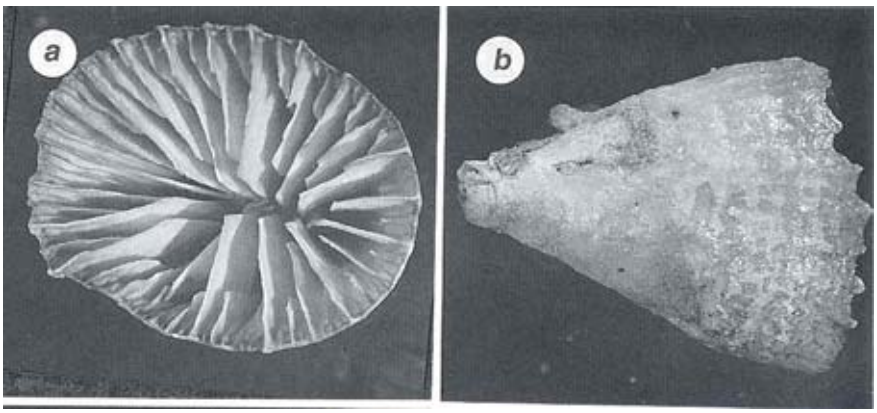

Figure 24. -- *Flabellum* sp. Resembles a small Javania, but with a very small base, skeleton gray color; a, oral view; b lateral view (S. Cairns).

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Figure 25. -- *Cyclohelia lamellata* – Colony relatively thin, lamellar, ruffled, or rose-formed, gastropore and dactylopores rather evenly distributed on all surfaces; reddish or orange-pink, whitish at the edges (D. Barnard).

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Figure 26. -- *Distichopora borealis* – Colony rather fragile, flattened, uniplanar; gastropores and dactylopores mostly restricted to grove at the edge of branches, front and back of colony rather smooth except for gonopore blisters; color pale buff to orange (D. Barnard).

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Figure 27. -- *Errinopora zarhyncha* – Colony robust, very rough, multiplanar; branches finger-like; dactylotome projection very large (1-2 mm), and crowded on all surfaces; color ochraceous-buff to light orange (D. Barnard).

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Figure 28. -- *Errinopora pourtalesi* – Colony moderately robust, rough, color pink to lavender with white tips (A. Simpson).

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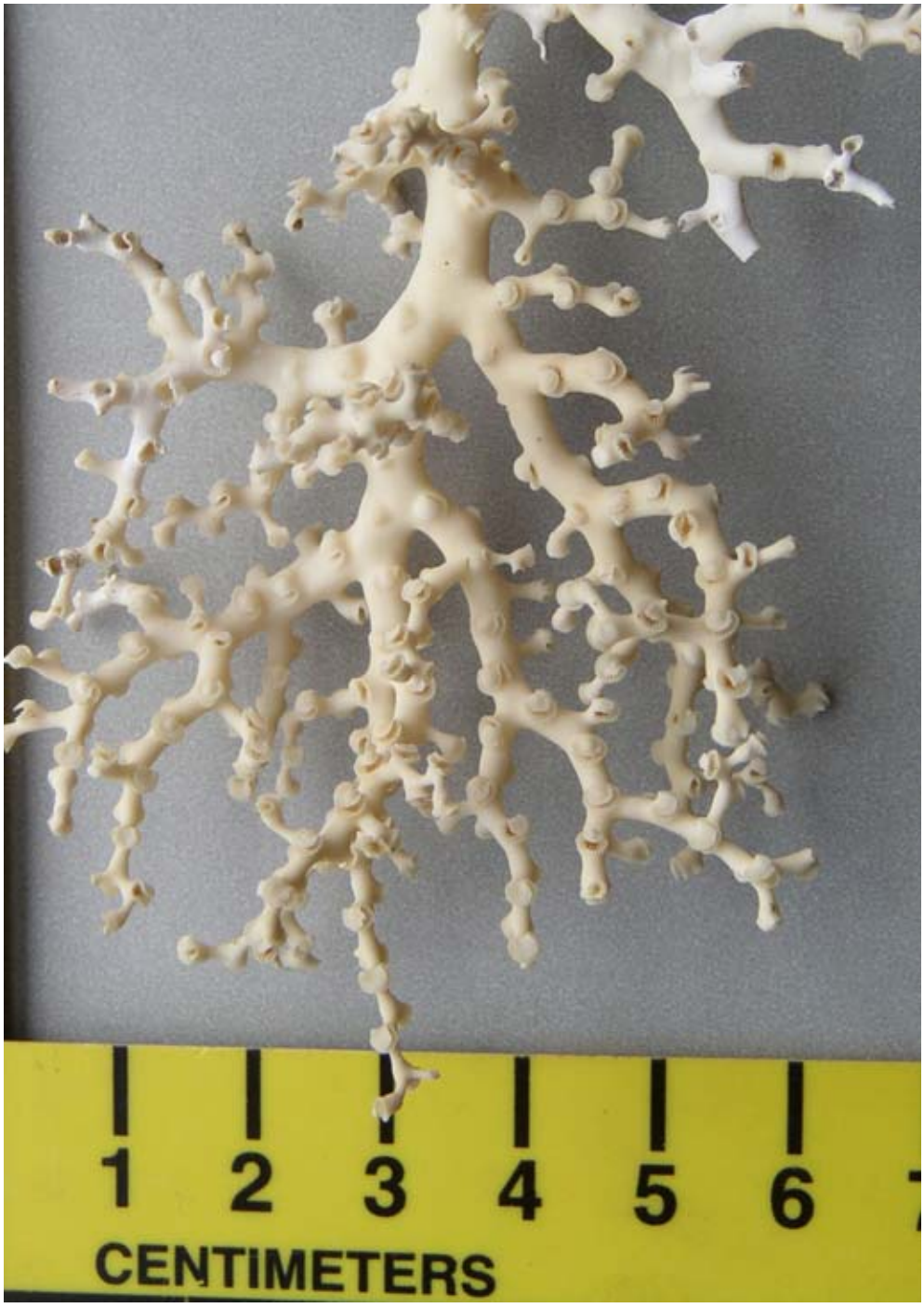

