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Accurate Identification of Deep-water Coral Harvested in the NAFO Regulatory Area

By

E. Kenchington[1], M. Best[1], A. Cogswell[1], K. MacIsaac[1], F. J. Murillo-Perez[2], B. MacDonald[1], V. Wareham[3], S. D. Fuller[4], H. I. Ø. Jørgensbye Hansen[5], V. Sklyar[6] and A. B. Thompson[7]

[1] Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada [2]Instituto Español de Oceanografía, Vigo, Spain
[3] Fisheries and Oceans, Northwest Atlantic Fisheries Center, St John's, Newfoundland and Labrador, Canada
[4]Biology Department, Dalhousie University, Halifax, Nova Scotia, Canada
[5]Gronlands Fiskerilicenskontrol, Greenland Home Rule, Nuuk, Greenland
[6]Knipovich Polar Research Institute of Marine Fisheries and Oceanography, Murmansk, Russian Federation
[7] NAFO Secretariat, Dartmouth, Nova Scotia, Canada

Introduction

The United Nations General Assembly Resolution 61/105 (UNGA, 2006) calls upon Regional Fisheries Management Organizations (RFMOs), such as NAFO, to identify vulnerable marine ecosystems (VMEs) in the high seas and to adopt protective measures for those in danger of significant adverse impact from fishing gear. The Fisheries and Agriculture Organization (FAO) of the United Nations has responded to this request by preparing technical guidelines to assist States and RFMOs in formulating and implementing the appropriate measures for the management of deep-sea fisheries (FAO, 2008). The FAO Guidelines provide examples of species groups, communities and habitat-forming species that are documented or considered sensitive and potentially vulnerable to fishing activities in the high-seas. These include deep-water corals, hydroids and sponges. However, not all deep-water coral species meet the criteria of VME components suggested by the FAO. Fuller et al. (2008) reviewed the coral taxa known to occur in the NAFO Regulatory Area (NRA) and produced a list of large gorgonians, black coral, stony coral and sea pens considered to be VME components. This list was adopted by the NAFO Working Group on the Ecosystem Approach to Fisheries Management (WGEAFM) (NAFO, 2008a) and by the NAFO Scientific Council (NAFO, 2008b). At the same time the NAFO *Ad hoc* Working Group of Fisheries Managers and Scientists has drafted an "Exploratory Fishery Data Collecting Form" template for its work on VME encounter protocols (NAFO, 2009) and identified the need for good keys to the coral taxa in the NRA (Divisions 3 LMNO) to improve data quality. The WGEAFM also drew attention to the poor quality of observer data and recommended that good keys should be developed. This working paper is a response to these calls for practical keys for use by fishers, technicians and others at sea for identifying coral. They are not intended to be used as taxonomic guides, as those are available elsewhere.

Development of the Coral Identification Sheets

A request was put to members of the WGEAFM for participation in a subgroup to develop coral identification sheets for the NRA. Further assistance was obtained from the Benthic Ecology Laboratory at the Bedford Institute of Oceanography, Canada, who have expertise in coral identification. Those who responded are included in the authorship of this working paper. The subgroup at first dealt with the following issues:

1) What is the purpose of the keys?
2) What species/taxa should be included to satisfy the purpose?
3) What format should the final product take?
4) What should the properties of the final product have?

It was decided that the keys should be used for identifying the coral taxa at sea in order to improve the quality of data coming to member States and NAFO. It was further decided that only the commonly caught taxa should be included and if full identification to species requires microscopic or expert identification, then the taxon should be represented at the genus level to avoid incorrect reporting. For example, the soft corals can be very difficult to identify, even for experts, and those that cannot be readily discerned were grouped as Neptheidae, representing the family. If one species of a genus was common and the other rare, and the two can be easily distinguished (e.g., *Paragorgia arborea* is common, while *P. johnsoni* is rare), then we included both to obtain better data on the rare occurrences and to show the similar species. The only exception was the inclusion of *Lophelia pertusa* as this coral although not found in the NRA is known to occur in the mid-Atlantic and on the Scotian Shelf and as it is such an important reef-building species the expert group included it. The initial list of taxa under consideration was that presented in the Fuller et al. (2008) report. This list was then collapsed according to the above criteria. In total 27 taxa were selected. The document is intended to be a "living" document and additional pages can be added if experience of use shows that change is required.

We also recognized that most of the intended users will use pictures to identify the taxa as they appear on deck, and will also wish to minimize reading time associated with identification. Consequently, the guide uses clear photos of the specimens taken on deck (no underwater photos) and illustrates those features which help to distinguish the taxon using current taxonomic descriptors. A number of products used to identify fish were examined and one which utilized half of a standard letter sheet of paper (8.5 x 5.5 in) was selected for its clarity and ease of use. Templates were sent around at various stages to the subgroup members and the majority opinions were followed. It was viewed that the pages should be uncluttered, simple, and provide quick and accurate reference. Some issues which were discussed but not entertained were: 1) use of maps (viewed to be quickly outdated and may preclude accurate identification if used over taxon guides; information on bottom type and depth ranges were included as a replacement for this type of information which was seen to be reinforcing rather than diagnostic in nature); 2) use of logos on photos (viewed to clutter the pictures unnecessarily and distract from the diagnostic features; an acknowledgement page was added to the guide to recognize contributions); 3) inclusion of a dichotomous key to identify taxa (this requires detailed knowledge, such as number of tentacles on the polyps, which is not practical for the purpose of the guide; a Table of Contents showing each genus as a picture thumbnail was included to facilitate comparison and assist in quick reference).

