Northwest Atlantic Fisheries Organization

Serial No. N6156 **NAFO SCR Doc. 13/007**

SCIENTIFIC COUNCIL MEETING – JUNE 2013

Preliminary mapping of the distribution of corals observed off West Greenland as inferred from bottom trawl surveys 2010-2012

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Abstract

During 2010-2012 corals were sampled in 9 bottom trawl surveys conducted by the Greenland Institute of Natural Resources along the west coast of Greenland at depths down to 1500 m. In total, 779 trawl hauls were completed of which 202 contained one or several species of corals. The catches were small, only five records > 1 kg. Corals from several taxonomic groups were identified: Alcyonacea (soft corals), Gorgonacea (branching corals), Pennatulacea (sea pens), Scleractinia (stony corals), and Antipatharia (black corals). There were few corals (mainly soft corals) at depths < 500 m. Only in a small area between 63°N and 64°N and at 1000-1500 m depth was there a relatively high density and diversity of corals.

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, 2008) and by the NAFO Scientific Council (NAFO, 2008b). "(Copied from Kenchington et *al*. (2009).

As a first step towards identification of VMEs in Greenland waters, the Greenland Institute of Natural Resources in 2011 initiated a program in order to identify and record corals observed during bottom trawl surveys. The present paper is based on recordings from trawl hauls conducted off West Greenland during surveys in 2011 and 2012 supplemented by observations from a survey in Baffin Bay in 2010.

Material and Methods

All corals were recorded in nine of the bottom trawl surveys conducted with R/V Paamiut. In Cruise 1-3 in 2011 (Kingsley et *al*. 2012) and 1-3 in 2012 a Cosmos shrimp trawl with 22 mm in the cod end was employed. Towing speed was 2.5 kn., tow duration was l5 minutes and wingspread was approximately 19 m. The surveys covered depths between 50 m and 600 m from Cape Farwell to 72.50° N (NAFO Divisions 1A-1F). Cruise 7 in 2010 covered Baffin Bay between 68.83°N and 75.50°N (NAFO Div. 1A) (Jørgensen 2011) between 400 and 1500 m. Cruise 6 in 2011 (Jørgensen 2012) and 2012 (Jørgensen 2013) covered NAFO Divisions 1CD (62.50°N – 66.25°N) between 400 and 1500 m. In the latter three cruises an Alfredo III trawl with 30 mm in the cod end was employed. Towing speed was 2.9 kn, haul duration was 30 min and wing spread approximately 21 m. Both trawls were equipped with rock hopper ground gear. All positions are in decimal degrees.

At each trawl haul position, depth and bottom temperature was recorded and the catch was sorted. Corals were identified to lowest possible taxon and most specimens were frozen and/or pictures were taken.

The identification of the corals is based on Kenchington et *al*. (2009) and Wareham (2008). The identification of almost all specimens has further been verified by OST on the basis of frozen samples or pictures.

The distribution maps are made in MAPINFO ver. 7.0

Results and Discussion

In total, 779 trawl hauls were conducted and corals, in some cases two or more species, were observed in 202 of the hauls.

A bottom trawl with heavy rock hopper ground gear is not particularly efficient in sampling corals, *i.e*. the ground gear runs over the corals without sampling them, and an unknown number of specimens and species may have been overlooked. Further, many of the corals were only fragments due to the rough treatment which impeded identification. Only at five stations was the sample weight > 1.0 kg and only one station had a sample weight > 5 kg (100 kg).

Alcyonacea (Soft corals)

Representatives of Alcyonacea were found along the entire shelf an upper slope of West Greenland and were observed in 54 trawl hauls (Fig.1), at depths ranging from 67 m to 1473 m and temperatures between 0.2°C and 5.6°C. Two specimens was identified as *Duva florida* (61.53°N - 64.58°N, depth 225 - 826 m, temperature 4.0 - 4.4°C), three as '*Capnella' sp*. (68.98°N – 74.90°N, depth 828 – 1349

m, temperature 0.2-1.2°C), four as *Gersemia rubiformes* (60.20°N – 62.46°N, depth 78 – 358 m, temperature 2.3-4.5°C), one as *Stenogorgia borealis* (62.93°N , depth 167 m, temperature 1.0°C), and the remaining just as members of the family *Nephtheidae.* Five species of Nephtheidae have been found in Greenland waters and four of them are widely distributed off West Greenland (Kramp 1932; Them Jensen 2006).