Figure 29. -- *Crypthelia trophostega* – Colony rather fragile; branches long, finger-like; cyclosystems very large and bearing cap-like fixed lids; color white or pale buff (D. Barnard).

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Figure 30. -- *Stylaster moseleyanus* – Colony robust, uniplanar; main branches flattened on front, rounded and smooth on back; cyclosystems barely projecting if at all, nearly absent on back, sparse, well-spaced on front, numerous on lateral surfaces; color white, buff or light pink-orange (D. Barnard).

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Figure 31. -- *Stylaster verrilli* – Colony short, stubby branches with blunt tips, color pink to violet (P. Malecha).

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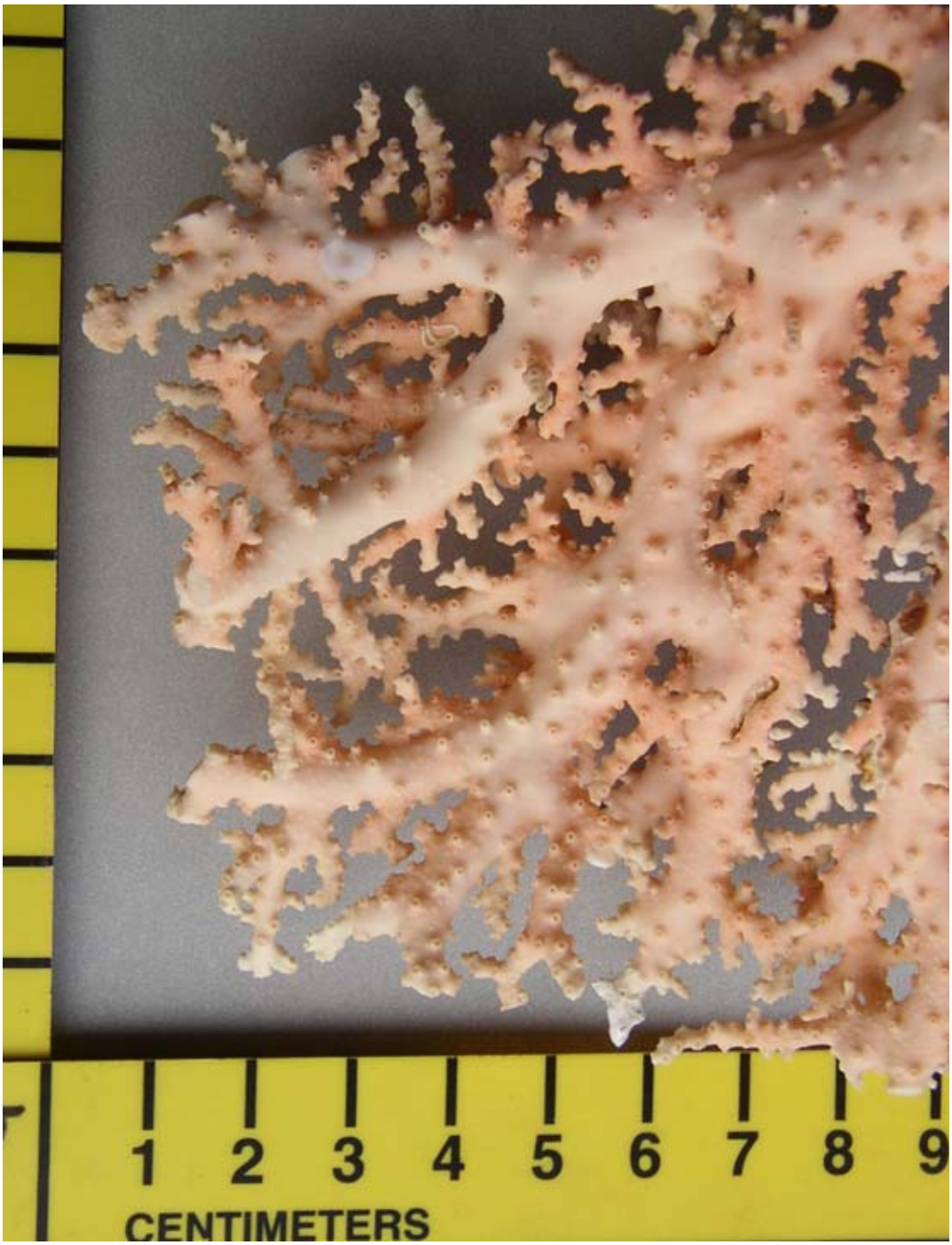

