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MARINE YOUNG FISH FROM THE CANADIAN
EASTERN ARCTIC

BY

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INTRODUCTION

Among the marine plankton collected by the writer at stations in the eastern arctic of Canada in the summers of 1939 and 1940 are eleven species of pelagic larvae of bottom-living fishes. Hydrographic information on the area investigated has been published (Dunbar 1942). The water concerned is typically arctic coastal water, the stations being: Hebron, in northern Labrador; Port Burwell, at cape Chidley; Lake Harbour, Frobisher bay, Pangnirtung, River Clyde, Pond inlet and Arctic bay, all in Baffin island; and Fort Ross, on Bellot strait. The bulk of the collecting was done at Lake Harbour, in southern Baffin island. All the young fish were taken in the one-metre stramin ring-trawl, towing at depths between 0 and 35 metres.

Larval fishes have not been taken before from the Baffin island waters. They are a notoriously difficult group taxonomically, and there is little doubt that many mistakes in determination have been made in the literature. Characters which are distinctive and unmistakable in the adult may not be present at all in the young, and characters which are used in identification keys for the adults may be of the opposite value in the larval fish; there are cases, for instance, where the lower jaw, included within the upper jaw in the adult, projects beyond the upper jaw in the young, and so on. Identification of the young fish, therefore, becomes a matter of the cumulative experience of workers in this field, and mistakes made in the early stages of the study are set right in the light of later work. Only complete knowledge of the life histories of the fish concerned can make the classification of the larval fish as straightforward as that of the adults. At present our knowledge of the life histories of most of the fish reported in the present paper is rudimentary. Most of the work on larval fish has been done in Europe, and is limited in scope. Nevertheless, the study of planktonic fishes is of importance both from the point of view of general plankton research, and taxonomically; for the affinity of the young is a guide to a true classification of the adults.

ACCOUNT OF THE SPECIES

Boreogadus saida Lepechin

130 specimens, from 10 to 21 mm. in length. Taken at Hebron (July 18, 1939, 2 specimens); Lake Harbour (July 31 to August 12, 1939, and July 30 to August 21, 1940, 111 specimens); Arctic bay (September 3, 1939, 16 specimens); and Fort Ross (August 30, 1939, 1 specimen).

In arctic water, where the presence of *Gadus callarias* is very rare, *Boreogadus saida* is readily identified by the steeply oblique mouth, the continuous fin right round to in front of the anus, the straight notochord with symmetrical tail fin, and in the largest specimens, by traces of the three dorsal and two anal fins. The same characters distinguish *saida* from *Gadus ogac*, which resembles *callarias* closely in the young stages. The present larvae are moreover separable from both *callarias* and *ogac* by their much slimmer form and by the characteristic pigment pattern.

General distribution: Circumpolar in arctic water; taken in numerous localities in Hudson bay and Hudson strait (Vladykov 1933).

Triglops pingeli Reinhardt. (Fig. 1)

One specimen, 28 mm. in length, taken at Lake Harbour, August 8, 1939.

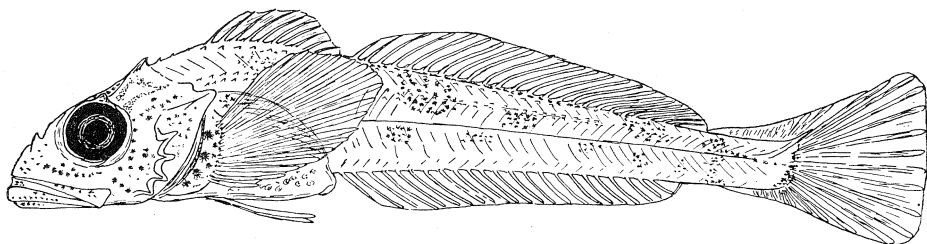


FIGURE 1. *Triglops pingeli* Reinhardt. 28mm. Lake Harbour, Baffin island, August 8, 1939.

