

Mesopelagic Fishes (excluding Myctophidae) from Research Surveys off Newfoundland and Labrador*

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Abstract

Examination of incidental collections of mesopelagic fishes off Labrador and Newfoundland indicated that *Stomias boa ferox*, *Chauliodus sloani*, *Serrivomer beani* and *Bathylagus euryops* were the dominant non-mycetophid types on the continental shelf, and all were widespread in the region. *Malacosteus niger* and *Borostomias antarcticus* were prevalent eastward of the shelf but not on the shelf. Identification diagrams and distribution maps are provided for four of the most abundant species.

Introduction

Mesopelagic fishes play an important role in the ecology of the ocean. Many serve as forage for larger fishes, and they are important in energy transfer between the surface and deeper regions of the sea as a result of their vertical migrations. They have been found in the stomachs of a variety of species such as Atlantic cod (Popova, 1962; Lilly and Rice, MS 1983), tuna and swordfish (Pearcy, 1964; Scott and Tibbo, 1974), and Atlantic salmon (Lear 1972; Pethon, 1981). Although distributed primarily in deep ocean layers, mesopelagic species have been taken over the continental shelf (Halliday and Scott, 1969; Musick, 1973; Markle *et al.*, 1980).

The mesopelagic fish fauna off Labrador and Newfoundland is not well described. Backus *et al.* (1977) included these areas in the Atlantic Subarctic faunal region, based on the distribution of lanternfishes (Myctophidae), but few of his collections were made in the Labrador Sea and Newfoundland Basin. However, species assemblages in the southern part of the region have been more completely described by Zurbrigg and Scott (1972) for fish fauna near the Flemish Cap and by McKelvie (MS 1984) for fauna of the Newfoundland Basin.

Collections of mesopelagic fishes from the Newfoundland area were made during surveys by research vessels of the Northwest Atlantic Fisheries Centre (NAFC), St. John's, Newfoundland. The myctophids in these collections have been fully identified (Cram, MS 1983), but only tentative names have been assigned to most of the remaining mesopelagic fishes. The purpose of this paper is to identify the other dominant mesopelagic species taken off Labrador and Newfoundland and to indicate their local distribution patterns. The descriptions of the dominant species will allow researchers to identify the common forms at sea,

with rare specimens usually being preserved for later identification.

Materials and Methods

The collections of mesopelagic fishes, which had accumulated at NAFC (formerly Newfoundland Biological Station) during 1953-82, were from catches of research vessels during surveys directed toward the commercially-important species. No systematic attempt was made to collect mesopelagic species during these surveys, and, in most cases, relatively few of the fishes actually caught were kept. Thus, the geographical distributions, showing locations of capture of specimens, represent the minimum confirmed ranges. Information on absolute abundance is not available.

Most of the material (Table 1) was obtained from otter-trawl catches of the research vessels *Investigator II*, *A. T. Cameron* and *Gadus Atlantica* on or near the

TABLE 1. Monthly distribution of samples containing mesopelagic fishes, 1953-82, and numbers of specimens for the six species considered in this paper. (Numbers in parentheses refer to specimens taken during the special cruise in May 1981.)

Month	No. of samples	No. of specimens
January	15	70
February	13	35
March	9	28
April	14	28
May	20(10)	88(664)
June	24	87
July	45	126
August	43	164
September	48	217
October	40	148
November	44	189
December	4	11
Total	319(10)	1,191(664)

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edge of the continental shelf. All tows were standard 30-min duration on bottom. Because opening-closing devices were not used, it is not possible to ascertain the depths where the mesopelagic fishes were actually captured. These collections were augmented with 10 samples (664 specimens) from catches by the *Gadus Atlantica* in May 1981 with an Engels 80 midwater trawl which was towed in depths of approximately 500 and 1,000 m at stations on a transect at 45°N, eastward from the edge of the Grand Bank. The material from this cruise was listed by McKelvie (MS 1984).