Figure 32. -- *Stylaster campylecus* – Colony robust, branching primarily in one plane, polyp pores projecting, mostly on front and lateral surfaces of branches; back of colony usually smooth; color white, buff, pink, or pale orange (Clark 1999).

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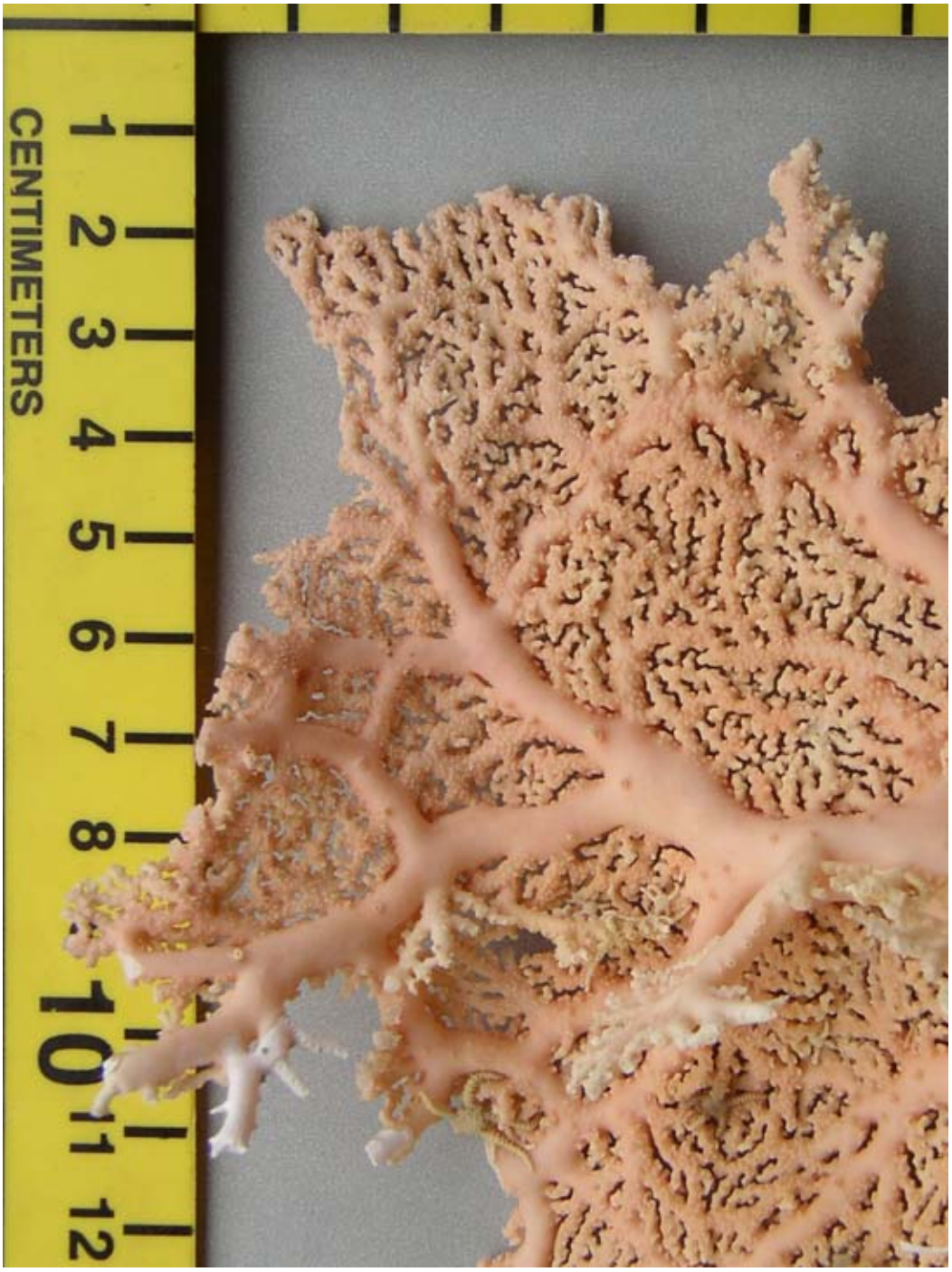