The fin ray formula (D. X, 24; A. 23; V. I, 3; P. 19), refers this specimen to the species *pingeli*; it is not possible to determine, in an individual so small, to which subspecies it belongs. Nasal and occipital spines are present. The occipital spines are much reduced in the adult. The toothed plates along the lateral line, and the spines along the base of the dorsals are developed in the present specimen. The skin folds, characteristic of the adult *Triglops*, are not yet apparent. Vomerine teeth present; slit behind last gill arch developed.

Koefoed (1907) gives a key to the separation of three cottids which are often found together, and which present problems of identification in the larval stages. These are *Gymnocanthus tricuspis*, *Myoxocephalus scorpius*, and *Triglops pingeli*. He has figures of *T. pingeli* larvae of 13, 16.5 and 22 mm. length, to which series the present figure (fig. 1) will serve as a fourth. In Koefoed's figure of an individual 22 mm. long, the occipital spines are developed.

General distribution: Circumpolar, arctic. It is interesting that the subspecies *beani*, the Pacific form, was recorded in Hudson bay by Vladykov (1933),

not the Atlantic form *pingeli*. Gulf of St. Lawrence (Vladykov 1935). Jones sound (Jensen 1910).

Myoxocephalus scorpius groenlandicus Cuvier and Valenciennes

Altogether 514 specimens, the largest 26 mm. long. Taken at Hebron (July 18, 1939, 14 specimens); and Lake Harbour (August 8 to 10, 1939, and July 30 to August 23, 1940, 500 specimens). One 30-minute haul in Glasgow inlet, Lake Harbour, close to the mouth of the Glasgow river, yielded 432 individuals from a depth of 3 to 5 metres below the surface. The surface water was almost fresh and had a temperature of 6.7° C. There was very little else in the haul beyond a few medusae and 21 specimens of *Gymnocanthus*.

The young stages of this species are quite unmistakable. The large head with four preopercular spines, nasal spines, orbital tubercles and occipital spines all developed, and the anus approximately in the centre of the body-length, are good characters. The most typical character, which is described by Ehrenbaum (1905) and by Jensen (1909), is the rectangular patch of chromatophores on the trunk between the anus and the caudal fin. The posterior limit of this patch forms a straight line across the tail; anteriorly, the chromatophores extend somewhat dorsally towards the first dorsal fin. In the present collection, the young begin to take on the adult appearance at about 23 mm. but fin folds still persist, even in the largest specimens, joining the anal and dorsal fins to the caudal. The fin rays are complete at a body length of about 20 mm. Fin formula: D. IX-X, 16-17; A. 13; P. 18. Gill membranes are still attached, at the distal edge only, to the isthmus.

Through the courtesy of Prof. Dymond of the Royal Ontario Museum of Zoology, the writer has had the opportunity of comparing the young of *groenlandicus* with those of *Oncocottus quadricornis*, collected by T. H. Manning in western Baffin island (Manning 1942). The differences are quite distinctive even at lengths under 20 mm. The head of the young *quadricornis* is much flatter than in *groenlandicus*; the body is round, whereas it is strongly laterally compressed in *groenlandicus*; in *quadricornis* the chromatophores are much smaller, and the dorsal fins are farther apart. At lengths over 20 mm. the differences in fin ray number are also characteristic.

General distribution: In North America, known from Hudson bay, James bay and Hudson strait (Vladykov 1933), Cumberland gulf (Bean 1879), Labrador and the strait of Belle Isle (Kendall 1909, Jeffers 1932) and south to the gulf of Maine. Widely distributed in northern seas of Europe and Asia.

Gymnocanthus sp. (Fig. 2)

Taken at Hebron (July 18, 1939, 5 specimens); Lake Harbour (July 31 to August 12, 1939, 50 specimens; July 30 to August 23, 1940, 47 specimens). Total 102 specimens, varying in length from 15 to 20 mm.

