

OBSERVATIONS ON THE DISTRIBUTION AND ECOLOGY OF SOME ARCTIC FISH

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Introduction

Information on the biology of fish in the Canadian Arctic has been scarce until quite recently. Since 1950, however, field parties of the Fisheries Research Board of Canada, the Arctic Institute of North America, and a number of universities have added considerably to our knowledge. As a member of two such parties during 1953 and from 1954 to 1955, I was able to collect and observe fish in a series of localities extending from Coppermine in the west to Frobisher Bay in the east (see Fig. 1). As I cannot now extend the data obtained, they are summarised here to add to the available knowledge about the distribution, ecology, and biology generally of arctic fish.

Some comments on taxonomy are included, especially where specific identification was difficult or impossible. The systematic arrangement and nomenclature follows Bailey *et al.* (1960). Specimens have been deposited in the museum of the Institute of Fisheries, University of British Columbia, Vancouver.

In 1953 fish were collected between June and September at several stations along the east coast of Baffin Island. A description of the expedition, a station list, and maps are included in Ellis (1955).

From May 8 to August 2, 1954, many specimens and notes were obtained at Coppermine. Specimens and notes were also gathered at Bathurst Inlet on August 4, at Cambridge Bay between August 4 and 22, at Spence Bay between August 26 and September 7, and at Arctic Bay from September 7 onwards. I travelled and collected with Eskimos near Arctic Bay until April 1955 and at Pond Inlet from May 1 until August 5.

The most recent comprehensive report on Canadian arctic fish (Walters 1955) includes data from the Coppermine and Bathurst Inlet regions, and a history of relevant collections in the western Canadian Arctic. This has been extended by Backus (1957) to Labrador. Dunbar and Hildebrand

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(1952) report on fish collections in Ungava Bay and give a historical account of previous collections in the region. Power and Oliver (1961) and Harper (1962) refer to fish in the Ungava Peninsula. Hanson, Queneau and Scott (1956) have listed fish they caught in the Perry River area. Intensive biological studies on particular species have been published in recent years by Grainger (1953) on arctic char, and Power (1959 and 1961) on Atlantic salmon. Recent Annual Reports of the Fisheries Research Board of Canada have summarised arctic fish collections made each preceding year.

Environmental conditions

These collections extend through several marine zoo-geographical regions, the characteristics of which have been reviewed by Dunbar (1958, 1953, and 1951) and Ekman (1954). Other recent oceanographic data on particular areas are given by Grainger (1959), Bailey (1957) and Ellis (1956).

Much of this paper is concerned with fish in the lower Coppermine River and its delta. Physical observations of this river in 1954 can be used as indications of conditions in the larger rivers draining the northern Canadian mainland.