Figure 33. -- *Stylaster cancellatus* – Colony rather delicate, smooth uniplanar; branches coalescing, secondary branches anastomosed; color pale orange-pink (J. Andersen).

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Figure 34. -- *Chrysopathes speciosa* – A bushy delicate species when dried; dark tan when fresh (P. Malecha).

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Figure 35. -- *Bathypathes patula* – Pinnules in two lateral rows, bright red polyps when fresh (P. Malecha).

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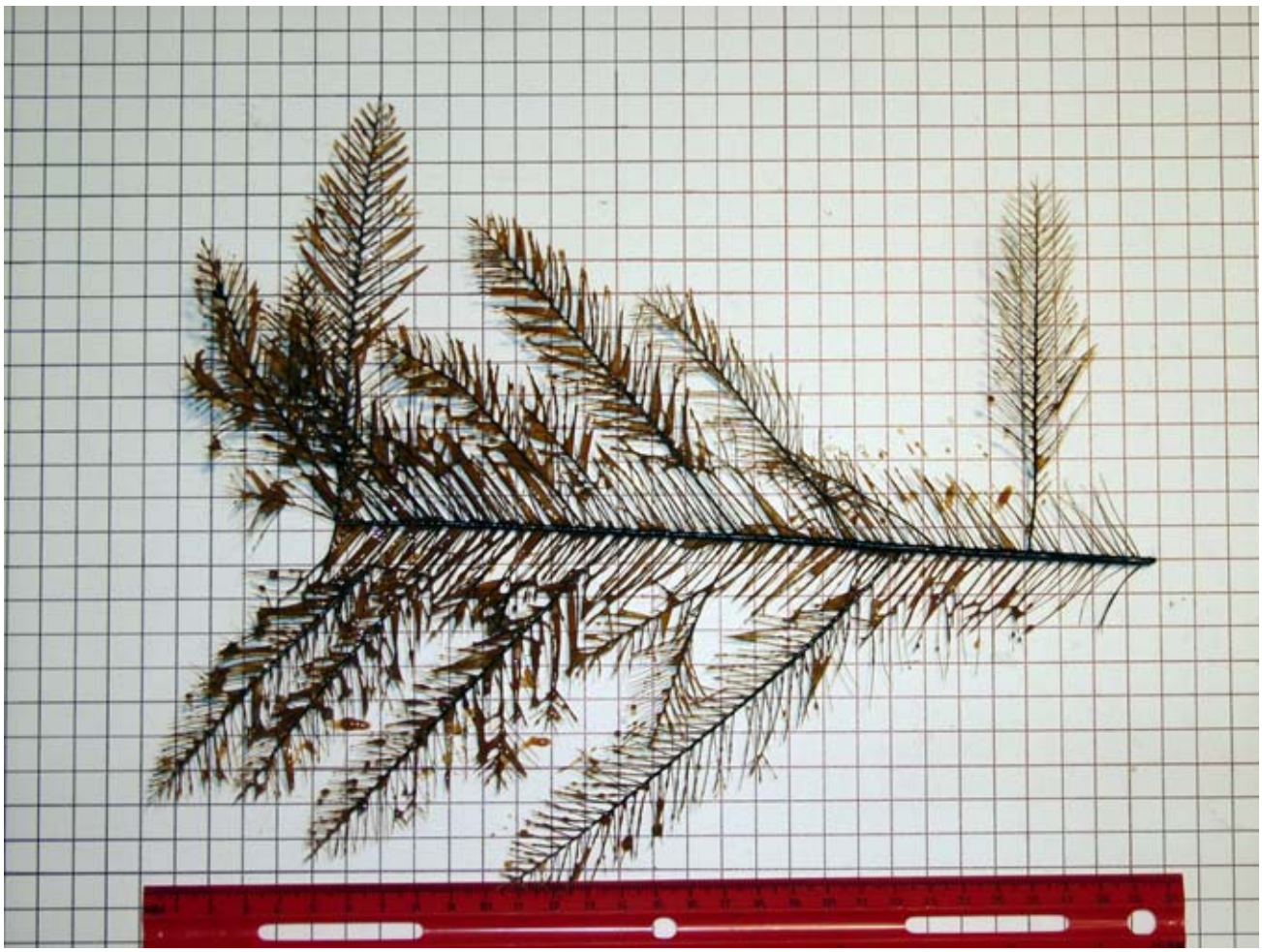