The draft coral identification sheets are illustrated in Appendix 1. Upon endorsement from the Scientific Council these sheets will be placed on the NAFO website and hard copies printed on waterproof or laminated paper and spirally-bound.

References

FAO. 2008. Report of the Technical Consultation on International Guidelines for the Management of Deep-sea Fisheries in the High Seas. Rome, 4–8 February and 25-29 August 2008. FAO Fisheries and Aquaculture Report, No. 881, Rome, FAO. 2008, 42 pp. ftp://ftp.fao.org/docrep/fao/011/i0605t/i0605t00.pdf

Fuller, S.D., F.J. Murillo Perez, V. Wareham and E. Kenchington. 2008. Vulnerable Marine Ecosystems Dominated by Deep-Water Corals and Sponges in the NAFO Convention Area. Serial No. N5524. NAFO SCR Doc. 08/22, 24pp.

NAFO. 2008a. Report of the NAFO Scientific Council Working Group on Ecosystem Approach to Fisheries Management (WGEAFM). Serial No. N5592. NAFO SCS Doc. 08/24, 19pp.

NAFO. 2008b. Scientific Council Meeting, 22-30 October 2008, Copenhagen, Denmark. Serial No. N5594. NAFO SCS Doc. 08/26, 32pp.

NAFO. 2009. Report of the Ad Hoc Working Group of Fishery Managers and Scientists on Vulnerable Marine Ecosystems (WGFMS) 19-20 March 2009 Vigo, Spain. Serial No. N5625., NAFO/FC Doc. 09/2, 30 pp.

UNGA. 2006. United Nations General Assembly Resolution 61/105. http://daccessdds.un.org/doc/UNDOC/GEN/N06/500/73/PDF/N0650073.pdf?OpenElement

Appendix 1. Draft Coral Identification Guide

Coral Identification Guide NAFO Area

Contributors: E. Kenchington, M. Best, A. Cogswell, K. MacIsaac, F. J. Murillo-Perez, B. MacDonald, V. Wareham, S. D. Fuller, H. I. Ø. Jørgensbye Hansen, V. Skylar and A. B. Thompson - NAFO SCR Doc. 09/7.

Photo credits:

F.J. Murillo-Perez, Instituto Español de Oceanografía (ECOVUL/ARPA project), Vigo, Spain: Page 3, *Gersemia* lower photo; Page 21, *Ombellula* upper photo
V. Wareham, Department of Fisheries and Oceans, St. John's, Newfoundland and Labrador, Canada: Page 1 both photos; Page 2 bottom; Page 5 top; Page 9, *Flabellum macandrewi* (C) lower right photo; Page 11 bottom; Page 15 top; Page 22, *Pennatula phosphorea* (B) middle photo
T. Patrocinio, Instituto Español de Oceanografía (ECOVUL/ARPA project), Vigo, Spain: Page 7, *Lophelia pertusa* upper photo
M. Butler, Ecology Action Centre, Halifax, Nova Scotia, Canada: Page 7, *Lophelia pertusa* lower photo
S.C. France, Department of Biology, The University of Louisiana, Lafayette, Louisiana, USA: Page 6, *Stichopathes*

All other photos courtesy of the Department of Fisheries and Oceans, Ecosystem Research Division, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada

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Northwest Atlantic Fisheries Organization
P.O. Box 638, Dartmouth, Nova Scotia
Canada B2Y 3Y9
Tel: (902) 468-5590 • Fax (902) 468-5538