Specimens were identified to species, measured as standard length (mm SL), or total length (mm TL) for eels, and weighed to the nearest 0.1 g. Literature sources used for the identifications included Cohen (1964) for Argentinioidea, Gibbs (1964) for Astronesthidae, Morrow (1964a, 1964b, 1964c) for Stomiidae, Chauliodontidae and Malacosteidae respectively, and Liem and Scott (1966). Specimens which are identified by others and not examined by the authors are indicated by triangles on the distribution maps. The material is curated in the museum of NAFC, St. John's, Nfld.

Results

Of the 50 species of mesopelagic fishes, which were identified by McKelvie (MS 1984) as occurring in the Newfoundland region, only four species occurred regularly in the NAFC collections, and the numbers of specimens were sufficient to illustrate their distributions. These are *Stomias boa ferox*, *Chauliodus sloani*, *Serrivomer beani* and *Bathylagus euryops*, each being representative of a different family. Two other less common deepwater species (*Malacosteus niger* and *Borostomias antarcticus*) are also illustrated, but their numbers were insufficient to warrant illustrating their distributions.

Stomiidae (Fig. 1)

These fish are long, thin and dark, with hexagonal pigment patterns in the skin which is often covered with thick transparent slime. Teeth are prominent but not large, the bottom jaw curves upward, and a barbel is present on the chin. The representative of this family off Newfoundland is *Stomias boa ferox* Reinhardt 1842, distinguished by a barbel which is approximately 50% of the head length and by six rows of hexagonal pigment patterns on each side of the body.

The 528 specimens in the collections ranged in size from 36 to 318 mm SL. The maximum size reported by Morrow (1964a) was 289 mm SL. The log-log (base 10) relationship between length (mm) and weight (g) for 279 specimens is

$$\log W = 3.35 \log SL - 6.52 \quad (r^2 = 0.92)$$

In the samples from the *Gadus Atlantica* cruise in May 1981, *S. boa ferox* was the second most important fish after the myctophid *Benthosoma glaciale* (McKelvie, MS 1984). According to Morrow (1964a), it is most abundant in the upper 300 m of the water column, and it has been found in stomachs of Atlantic cod (Lilly and Rice, MS 1983).

Stomias boa boa, with 82–88 large ventral photophores, compared with 85–91 in *S. boa ferox*, occurs in the eastern Atlantic (Morrow, 1964a).

Chauliodontidae (Fig. 2)

Similar to the stomiatids, these fish are long, thin and dark, with hexagonal pigment patterns. However, the dorsal fin is located much farther anteriorly, the lower jaw is straight, and the teeth are very large, protruding outside the mouth when it is closed. The representative of this family off Newfoundland is *Chauliodus sloani* Bloch and Schneider 1801.

The 455 specimens in the collections ranged in size from 33 to 256 mm SL. The maximum size reported by Morrow (1964b) was 278 mm SL. The log-log (base 10) relationship between length (mm) and weight (g) for 121 specimens is

$$\log W = 3.29 \log SL - 6.21 \quad (r^2 = 0.81)$$

Morrow (1964b) described the depth range of this species as 1,000–1,800 m during the day and less than 800 m at night, but some specimens in the NAFC collections were taken in depths less than 500 m during the day. This species has been identified from stomachs of Atlantic cod (Lilly and Rice, MS 1983).

Serrivomeridae (Fig. 3)

These eels are identified by the stout beak-like mouth with a row of saw-like teeth along the midline of the roof of the mouth. The species is *Serrivomer beani* Gillard Ryder 1883.

The 284 specimens in the collections ranged from 223 to 775 mm SL. According to Liem and Scott (1966), the previous Canadian record size was approximately 680 mm TL. The log-log (base 10) relationship between length (mm) and weight (g) for 50 specimens is

$$\log W = 4.38 \log TL - 10.43 \quad (r^2 = 0.81)$$

This species has been reported from depths between 250 and 800 fath (457–1,463 m) off eastern Canada (Liem and Scott, 1966). However, some of the specimens in the NAFC collections were taken in depths of 300 m or less. The species has been found in stomachs of Atlantic cod from the northern Grand Bank (Lilly and Rice, MS 1983).