Figure 36 --. *Lillipathes lilliei* – Pinnules in four lateral rows, red polyps when fresh (P. Malecha).

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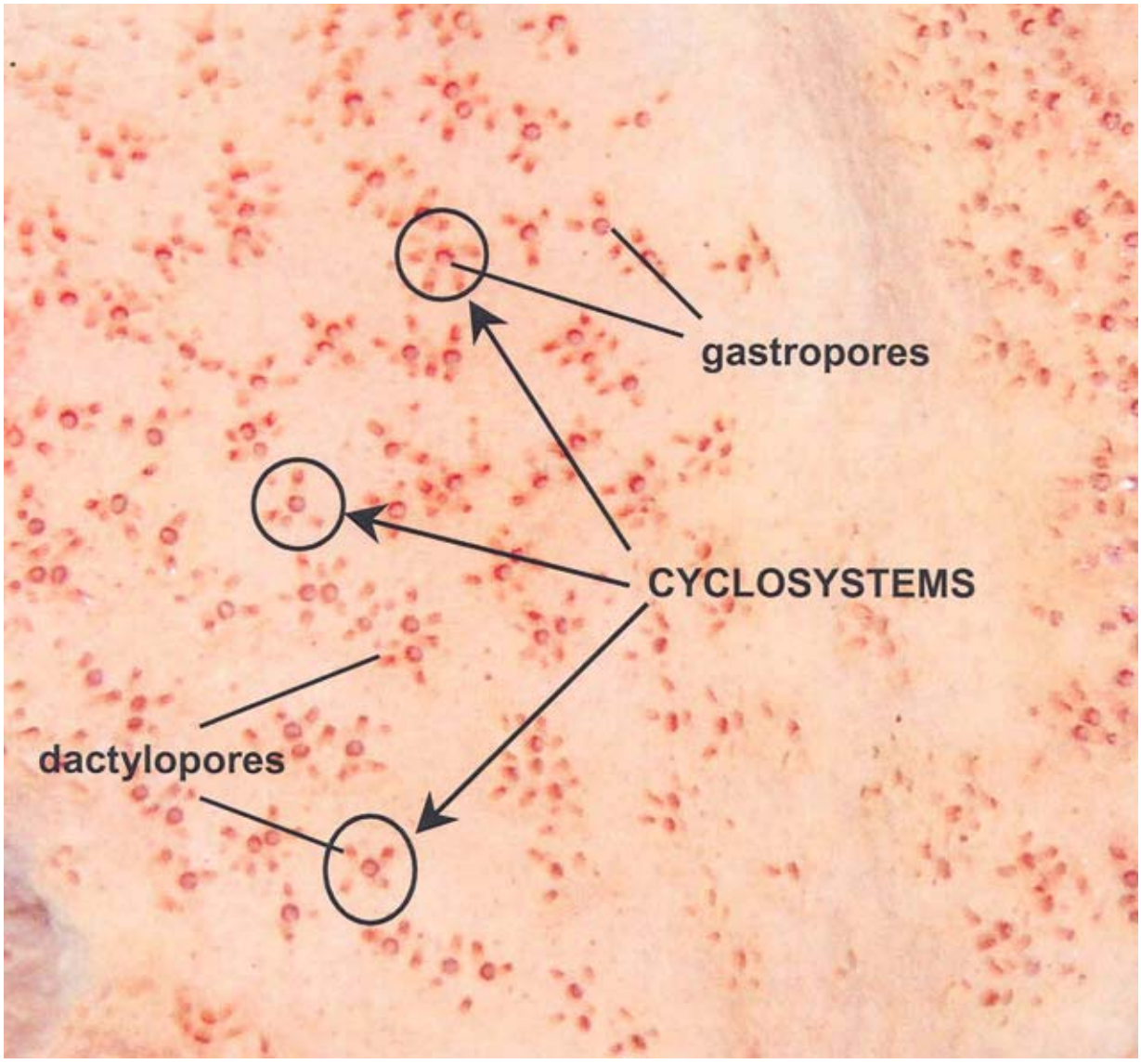