Fin ray formula: D. XI (XII), (15)-16; A. 17-18; P. 19. The fins in the larger individuals in the collection have developed the full number of fin rays,

but fin folds still connect the dorsal and the anal fins with the caudal. The young of *Gymnocanthus tricuspis* Reinhardt are described by both Koefoed (1907) and Jensen (1909). Both authors have figured the species, and Koefoed gives a key to the separation of *Gymnocanthus* from *Myoxocephalus scorpius* and *Triglops pingeli*. The present specimens are in agreement with these descriptions and figures; figure 2 shows a rather larger individual than is figured by these authors, and smaller than those figured by Johansen (1912).

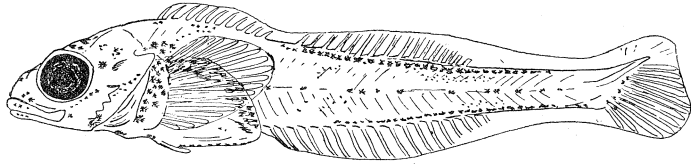


FIGURE 2. *Gymnocanthus* sp. 17.5 mm. From the Canadian Eastern Arctic.

The general form of this stage is distinctive; the head has no armament, and there is a smooth slope from occiput to snout. The snout-anus distance is about 2.5 in the body length (nearly 3 in *Triglops*, and 2 in *Myoxocephalus*). A row of small chromatophores along the mid-ventral line of the abdomen, in front of the anus, is a distinctive character of the young of this genus at this body size. The preopercular spines are well developed at a size of about 18 mm., the upper spine curved very slightly upward and without the antler-like processes present in the adult. There is a small pore behind the last gill arch, which normally disappears in the adult.

Vladykov (1933) records *G. galeatus*, a Pacific form, and two subspecies of *G. tricuspis*, from the Hudson bay region. The young stages of *G. galeatus* have not been described, and it is thought better not to attach a specific name to the present material until such time as slightly larger individuals are collected. It is possible that both species are represented in this collection.

General distribution: *Gymnocanthus tricuspis* is found in arctic seas, south to Labrador and Norway (Jordan and Evermann 1896-1900); strait of Belle Isle (Jeffers 1932); gulf of St. Lawrence (Vladykov and Tremblay 1935). *G. galeatus* is known from the Aleutians and the Pribilof islands, and from Point Barrow.

***Agonus decagonus* Bloch and Schneider**

Total of 87 specimens, length 19-21 mm. Taken at Lake Harbour only (July 31 to August 10, 1939, 74 specimens; July 30 to August 23, 1940, 13 specimens).

Fin-ray formula: D. VI, 7; A. 6; P. 16; V. I, 2; C. 11; Br. 6. Greatest breadth (at opercles) 7 in length. Tail compressed. Mouth oblique, lower jaw reaching beyond upper jaw. Traces of barbel rudiments evident on lower jaw

in some specimens, very small. Nasal and orbital spines apparent, but still small. Occipital spines in form of ridge, or comb. Snout-anus distance 2.25 in body length. First dorsal reaches from 6th to approximately the 12th scale, not yet perfectly formed. Second dorsal reaches from the 17th to the 25th scale. Anus level with the 14th scale, immediately anterior to the anal fin. Pectorals longer than head, about 4 in body length. Ventrals still rudimentary. The second dorsal fin starts posterior to the level of the front of the anal fin (exactly opposite it in the young of *A. cataphractus*). All fins connected by broad fin-fold. Body scales, with their backward pointing denticles, developed.

Chromatophores all over the body except on the lower side of the abdomen (but there is a line of colour along the mid-ventral line); broad dark bands across the tail and between dorsal and anal fins, continued partly on to the fins; radiating rows of pigment spots on the caudal fins and between the rays of the pectorals almost to the tips; the margin of the pectorals evenly brown (perhaps faded somewhat in the present collection).