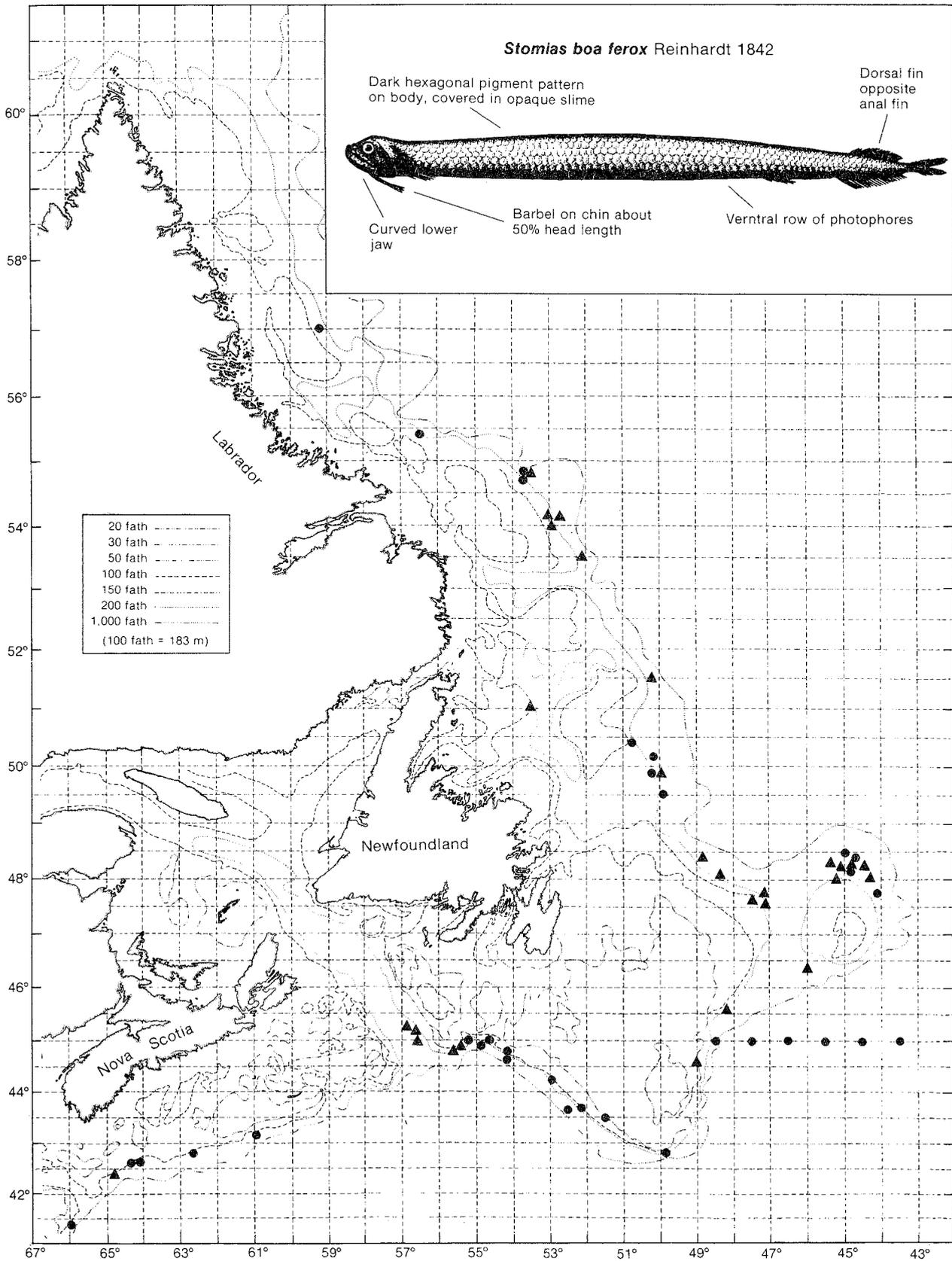


Fig. 1. Distinctive features of *Stomias boa ferox* and distribution of catch records off Newfoundland.