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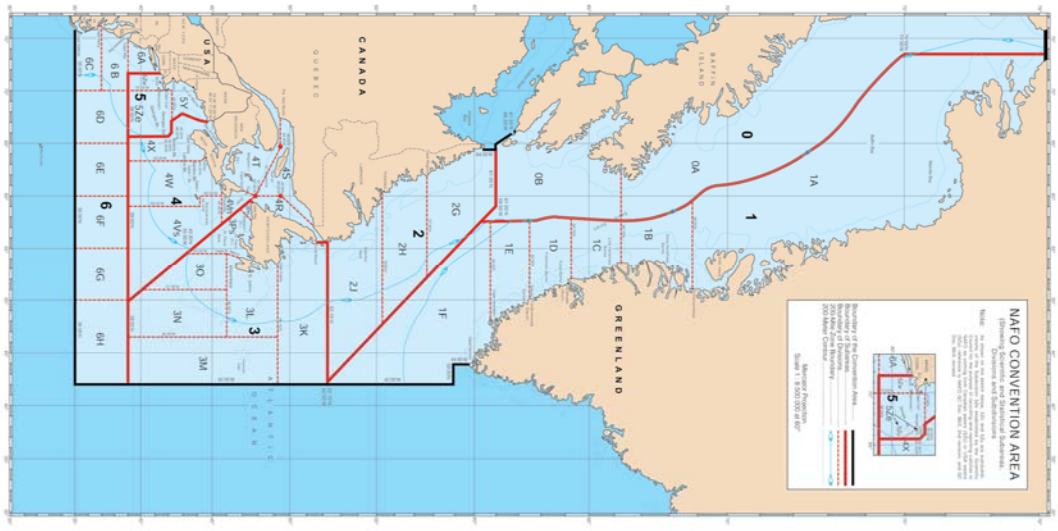


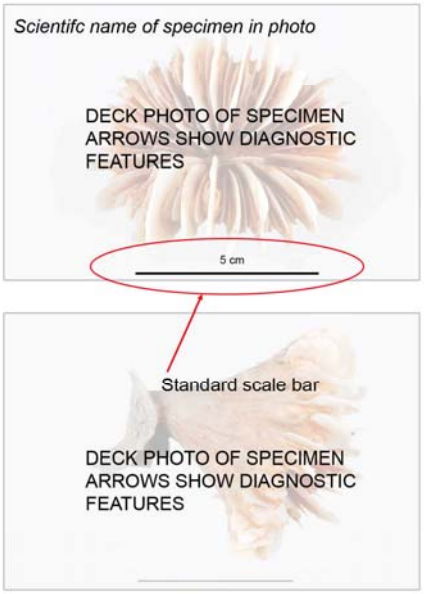
Page ii

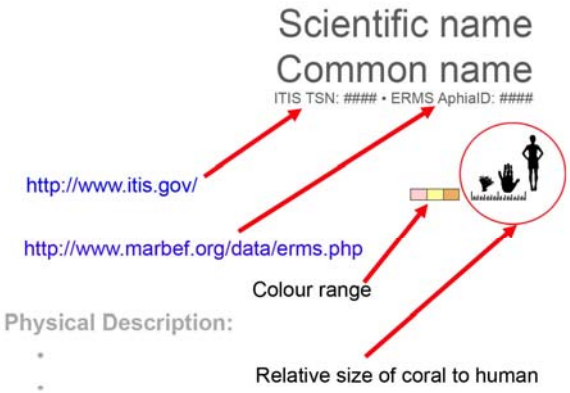
Preface

This book is intended as a pictorial identification guide for some species of coral found on the Grand Banks of Newfoundland and on Flemish Cap. Some species also occur more broadly in NAFO Divisions 1, 2, 3, 4 and 5, however Divisions 5 and 6 will contain many more species not yet included. Our intent was that the guide should be useful for at-sea identifications by non-specialists. It was written for fishers, fishery observers, scientific technicians and others who may not be familiar with coral identification. It is hoped that it will result in improved data collection for improving our knowledge of the distribution of these vulnerable marine species. Should users find specimens that do not fit the guide, or need assistance in identification, please contact:

Dr. Ellen Kenchington
Bedford Institute of Oceanography
Fisheries and Oceans Canada
1 Challenger Drive
Dartmouth, Nova Scotia, Canada
B2Y 4A2
Tel: (1-902) 426-2030 • e-mail: KenchingtonE@dfo-mpo.gc.ca

Page iii





Physical Description:

-
-

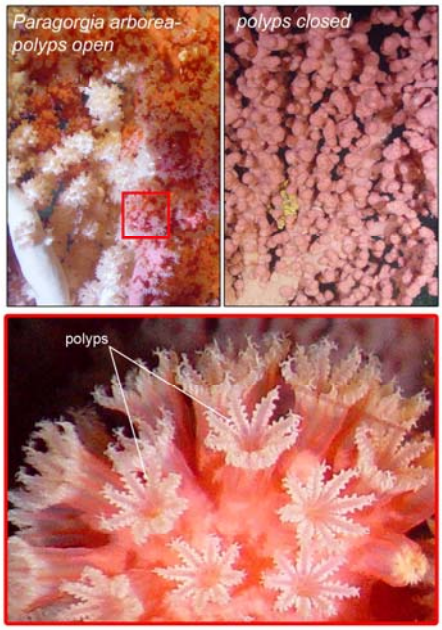
Size Information:

-

Habitat and Depth:

-

Page iv



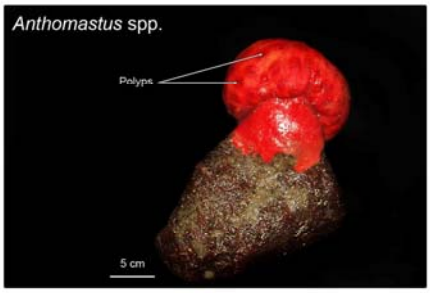
Terminology - Polyps

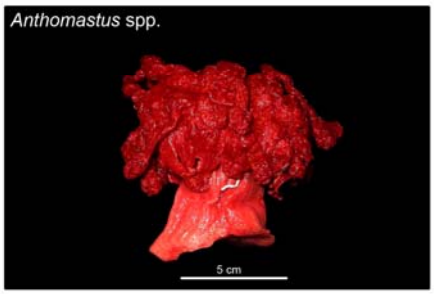
Physical Description:

- Tubular flower-like structures used for both feeding and reproduction
- Polyps are always closed when specimen caught
- In a variety of forms and can be clustered or solitary depending on the species or size of the individual
- An example of a coral species composed of a single polyp is *Desmophyllum* spp. (Page 8)
- *Paragorgia arborea* is an example of a species with many hundreds of polyps per individual

Page v

Table of Contents





Anthomastus

ITIS TSN: 52030 • ERMS AphiaID: 125285

Physical Description:

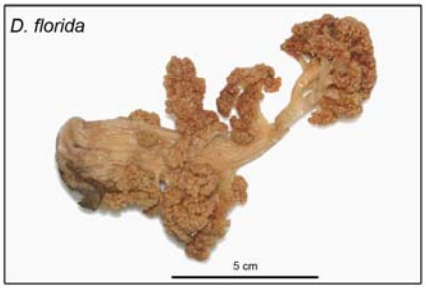
- Soft, mushroom shaped with cap and (usually) stalk, round to flat; large tentacles (if present) attached to cap; dot-like smaller polyps scattered between larger polyps
- Colour: light to dark red

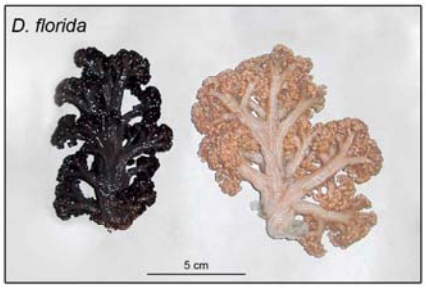
Size Information:

- Up to 10cm diameter, but typically 5cm or less

Habitat and Depth:

- On hard bottom, attached to hard substrate; free on soft bottom; 170-1400m





Duva florida

ITIS TSN: 52047 • ERMS AphiaID:146764

Physical Description:

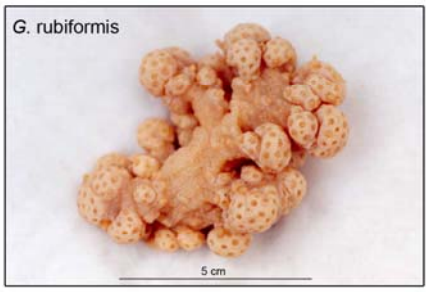
- Soft, branching, broccoli-like, with polyps in loose clusters, stem slightly rough to touch
- Colour: dark to tan

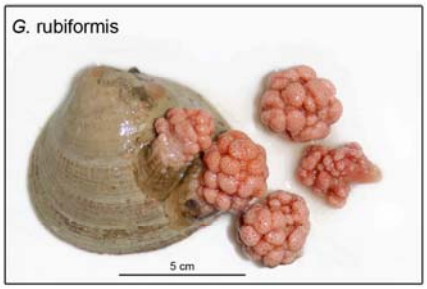
Size Information:

- Up to 25cm, but typically less than 15cm

Habitat and Depth:

- Attached to hard substrate on hard and soft bottom; 200-1500m





Gersemia rubiformis

ITIS TSN 52037 • ERMS AphiaID:N/A

Physical Description:

- Soft but firm, branching, cauliflower-like to round, with polyps in tight clusters
- Colour: tan to pink

Size Information:

- Up to 10cm, but typically less than 5cm

Habitat and Depth:

- Attached to hard substrate on hard and soft bottom; 35-700m (can be common on fishing banks)

Page 3

Other Nephtheidae

ITIS TSN: 52034• ERMS AphiaID: 146762

Physical Description:

- Soft or firmer, branching with polyps variable but may resemble clusters of grapes, stem smooth to touch
- Colour: white to tan to dark

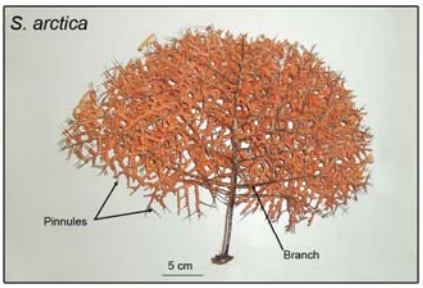
Size Information:

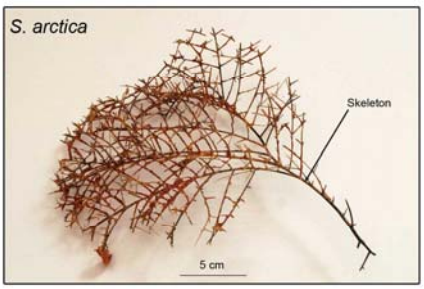
- Typically less than 25cm

Habitat and Depth:

- Attached to hard substrate on hard and soft bottom; 200-1500m

Page 4





Stauropathes arctica

ITIS TSN (Genus): 719057 • ERMS AphiaID:

Physical Description:

- Bush-like, densely branched on one plane causing flat appearance; two rows of small, unbranched pinnules (needles) on branches, often crossed and fusing with other branches/pinnules
- Colour: polyps orange, skeleton black

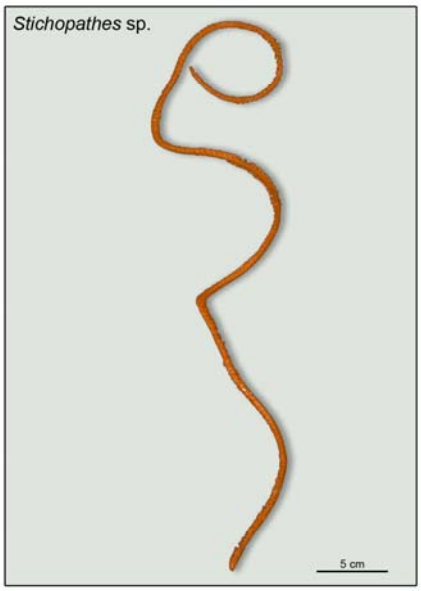
Size Information:

- Up to 80cm

Habitat and Depth:

- Hard bottom; 700-1850m

Page 5



Stichopathes

ITIS TSN: 51963 • ERMS AphiaID: 103308

Physical Description:

- Elongate and whip-like; spiralled
- Colour: polyps orange which can be peeled to reveal a black skeleton

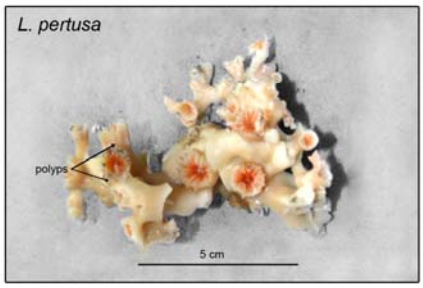
Size Information:

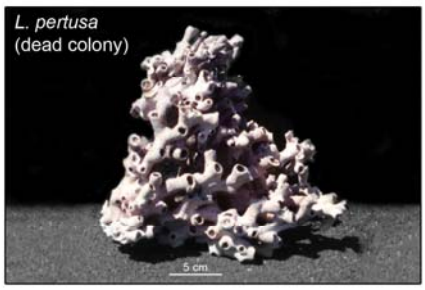
- Up to 80cm

Habitat and Depth:

- Hard bottom; 700 - 1300m

Page 6





Lophelia pertusa
Spider Hazards

ITIS TSN: 53706 • ERMS AphiaID: 135161

Physical Description:

- Hard, branching network crossed and fused
- Colour: tissue transparent white to orange-pink; skeleton white
- Reef-building

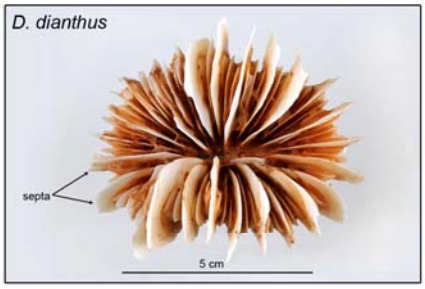
Size Information:

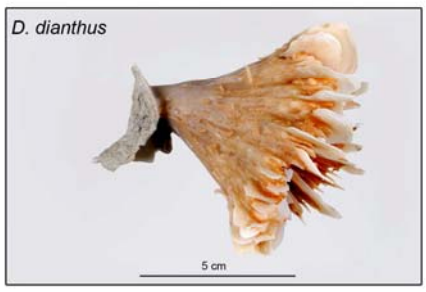
- Individual polyps several cm; colony up to 200cm; typically fragments collected

Habitat and Depth:

- Hard bottom; 200-1000m

Page 7





Desmophyllum dianthus

ITIS TSN: 572071 • ERMS AphiaID: 135159

Physical Description:

- Hard, solitary, stalked, will show sign of breakage where removed from substrate; many blade-like plates (septa) at the top; relatively robust
- Colour: polyps transparent pink, yellow, or orange; skeleton white

Size Information:

- Up to 10cm

Habitat and Depth:

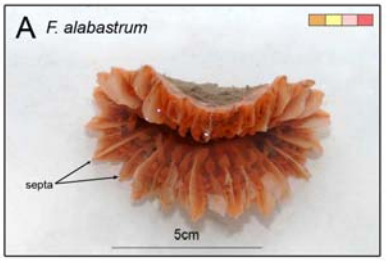
- Hard bottom, attached; 700-1400m

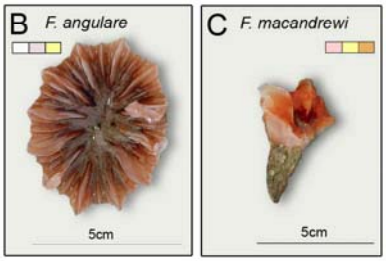
Page 8

Flabellum

Flabellum alabastrum (A), *F. angulare* (B), *F. macandrewi* (C)

ITIS TSN: 572140 (A), 572141 (B), 53731 (C) • ERMS AphiaID: 135194 (A),135195 (B), 135197 (C)





Physical Description:

- Hard, solitary, conical or cup-like; no stalk, with blade-like septa; skeletons are white
- A – Cup "pinched" in centre; tissue colourless to yellow, orange, pink or red
- B – Oval-shaped cup; tissue colourless to white to yellow
- C – Cup is fragmented; tissue colourless to pink, yellow or orange

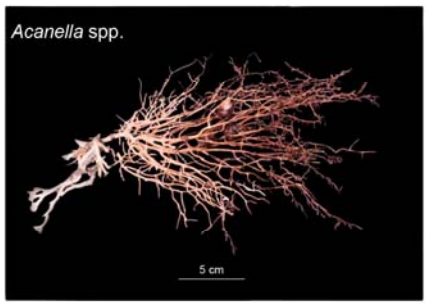
Size Information:

- A – Up to 8cm
- B – Up to 8cm
- C – Up to 3cm

Habitat and Depth:

- A – Soft bottom; 200-2000m
- B – Soft bottom, 2200-3200m
- C – Soft bottom; 180-650m

Page 9



Acanella

ITIS TSN (Genus): 52337 • ERMS AphiaID (Genus): 125303

Physical Description:

- Bush-like; skeleton stiff but delicate, segmented; branching base (sometimes missing)
- Colour: polyps pale to dark orange; skeleton white with darker bands

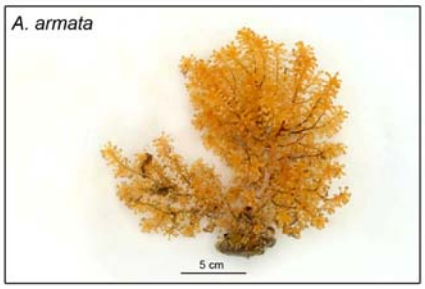
Size Information:

- Less than 30cm

Habitat and Depth:

- Soft bottom; 150-2300m

Page 10



Acanthogorgia armata

ITIS TSN: 52119 • ERMS AphiaID: 125348

Physical Description:

- Bushy, slightly flattened, rough to the touch; skeleton flexible
- Colour: polyps yellow (rarely blue), grey when dead; skeleton brown to grey

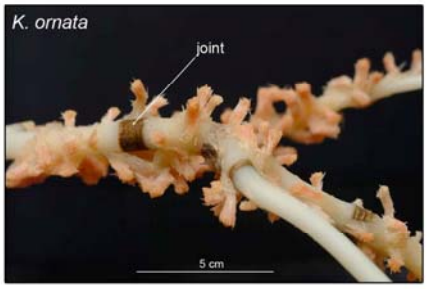
Size Information:

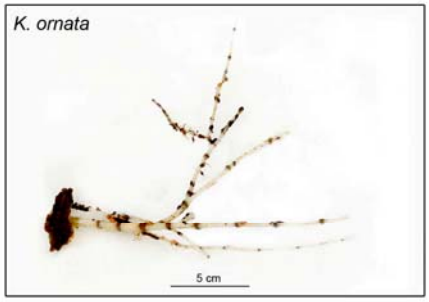
- Less than 20cm; occasionally up to 50cm

Habitat and Depth:

- Attached to hard substrate on hard and soft bottom, 170-1400m

Page 11





Keratoisis ornata
Bamboo Coral

ITIS TSN (Genus): 52330 • ERMS AphiaID (Genus): 125306

Physical Description:

- Tree-like; hard and rigid; long, slender, sparse branches
- Colour: polyps pale pink to orange (may phosphoresce); skeleton white with golden-brown joints

Size Information:

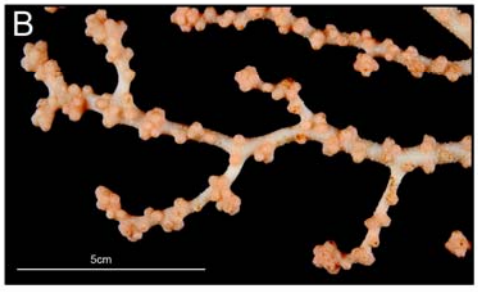
- Up to 150cm

Habitat and Depth:

- Attached to hard substrate on hard and soft bottom; 200-1100m

Page 12

Page 13



Paragorgia arborea (A)
P. johnsoni (B)
Bubblegum Coral

ITIS TSN: 52108 (A), 52107 (B) (Genus)
ERMS AphiaID: 125418 (A), 125419 (B)