A young specimen of *A. decagonus*, 48 mm. long, was described by Steenstrup and Lütken (1862), and compared with a smaller specimen on which Kröyer (1845) had formed a new species, *Aspidophorus spinosissimus*. Kröyer's specimen measured about 32 mm. in length. It was shown by Steenstrup and Lütken that Kröyer's *spinosissimus* was in fact a younger stage of *decagonus*. The present specimens from Lake Harbour conform with these two accounts, with certain divergences due to their smaller size. Thus the temporal spines are not developed, and the ventral fins are much shorter and more rudimentary than described in the above accounts. The greatest divergence is in the position of the anus. Steenstrup and Lütken showed that there is a progressive relative movement forward of the anus during the development of this species. In the adult, the anus lies at the level of the 3rd scale, at 48 mm. body-length the anus is at the 5th scale, at 32 mm. it is at the 8th scale, and in the Lake Harbour material, length 20 mm., the anus is at the 14th scale. There is a corresponding increase in the distance between the anus and the anal fin, with increasing body-size.

A specimen of *A. decagonus*, length 21 mm., is figured in Ehrenbaum (1905), after Smitt (1892).

General distribution: A specifically arctic fish, known from Newfoundland to Novaya Zemlya. Not hitherto recorded from the eastern arctic of Canada, but mentioned in Halkett's (1913) check-list. It is known from west Greenland north of the Holsteinsborg-cape Walsingham ridge and in the extreme southwest where it is no doubt carried round by the east Greenland current. A young specimen 24 mm. long was taken by the Canadian Fisheries expedition of 1914-1915 in the gulf of St. Lawrence at the surface (Dannevig 1919). For details of records see Hofsten (1919).

***Aspidophoroides olriki* Lütken. (Fig. 3)**

Taken at Hebron (July 18, 1939, 1 specimen), and at Lake Harbour (July

31 to August 12, 1939, 27 specimens; July 30 to August 23, 18 specimens). Altogether 46 specimens, 20-21 mm. in length.

Fin-ray formula: D. 5-6; A. 6; V. I, 2; P. 14-15; C. 10; Br. 6. The lack of first dorsal fin is definitive for the genus, and the large number of pectoral rays decides the species *olriki*. The mouth is oblique, the lower jaw just projecting beyond the upper (the reverse of the condition in the adult). The body is laterally compressed and hexagonal in cross-section (much more markedly so than in *Agonus decagonus*). There are four rows of spinous scales all along the body on each side, the spines longer and more striking than in *decagonus*. These spines disappear in the adult. The colour markings are also better defined than in *decagonus*; four dark brown bands across the body between the anus and the tail, and another across the base of the caudal fin. These bands extend somewhat into the fins and fin-folds, and the tips of the pectoral, dorsal and anal fins are

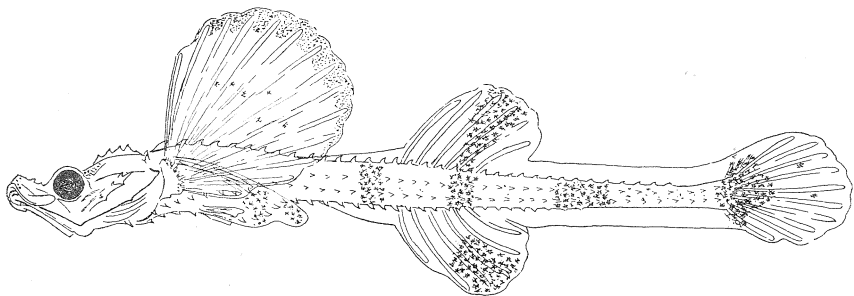


FIGURE 3. *Aspidophoroides olriki* Lütken. 20 mm. From the Canadian Eastern Arctic.

dark. There is a considerable amount of the same colour on the tip of the snout, the post-orbital and occipital region, and along the upper side of the abdomen. The dorsal and anal fins are precisely opposite each other, (the dorsal is behind the anal in *decagonus*). The snout-anus distance is about 2.5 in the body length. Fin folds persist in front of the dorsal and anal fins, and between both of them and the caudal. The eyes are large and very prominent. The isthmus is broader than in *Agonus decagonus*, the gill membranes are united and in part joined to the isthmus.