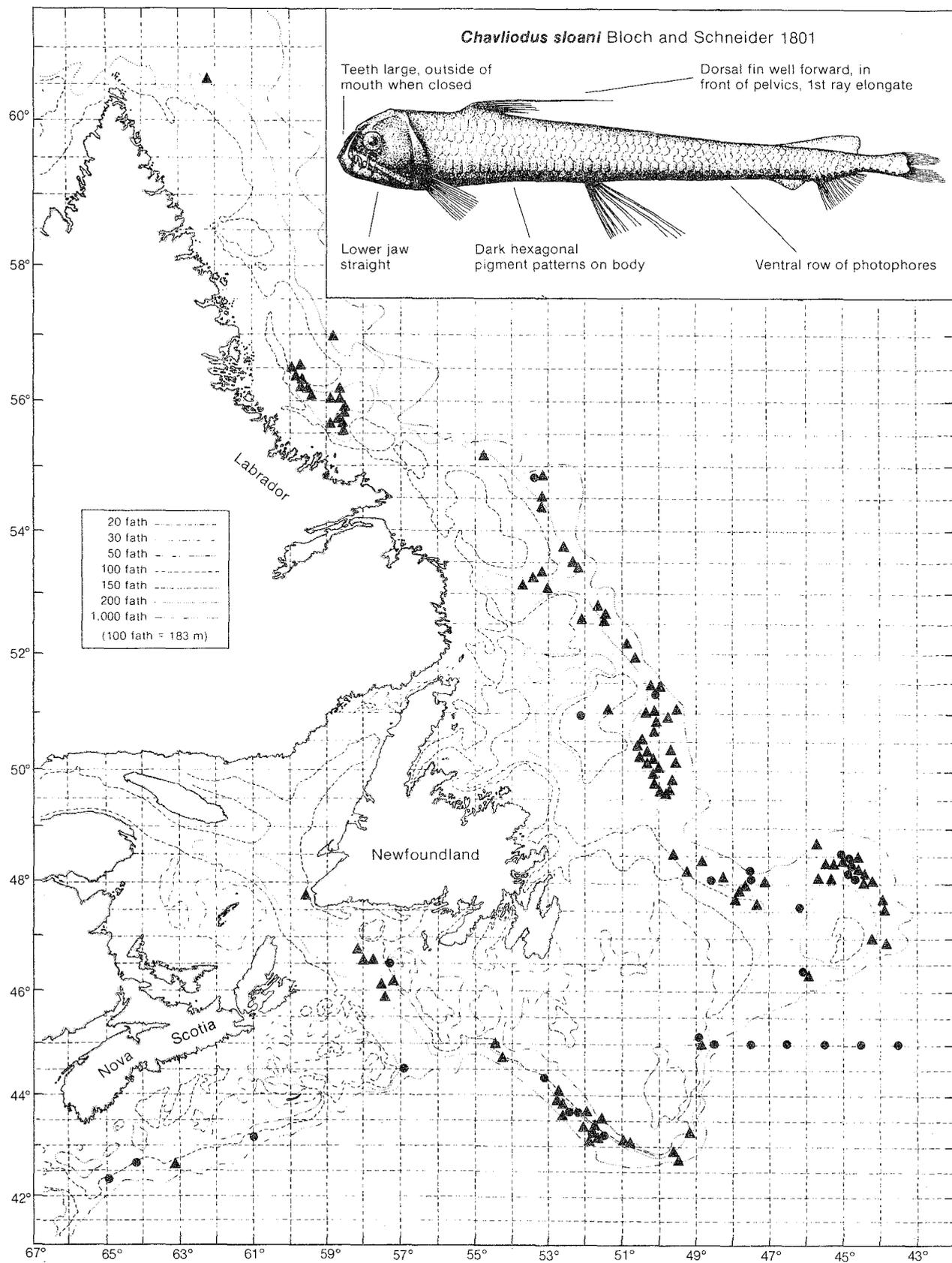


Fig. 2. Distinctive features of *Chauliodus sloani* and distribution of catch records off Newfoundland.