Physical Description:

- A – Branches thicker with tips greater than 5mm; association with basket stars common (pictured)
- A – Colour: polyps white to tan,orange, pink and red, dark purple
- B – Branches thinner with tips 2-4mm
- B – Colour: polyps white to tan, orange, pink and red

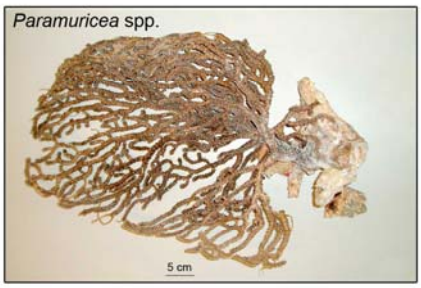
Size Information:

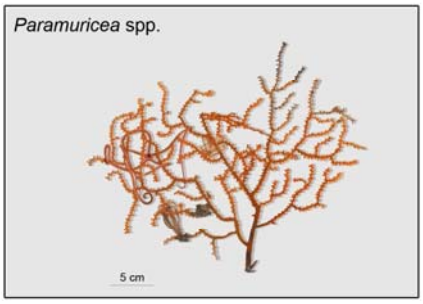
- A – up to 600cm, typically broken pieces collected
- B – up to 100cm, typically broken pieces collected

Habitat and Depth:

- A – Hard bottom, 200-1300m
- B – Hard bottom, 800-4100m

Page 14





Paramuricea

ITIS TSN (Genus): 52124 • ERMS AphiaID (Genus): 125311

Physical Description:

- Fan-like, curving branches; skeleton flexible, rough to touch
- Colour: polyps yellow to orange; grey to black when dead; skeleton green to brown

Size Information:

- Up to 80cm

Habitat and Depth:

- Hard bottom; 150-2200m

Primnoa resedaeformis
Sea-corn Coral

ITIS TSN: 52307 • ERMS AphiaID: 125411

Physical Description:

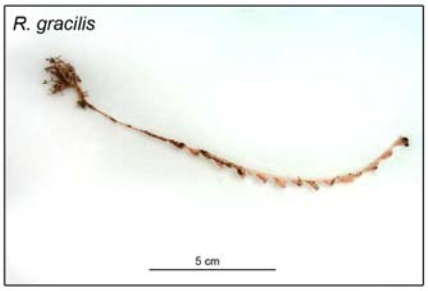
- Bush or tree-like; skeleton stiff yet flexible, hard and rigid at the base; conspicuous scale-like polyps
- Colour: polyps pink to orange, skeleton brown

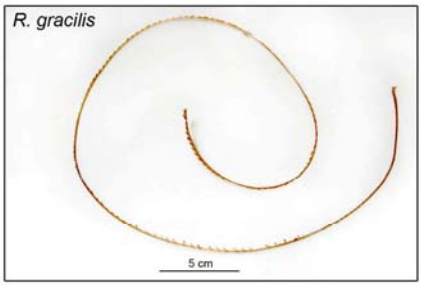
Size Information:

- Up to 120cm

Habitat and Depth:

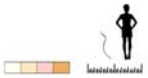
- Hard bottom, 150-1150m





Radicipes gracilis

ITIS TSN (Genus): 719055 • ERMS AphiaID: 125357



Physical Description:

- Slender, unbranched, whip-like, with slight spiral; skeleton flexible, stiff, with branching, root-like base; polyps located on one side of frond
- Colour: white to pink and orange, may be iridescent

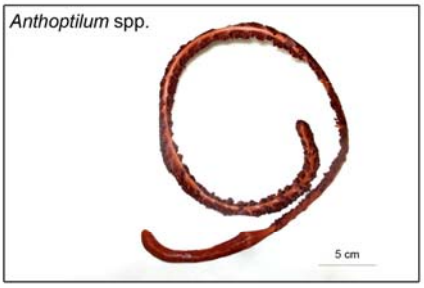
Size Information:

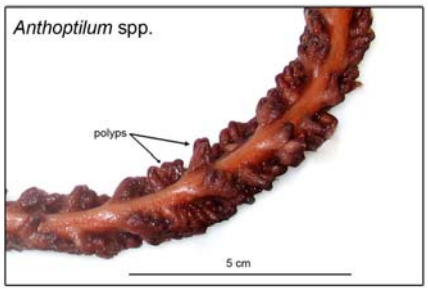
- Up to 90cm, but typically less

Habitat and Depth:

- Soft bottom; 400-1500m

Page 17





Anthoptilum

ITIS TSN (Genus): 52401 • ERMS AphiaID (Genus): 128489

Physical Description:

- Elongate and whip-like, often "?" shaped; polyps at an angle to the main stem in two rows running its length, one side of the stem relatively bare of polyps; smooth to touch
- Colour: polyps brown to red, stalk brown to red or yellow
- Bulbous root