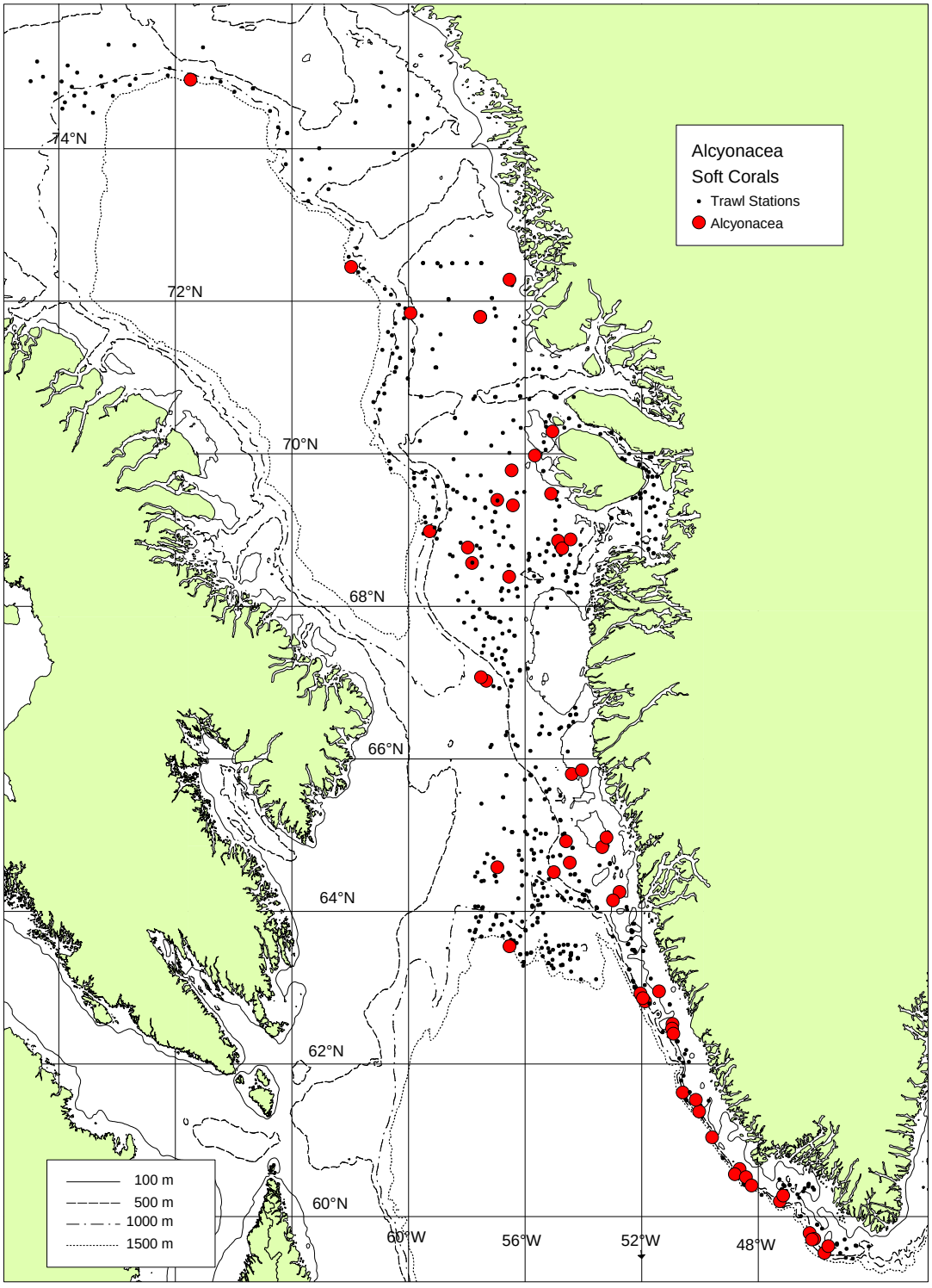

Fig. 1. Distribution of soft corals (Alcyonacea).