Steenstrup and Lütken (1862) describe the young of the related *A. monopterygius* Bloch, from specimens 35 and 38 mm. in length. Apart from the number of pectoral rays, their description is in general agreement with the present material (including the well-developed spine-rows along the body), but with differences due to the larger size of the specimens described, of a similar nature to those found in *decagonus*. Thus the ventrals are short in the Lake Harbour specimens, just beginning to develop; the snout-anus distance is greater in proportion to the body length in the younger individuals. In *monopterygius*, Steenstrup and Lütken find this distance to be 3 in body length in their 35-38 mm. specimens; 4 in the adult; in the Lake Harbour *olriki* specimens, 2.5. There

is a similar forward progression of the position of the anus, with growth, to that found in *decagonus*. A young specimen of *A. monopterygius* was also recorded from the gulf of St. Lawrence by Dannevig (1919); here too the author comments on the presence of the spinous scales.

General distribution: Taken in Hudson bay (Vladykov 1933). An arctic form, known from the coasts of Greenland (Jensen 1926), Barents sea, Novaya Zemlya, the Kara sea, and the coast of Alaska (Jordan and Evermann 1896-1900).

Eumicrotremus spinosus Müller

Two specimens, taken at Lake Harbour on August 3, 1939; 10.5 and 11 mm. in length.

Vladykov (1933) records *E. spinosus* and *E. derjugini* from Hudson bay, and publishes a key for the separation of the two. The development of the posterior nostrils, and the spines in four rows on each side of the body, determine the present specimens as *spinosus*. The first dorsal fin is in fact still covered with skin, a character of *derjugini*, but this may well be a juvenile trait. As for the spines on the body, Ehrenbaum (1905) writes: "Der Zeitpunkt für das Erscheinen dieser Bewaffnung ist nicht genau fixiert, so dass Exemplare von 20 mm. und darüber entweder noch mit völlig glatter oder auch schon mit stark stacheliger Haut versehen sein können." Koefoed (1907), describing material from the Spitsbergen area, comments: "Lorsque l'animal a atteint 12.5 mm. on peut constater l'apparition de diverses épines." In the Lake Harbour specimens, the spines are well developed at an even lesser length than this.

A specimen 11 mm. long is figured by Koefoed (1907); with the exception of the lack of spines in Koefoed's specimen, the figure is in agreement with the specimens from Lake Harbour.

General distribution: Hudson bay (Vladykov 1933); Devon island (Jensen 1910); gulf of St. Lawrence (Vladykov and Tremblay 1935); north Atlantic and Arctic oceans.

Liparis fabricii Krøyer. (Syn: *Cyclogaster fabricii* Krøyer, *Liparis major* Gill).

Taken at Hebron (July 18, 1939, 4 specimens); and at Lake Harbour (July 31 to August 12, 1939, 189 specimens; July 30 to August 23, 1940, 43 specimens). Altogether 236 specimens, 12 to 31 mm. in length.

Liparis liparis L. and *L. fabricii* were united to one species by Smitt (1892), with Lönnberg (1899), Knipowitsch (1901), Collett (1902) and Hofsten (1919) in agreement. Jensen (1909) keeps them separate; so do Ehrenbaum (1905), Jordan and Evermann (1896-1900) and Johansen (1912). There appear to be weighty differences between the two according to Jordan and Evermann. The number of vertebrae is considerably greater in *fabricii*, and the gill openings are larger. *E. fabricii* is "a more genuine arctic fish than *L. liparis*" (Jensen 1909).

Vladykov (1933) records *L. cyclostigma* Gilbert from Hudson bay, a form known from the Bering sea. The present specimens differ from *cyclostigma* in

the position of the pectoral fin, the number of pectoral rays (35-37, as against 38-42 in *cyclostigma*), the vertebral number (44-50, according to state of development, as against 46 in the adult *cyclostigma*), the presence of tubes on the nostrils (none in *cyclostigma*).