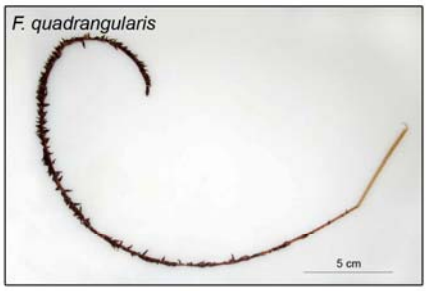
Size Information:

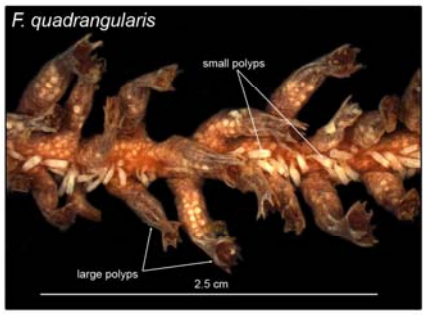
- Up to 100cm

Habitat and Depth:

- Soft bottom; 150-2400m

Page 18





Funiculina quadrangularis

ITIS TSN: 719232 • ERMS AphiaID: 128506

Physical Description:

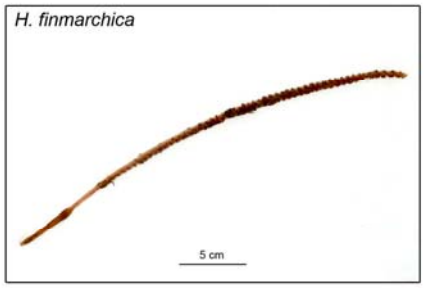
- Elongate and whip-like, thin, tip often curled or coiled, two rows of large polyps; smaller polyps conspicuous and scattered sparsely on stalk
- Colour: polyps yellow, pink to purple with root white to yellow, orange and brown
- Bulbous root

Size Information:

- Up to 210cm

Habitat and Depth:

- Soft bottom; 100-2700m



Halipteris finmarchica

ITIS TSN: 719237 • ERMS AphiaID: 128509

Physical Description:

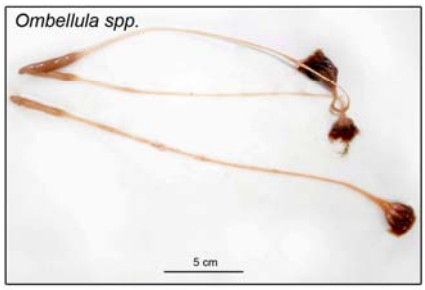
- Elongate and whip-like, polyps in rows at angle to the main stem on raised ridges, rough to touch, tip often bare or with anemones attached
- Colour: polyps brown to red, stalk white to yellow
- Bulbous root

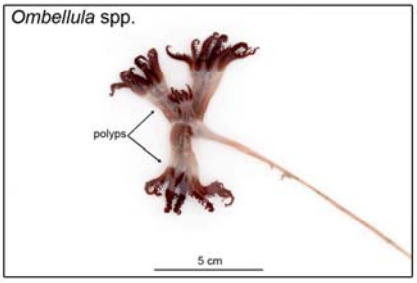
Size Information:

- Up to 125cm

Habitat and Depth:

- Soft bottom; 110-1800m





Ombellula

ITIS TSN (Genus): 719032 • ERMS AphiaID (Genus): 128499

Physical Description:

- Elongate, thin, with large polyps in cluster at top of stem
- Colour: polyps pink to red to brown, stalk white or pink

Size Information:

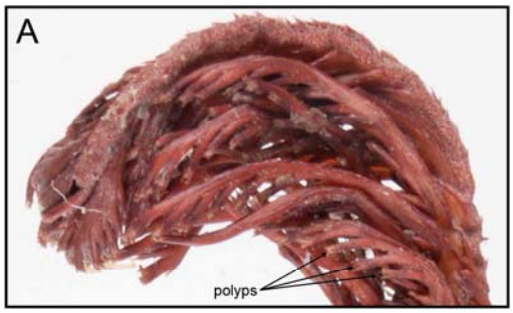
- Up to 50cm

Habitat and Depth:

- Soft bottom; 200-2600m

Page 21

Page 22



Pennatula

Pennatula aculeata (A)
P. phosphorea (B)
P. borealis (C)

ITIS TSN: 52418 (A), 52419 (B), 52422 (C)
ERMS AphiaID: 128515 (A), 128517 (B), 128516 (C)

Size Information:

- A – Up to 40cm
- B – Up to 40cm
- C – Up to 40cm and greater

Physical Description:

- Feather-like, with polyp leaves
- A – few polyps on larger leaves; 20 or less/leaf
- B – few polyps on larger leaves, 20 or less/leaf; thicker stalk than A
- C – many polyps on larger leaves; 30 or more/leaf
- Colour typically red to pink, but variable

Habitat and Depth:

- A – Soft bottom, 100-500m and deeper
- B – Soft bottom, 10-100m and deeper
- C – Soft bottom, 200-2300m

Page 23