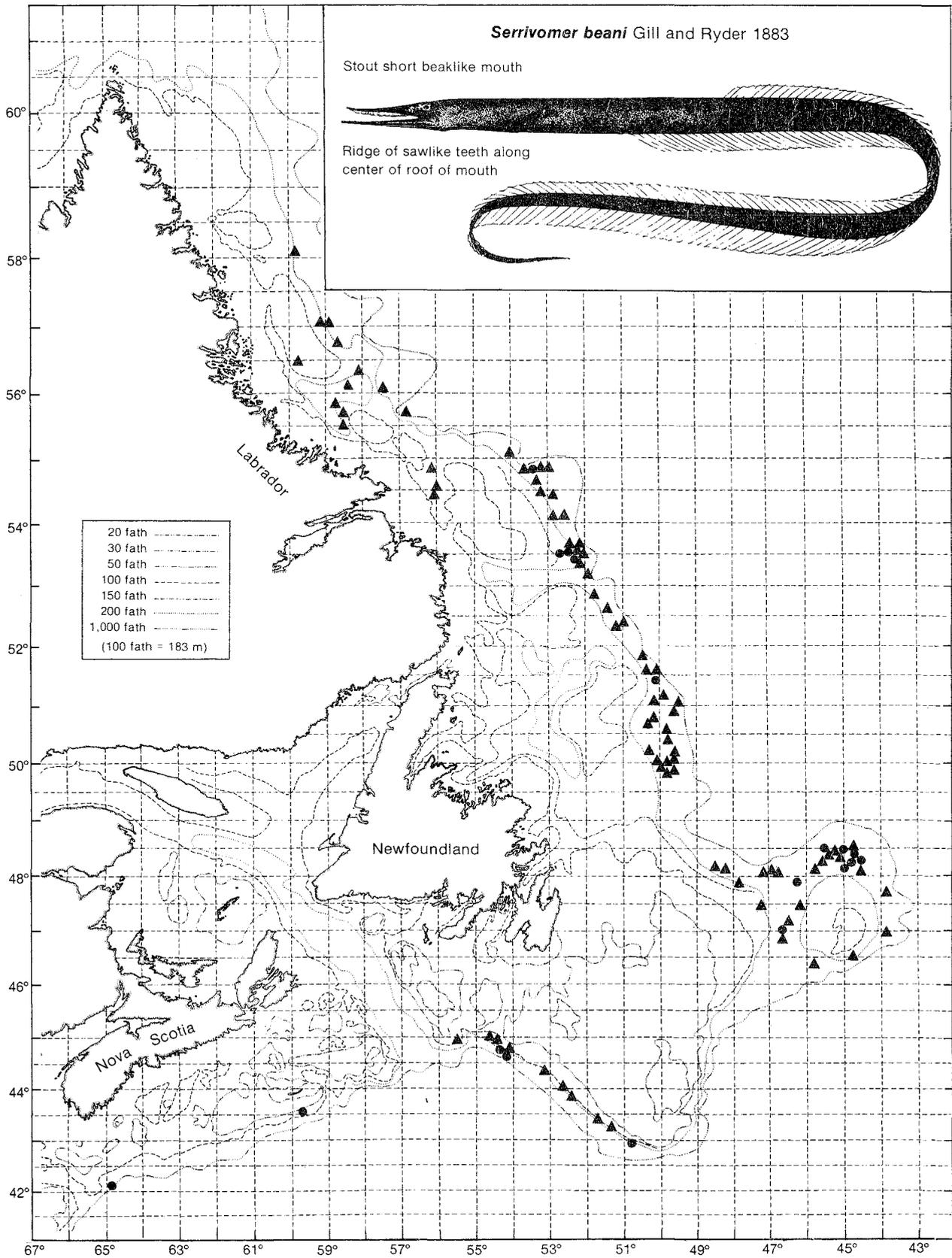


Fig. 3. Distinctive features of *Serrivomer beanii* and distribution of catch records off Newfoundland.