Fin-ray formula of the larger specimens (over 18 mm. long): D. 42-46; A. 35-39; P. 35-37. Vertebrae up to 50; in most of the specimens the posterior vertebrae are very indistinct.

The colour has faded from most of the specimens, but one large (31 mm.) individual has chromatophores scattered along the body, a darker stripe along the base of the dorsal fin. Chromatophores evenly distributed over the abdomen and cheeks; concentrated along the upper edge of the abdomen and on the top of the head. The pectorals dotted with radiating rows of chromatophores. The skin is quite loose in individuals over 20 mm. long, and has patches of dark brown in the region of the dorsal and anal fins. Good figures of young individuals of *Liparis fabricii* are published by Johansen (1912).

General distribution: *Liparis fabricii* was taken by the Second Norwegian Arctic Expedition in Goose fjord, off Jones sound (Jensen 1910), and by the Canadian Fisheries Expedition in the gulf of St. Lawrence (Dannevig 1919). An arctic water fish, known from Greenland to the White sea (Jordan and Evermann 1896-1900).

Lumpenus lampetraeformis Walbaum. (Fig. 4)

Two specimens, taken at Hebron on July 18, 1939, measuring 23 and 26 mm.

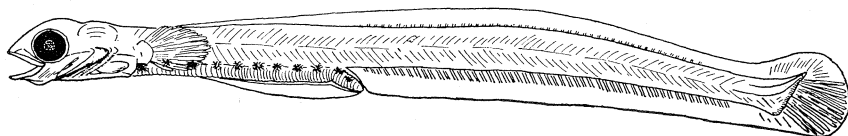


FIGURE 4. *Lumpenus lampetraeformis* Walbaum. 26 mm. From Hebron, northern Labrador.

The anal rays in these two specimens are 48 and 51 respectively; the dorsal spines are still very rudimentary and scarcely visible, the ventral fins still very small, with no rays visible. The species is easily recognizable by the number of anal fin-rays and the position of the anus, well in front of the middle of the body.

Vladykov (1935) has described two new subspecies of *L. lampetraeformis*, making three in all: *L. l. lampetraeformis*, the European form (Norway-Greenland), with 49-52 anal rays; *L. l. americanus*, from the gulf of St. Lawrence, with 52-56 anal rays; and *L. l. terrae-novae*, from Newfoundland, with 62 anal rays. The present specimens from the Labrador apparently belong to one of the first two, probably the European form, *L. l. lampetraeformis*.

General distribution: Reported before from northern Labrador (Kendall 1909). North Atlantic and Arctic on both sides, south to cape Cod, Scotland, the North sea, and the Baltic (Hofsten 1919). Gulf of St. Lawrence (Vladykov and Tremblay 1935).

***Stichaeus punctatus* (?) Fabricius. (Fig. 5)**

Taken at Hebron (July 18, 1939, 1 specimen); and at Lake Harbour (August 2 to 12, 1939, 63 specimens; July 30 to August 23, 1940, 90 specimens). Altogether 154 specimens, 15 to 22 mm. long.

The correctness of this determination is in doubt. Dannevig (1919) records two specimens of this species from the gulf of St. Lawrence. The Lake Harbour specimens, measuring about 20 mm., are in close agreement with Dannevig's figure of an individual 30 mm. in length. On the other hand, both the present specimens and Dannevig's *punctatus* are in agreement with the description of the young of *Lumpenus medius* Reinhardt given by Ehrenbaum (1905). It is therefore considered best to query this determination until the collection of material from which the early stages of *Stichaeus* and *Lumpenus* can be worked out fully. *Stichaeus punctatus* and *Lumpenus medius* have both been recorded from Hudson bay by Vladykov (1933).