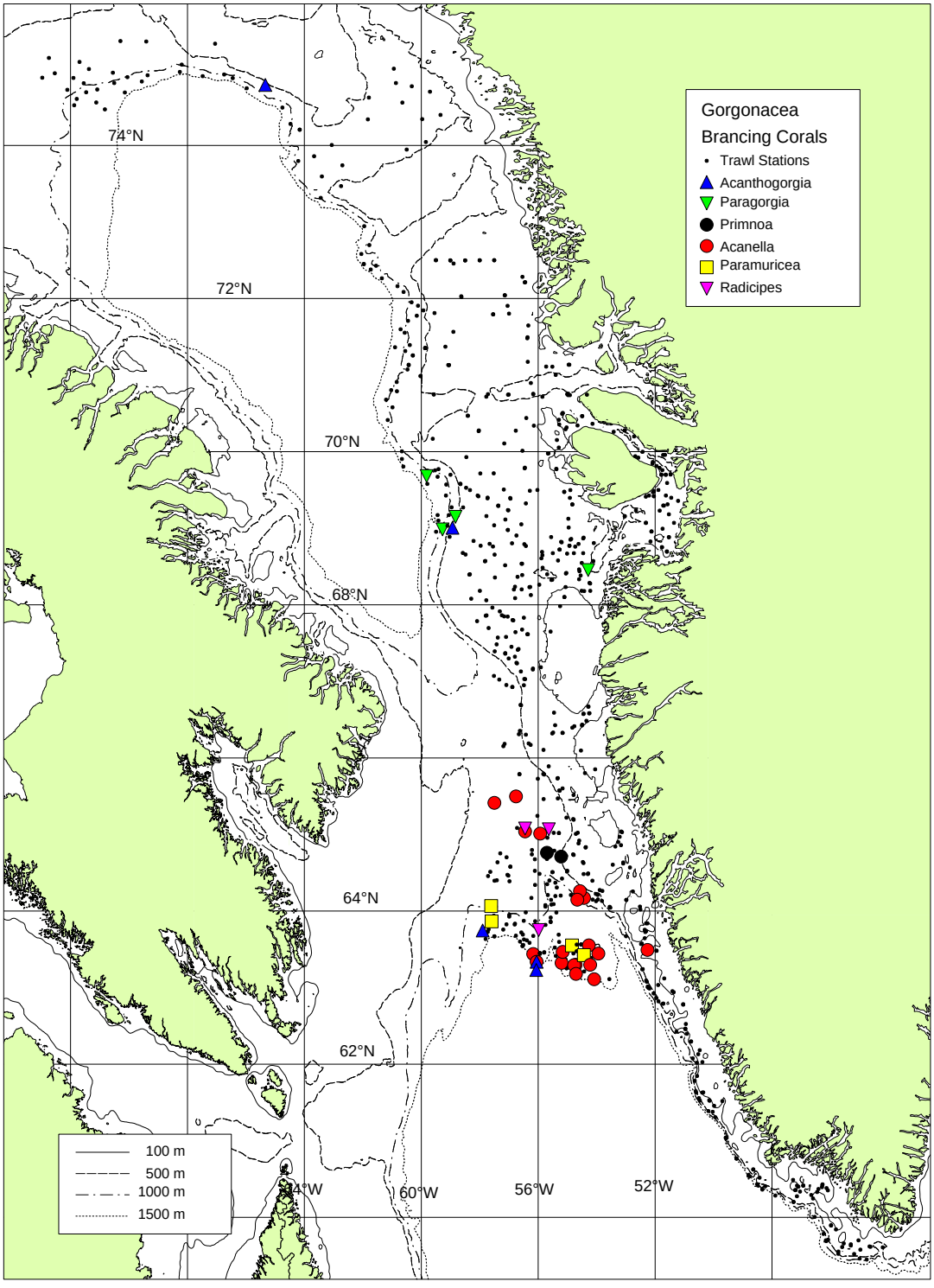

Fig. 2. Distribution of branching corals (Gorgonaria).