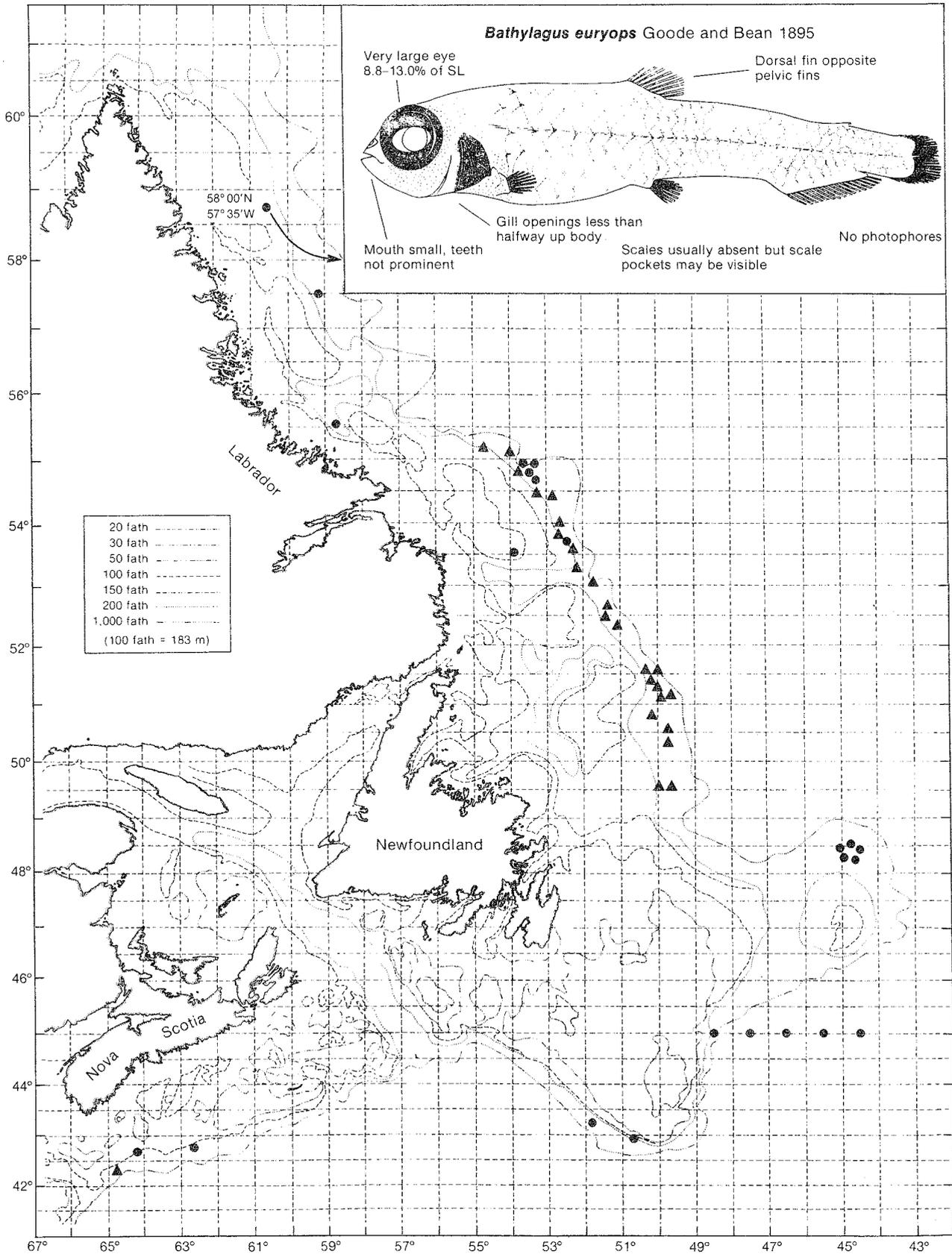


Fig. 4. Distinctive features of *Bathylagus euryops* and distribution of catch records off Newfoundland.