The exact determination is rendered impossible by the lack of development of the dorsal fin spines. The maxilla reaches beyond the front of the eye, but not beyond the middle of the eye; this is the condition in the adult *punctatus*. The head is 6.5 in the body length. The adult *punctatus* has 4.5 in body, Dannevig's figure 6.5 in body. The adult *medius* head is 5-6 in the body length; *maculatus* about the same. The anal rays vary between 35 and 38, averaging 36, and have

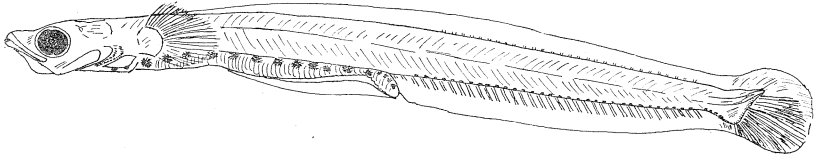


FIGURE 5. *Stichaeus punctatus* (?) Fabricius. 21 mm. From the Canadian Eastern Arctic.

the appearance of having reached the adult number. The anal ray number in *punctatus*, according to Jordan and Evermann, is 32 and 35, but 36 to 38 in Vladykov's specimens from Hudson bay. Dannevig's figure has 38. Anal rays in *maculatus* are 35 to 38 according to Jordan and Evermann, in *medius* 42. But Ehrenbaum gives 38-40 anal rays as the figure for *medius*. It will be seen that there is considerable variation in the character, possibly some confusion in the literature. The pigmentation in the Lake Harbour material, and in Dannevig's figure, corresponds to the description of the young specimen ascribed to *medius* by Ehrenbaum.

The specimens have been referred tentatively to *Stichaeus punctatus*, but neither *Lumpenus medius* nor *L. maculatus* can be excluded on present knowledge; all three are known from arctic waters.

General distribution: *Stichaeus punctatus* is an arctic fish, known from Hudson bay west to Alaska and east to Siberia, south to Bristol bay and Newfoundland (Vladykov 1933, Jordan and Evermann 1896-1900).

Chirolophis ?galerita Walbaum

Taken at Lake Harbour only; 7 specimens, 12-14 mm. long.

Chirolophis was taken in large numbers in the gulf of St. Lawrence by the Canadian Fisheries Expedition, and is figured by Dannevig (1919). *C. galerita* is not known from the North American coasts, but is present in arctic water north of western Europe.

CONCLUSION

A detailed statement of the known distribution of almost all the species described here, with the exception of the most recent records, is given by Hofsten

All of the present collection are arctic or arctic-boreal forms, many of them circumpolar in occurrence. Of the eleven species, only one (*Agonus decagonus*) is new for the eastern arctic of Canada as such; as pelagic young fish, and members of the plankton, they are all new.

A remarkable absentee from the collection is the common four-spined sculpin, *Oncocottus quadricornis* Linnaeus. This species is included in Mr. Soper's collection from southern Baffin island (Halkett 1928) under the specific name *hexacornis*. It is recorded from James bay, Hudson bay and Hudson strait (Vladykov 1933), and from Fox basin (Manning 1942), but it was not found by Bean (1879) from Cumberland gulf, nor by the second Norwegian arctic expedition in the Lancaster sound area. Johansen (1912) reports that it is much commoner in northeast Greenland than farther south on that coast, and according to Jensen (1928) it is known in west Greenland only in the north, in Baffin bay. There is no information on the relative abundance of *quadricornis* and *groenlandicus* in Baffin bay. In east Greenland south of 69° N., and in west Greenland up to Baffin bay, the ecological place of *quadricornis* is taken by *Myoxocephalus groenlandicus*. *Quadricornis* is essentially an arctic fish, but since it is known that *groenlandicus* supplants it in part of arctic east Greenland, it is not improbable that it dominates also on the west side of its centre of Greenland distribution (west Greenland), extending to Hudson strait. As is shown here, there are indications that Hudson strait is the transition zone between the dominance of the two species, *quadricornis* to the west and *groenlandicus* to the east. Only more extensive work in eastern Baffin island can settle this point.

In the present collection, the only species taken in northern Baffin island was *Gadus saida*. The absence of the others may be due to the fact that collecting at the northern stations was done later in the season (in September) when the young fish may have left the plankton and sought the inshore bottom.

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