Gorgonacea (Branching corals)

Acanthogorgia
*Acanthogorgi*a *armata* was observed in five trawl hauls between 63.29°N and 74.79 °N (Fig. 2) at depths between 484 m and 1445 m and temperatures from 1.8 °C to 3.7° C. The species is new to Greenland..

Paragorgia
Paragorgia arborea was observed in four trawl hauls between 68.45°N and 69.68°N, 3 fragments and one entire specimen (100 kg) (Fig 4.). The depth range was 422 - 1253 m and temperature range 0.5 - 4.2 °C. The species was known from several records off West Greenland, but the new observations extend the known distribution appreciably towards north (Tendal 1992).

Primnoa
Primnoa resedaeformis was observed in two trawl hauls around 64.73°N (Fig. 4) at depths on 567 and 916 m and at temperatures at 4.2°C and 4.7°C, respectively. The species was known from some records, also in Southwest Greenland (Madsen 1944).

Acanella
Acanella arbuscula was observed in 20 trawl hauls in a relatively restricted area between 63.11°N and 65.50°N at depths between 484 m and 1429 m and at temperatures ranging from 1.7°C to 4.4°C. The species was known from several localities in the same general area, the new records extending the known distribution a little to the north (Madsen 1944).

Paramuricea
Paramuricea sp. was observed in four trawl hauls in a restricted area between 63.42°N and 64.07°N at depths between 949 and 1169 m and at temperatures ranging from 3.7 to 4.0°C. The species is new to West Greenland.

Radicipes
Radicipes gracilis was observed in three trawl hauls between 63.75°N and 65.07°N and 736 m and 1067 m and at temperatures ranging from 3.1°C to 4.2°C. The species was known from e few records from deep water, also off Southwest Greenland (Madsen 1944).

Pennatulacea (Sea pens)

Pennatula
Penatula grandis (three obs.) and *Penatula sp.* (five obs.) were found between 63.67°N and 71.35°N (Fig. 3) at depths ranging from 361 to 1454 m and temperatures between 0.5°C and 3.9°C. Only one record of *P. grandis* was previously known from Greenland (Kramp 1932).

Anthoptilum

Anthoptilum grandiflorum was observed in 21 hauls between 63,25°N and 74,20°N, at 361-1244 m and at temperatures between 1.4°C and 4.4°C. The species was previously known from only a 3 records off West Greenland.´(Kramp 1932).

Umbellula
Umbelulla spp. Were observed in 26 trawl hauls between 64.06°N and 75.36°N at depths between 131 and 1354 m and temperatures from 0.1 to 2.7°C. All observations except two are form the northern part of Baffin Bay at depths > 489 m except two observations at about 64°N and (131-270 m and 0.3-1.9°C) (Fig. 3). All records are *U. lindhardii* except one *O. encrinus* from 71.35°N (506 m, 2.3°C).

Scleractinia (Solitary cup coral).

One species of Scleractinia, *Flabellum alabastrum,* was identified. It was observed in 33 trawl hauls between 63. 21°N and 66. 93°N (Fig. 4) at depths ranging from 666 m to 1473 m and temperatures from 1.1°C to 4.3°C . The species is known from numerous localities off West Greenland (Kramp 1932; Tendal unpublished).

Antipatharia (Black – wire corals)

Stauropathes arctica was observed in 22 trawl hauls between 60.20°N and 65.01°N mainly around 63.40° N (Fig. 4) at depths between 188 m and 1361 m, mainly deeper than 1000 m, and temperatures ranging from 1.8°C. to 4.5°C. The species is common in certain areas off West Greenland (Kramp 1932; Tendal unpublished).

Generally there are few records from depths < 500 m (63) and these were mainly Alcyonacea. This could to some extend reflect the shorter towing time (15 min) in most of the 475 hauls at that depth, but it is also in accordance with earlier investigations (Kramp 1963).