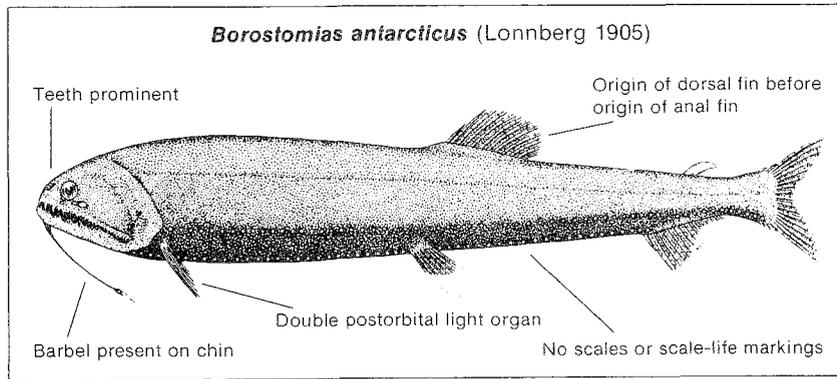


Fig. 5. Distinctive features of *Malacosteus niger*.

Serrivomer brevidentatus with 20–30 vomerine teeth, compared with 50–80 in *S. beani*, occurs in the warmer slope-water areas south of Georges Bank (Beebe and Crane, 1936; Leim and Scott, 1966).

Bathylagidae (Fig. 4)

This family is characterized by very large eyes (8.8–13.0% of SL), small mouth with no prominent teeth, opposing dorsal and anal fins, no photophores, and gill opening extending less than half way up the lateral side of the head. The body is thick, and scales are usually absent, although scale pockets may be visible. The representative of this family off Newfoundland is *Bathylagus euryops* Goode and Bean 1895.

The 559 specimens in the collections ranged from 31 to 166 mm SL. The maximum size recorded by Cohen (1964) was 158 mm. The log-log (base 10) relationship between length (mm) and weight (g) for 227 specimens is

$$\log W = 3.52 \log SL - 6.02 \quad (r^2 = 0.98)$$

Cohen (1964) suggested that two species may exist in the area, based primarily on the presence of two types of larvae. However, there are no distinguishable differences in adults, and, in his later checklist, Cohen (1973) recognized only one species (*B. euryops*) from subarctic waters. Unlike the distributions of the three preceding species of mesopelagic fishes, a greater number of *B. euryops* was captured toward the northern extent of the study area. It usually lives at depths of 500–1,500 m, but there are reports of captures at 300 m in Davis Strait (Cohen, 1964).

Bathylagus bericoides and *B. longirostris*, both with smaller eyes (<8% of SL), occur southward in warmer waters.

Malacosteidae (Fig. 5)

The representative of this family in the Newfoundland area is *Malacosteus niger* Ayres 1848. It is black in

color and is characterized by a hinged skull with no floor in the mouth, opposing dorsal and anal fins, the bases of which are black, and smooth-skinned body with no scales or scale-like markings.

The size of 20 specimens captured in the Newfoundland area ranged from 54 to 187 mm SL. The maximum size, previously recorded by Morrow (1964c), was 186 mm SL. This species was quite rare in the NAFC collections, occurring only in seven tows at depths exceeding 500 m. There are no published data on its vertical distribution, but it is unlikely that the species normally occurs on the continental shelf.

A related species, *Photostomias guernei*, with no pectoral fins, occurs to the south in warmer waters.

Astronesthidae (Fig. 6)

One species of this family, *Borostomias antarcticus* (Lonnberg 1905), occurs in the Newfoundland area. It has no scales or scale-like markings on the skin, the origin of the dorsal fin is anterior to the origin of the anal fin, teeth are prominent, a barbel on the chin, and there is a postorbital light organ.