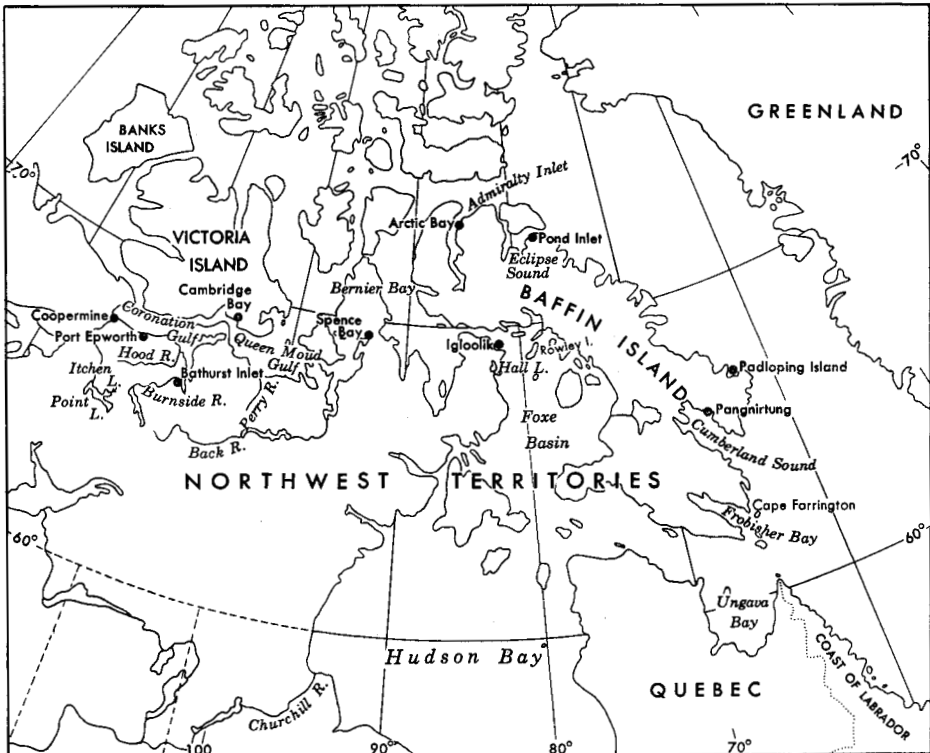


Fig. 1. Map of the Canadian Arctic showing localities mentioned in the text.

The land and streams around Coppermine were frozen in 1954 until May 29, when the main thaw started. Streams began to run soon after. Surface ice on the Coppermine River began to break and move downstream in early June, and finally cleared by June 19. The river immediately began to warm rapidly, especially where flowing slowly over shallow sand flats. Temperatures of up to 13° C. were recorded on June 29, and 18° C. on July 18 after several clear, hot days. Afterwards temperatures dropped rapidly. These changes appeared to affect fish movements (see p. 183).

Sea-ice remained off the delta in June, but was rapidly eroded by the warm river water until a wide lead extended out to sea. Shore leads quickly opened up and connected with those from neighbouring rivers. Finally the sea-ice broke extensively in the middle of July, began to drift with the currents and permitted a freighter to reach Coppermine on July 31.

Some freshwater specimens will be described here. In general, small rivers and streams are frozen completely during winter, often from September to June or even longer. Large rivers have a surface crust of ice, and a reduced flow, if any, below. Lakes also have an ice cover, with water from 0° to 4° C. underneath. Summer conditions in streams, lakes, and rivers are highly variable.

Methods and materials

Cambridge Bay, Spence Bay, Arctic Bay, and Pond Inlet

Gill-nets were operated in lakes, estuaries and in the sea. Fish were also taken in hand-nets, plankton and benthos hauls.

Southeastern Baffin Island

Specimens were obtained by dredge in shallow water (0 to 5 m.), by hand-net in tidal pools, and by collecting carcasses on shore.

Coppermine

Many specimens were obtained by gill-nets in the channel of the river delta by the village. Although the results were not quantitative, they indicate the movements of some species in and out of the estuary. Other species were obtained by hand-nets from freshwater pools and streams. Some were taken in plankton and dredge hauls off shore.

The Eskimo fishery in the Coppermine River during 1954

The Eskimos living near the Coppermine River operate an intensive summer fishery in the delta, among the offshore islands and in some deep pools below Bloody Falls about 12 miles inland.

In the spring of 1954 the first fish (arctic char) were taken by Eskimos setting gill-nets through cracks in the river ice, the first record obtained was June 5. Fishing was intermittent until the river cleared completely

on June 19, but was carried out intensively from then on. As the river warmed and the sea-ice melted around the delta fishing became more profitable near the islands off shore. A variety of species, both marine and fresh-water were then caught (see Fig. 2). Between June 29 and July 27