There is only one area with relatively high densities and diversity of corals, - between 63°N and 64°N and 54°W and 56°W and depths between 1000 m and 1500 m, where Acanthogorgia, *Paramuricea, Acanella, Stasuropsathes Flabellum alabastrum* and *Anthoptilum* were sampled.

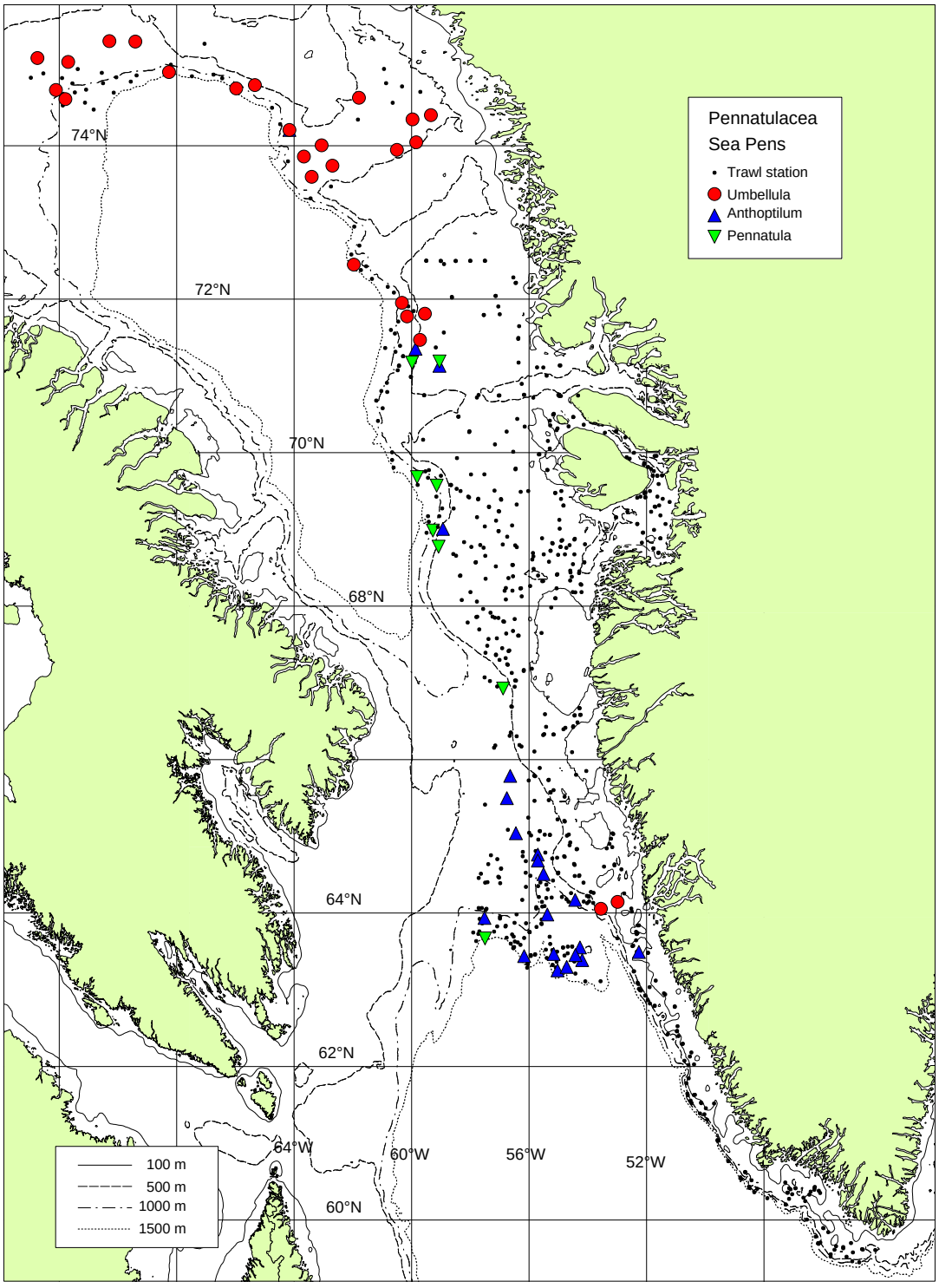

Fig. 3. Distribution of sea pens (Pennatulacea).