The size of 9 specimens captured in the Newfoundland area ranged from 80 to 213 mm SL. The maximum size, previously recorded by Gibbs (1964) was 293 mm SL. This species did not occur in the NAFC collections but was found in 5 of the 10 samples from the *Gadus Atlantica* cruise in May 1981. Gibbs (1964) indicated that this species lives at depths of 350–2,500 m, the maximum being somewhat greater than the depths which yielded the NAFC collections.

Discussion

None of the mesopelagic species noted above are endemic to Newfoundland waters. All are reported to be widely distributed, with some occurring throughout the North and South Atlantic Oceans (Krefft, 1974).

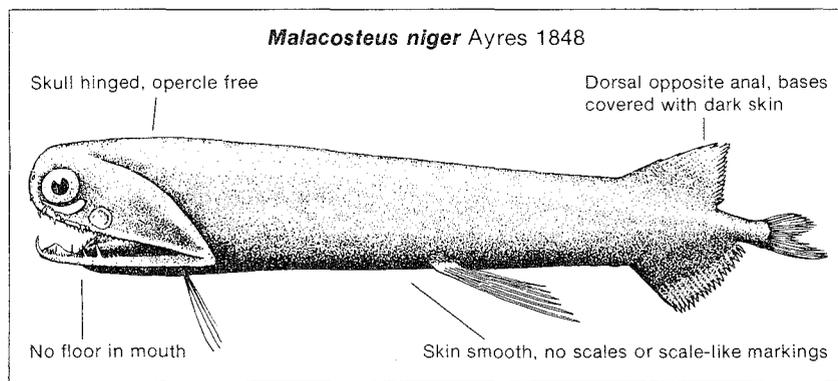


Fig. 6. Distinctive features of *Borostomias antarcticus*.

They are cold-water species, generally avoiding tropical waters, and the waters of the Labrador Current are likely to be the coldest that they inhabit. Although the literature contains isolated records of their occurrence off Newfoundland, their frequency of occurrence is unknown. The results from the present study indicate that these species are regular components of the mesopelagic fauna along the edge of the continental shelf off Labrador and Newfoundland, and most are generally present throughout the year.

Previous records of *Chauliodus sloani* indicate the northern limit to be Browns Bank (42° 37'N, 65° 55'W) on the southern part of the Scotian Shelf (Morrow, 1964b) or the northeastern part of the Grand Bank (Liem and Scott, 1966). Lilly and Rice (MS 1983) found the species in stomachs of Atlantic cod from the northern Grand Bank. The catch locations in Fig. 2 indicate a northern extension of the range to waters off Labrador. These are the first records of *C. sloani* off Labrador, and one is at 60° 33'N. This species should thus be added to the Canadian Arctic checklist of Hunter *et al.* (1984).

Two trends are evident from the catch records. There is a tendency for the fishes to be found at shallower depths toward the northern extent of their ranges. Both *Chauliodus sloani* and *Serrivomer beani* were taken in shallower depths than had been previously reported. Cohen (1964) reported a similar trend for *Bathylagus euryops*. Secondly, the maximum sizes of the species examined were approximately equal to, or greater than, the previously-recorded maximum sizes for the species.

Most of the specimens in this study were taken on or near the edge of the continental shelf. In part, this is due to the nature of the sampling. The species are considered generally to be deep-water oceanic types and not to occur over the continental shelf. However, Musick (1973) reported that some species that are usually associated with deep areas of the continental shelf

were found in the Gulf of Maine. Markle *et al.* (1980) found representatives of four deepwater families of mesopelagic fishes in extensive samples from the Scotian Shelf, but they occurred in very low numbers. These species may have been advected to the shelf by warm-core Gulf Stream eddies which are prevalent in the region (Wroblewski and Cheney, 1984). Such an agent might operate at the edge of the Grand Bank, but this mechanism cannot be invoked off Labrador.

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