Appendix Figure 1. -- Close-up of surface of *Cyclohelia lamellata* showing cyclosystems, gastropores, and dactylopores (D. Barnard).

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145 RUGH, D. J., B. A. MAHONEY, and B. K. SMITH. 2004. Aerial surveys of beulga whales in Cook Inlet, Alaska, between June 2001 and June 2002, 26 p. NTIS number pending.

144 ANGLISS, R. A., and K. L. LODGE. 2004. Alaska marine mammal stock assessments, 2003, 224 p. NTIS number pending.

143 ZENGER, H. H. JR. 2004. Data report: 2002 Aleutian Islands bottom trawl survey, 247 p. NTIS No. PB2004-105068.

142 STEVENSON, D. E. 2004. Identification of skates, sculpins, and smelts by observers in North Pacific groundfish fisheries (2002-2003), 67 p. NTIS No. PB2004-105817.

141 HOFF, G. R., and L. L. BRITT. 2003. The 2002 eastern Bering Sea upper continental slope survey of groundfish and invertebrate resources, 261 p. NTIS No. PB2004-101668.

140 STONE, R. P., and M. M. MASUDA. 2003. Characteristics of benthic sediments from areas open and closed to bottom trawling in the Gulf of Alaska., 40 p. + Appendices (111 p.). NTIS No. PB2004-100650

139 JOHNSON, S. W., M. L. MURPHY, D. J. CSEPP, P. M. HARRIS, and J. F. THEDINGA. 2003. A survey of fish assemblages in eelgrass and kelp habitats of southeastern Alaska, 39 p. NTIS No. PB2004-100139.

138 PEREZ, M. A. 2003. Compilation of marine mammal incidental take data from the domestic and joint venture groundfish fisheries in the U.S. EEZ of the North Pacific, 1989-2001, 145 p. NTIS No. PB2004-100649

137 MASELKO, J. M., A. C. WERTHEIMER, and J. F. THEDINGA. 2003. Selection and application of a mark-and-recapture technique for estimating pink salmon escapements, 44 p. NTIS No. PB2003-107101.

136 BARBEAUX, S. J., and M. W. DORN. 2003. Spatial and temporal analysis of eastern Bering Sea echo integration-trawl survey and catch data of walleye pollock, *Theragra chalcogramma*, for 2001 and 2002, 34 p. NTIS No. PB2003-106479.

135 DIETER, B. E., D. A. WION, and R. A. MCCONNAUGHEY. 2003. Mobile fishing gear effects on benthic habitats: A bibliography (second edition), 207 p. NTIS No. PB2003-105080.

134 ROBSON, B. W. (editors). 2002. Fur seal investigations, 2000-2001, 80 p. NTIS No. PB2003-103825.

133 ANGLISS, R. A., and K. L. LODGE. 2002. Alaska marine mammal stock assessments, 2002, 224 p. NTIS PB2003-103793.

132 DOYLE, M. J.., M. S. BUSBY, J. T. DUFFY-ANDERSON, S. J. PICQUELLE, and A. C. MATARESE. 2002. Aspects of the early life history of capelin (*Mallotus villosus*) in the northwestern Gulf of Alaska: A historical perspective based on larval collections October 1977- March 1979, 32 p. NTIS No. PB2002-102535.

131 SEASE, J. L., and C. J. GUDMUNDSON. 2002. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) from the western stock in Alaska, June and July 2001 and 2002, 45 p. NTIS No. PB2003-102164.