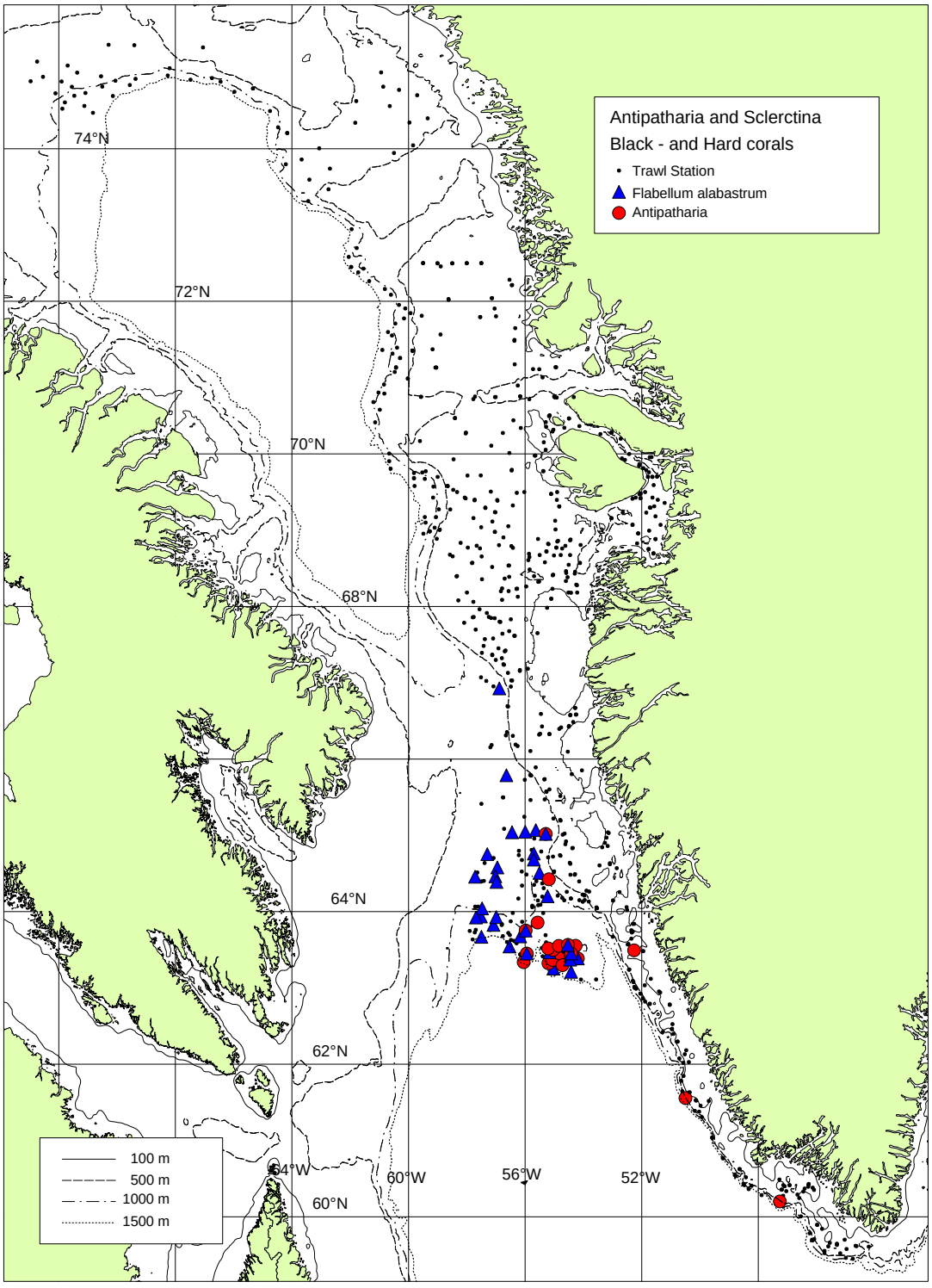

Fig. 4. Distribution of black and stony corals (Antipatharia and Sclerctinia).

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