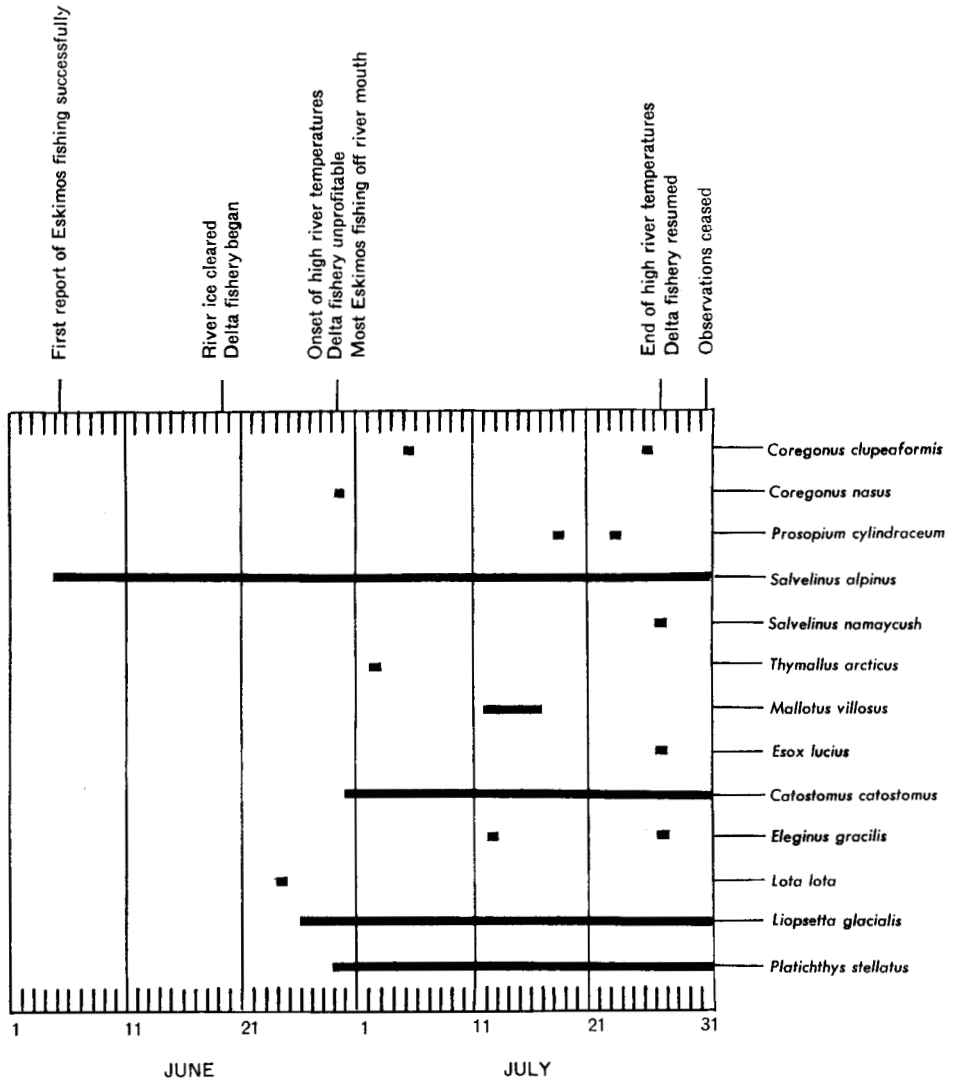


Fig. 2. The presence of various species in the Eskimo fishery at the Coppermine River is shown in this diagram. The fishery catches principally arctic char, *Salvelinus alpinus*, longnose sucker, *Catostomus catostomus*, arctic flounder, *Liopsetta glacialis*, starry flounder, *Platichthys stellatus*, and at least two species of whitefish, whose importance in the fishery is considerably greater than suggested by the diagram (see p. 183).

water temperatures in the delta reached about 10° C. and remained at that figure, attaining a maximum of 18° C. on July 18. Few fish were caught in the delta during this warm period. At the end of July the fishery again became profitable in the delta, coinciding with a drop in water temperature.

The periods during which different species were caught are shown in Fig. 2. Arctic char, *Salvelinus alpinus*, longnose sucker, *Catostomus catostomus*, arctic flounder, *Liopsetta glacialis*, and starry flounder, *Platichthys stellatus*, occurred regularly throughout the period of observations, also at least two of the three species of whitefish, which were not specifically identified during the field work. Whitefish data in Fig. 2 are based on the few collected specimens only. All three species probably occur regularly in the Coppermine River fishery, and possibly others also in view of the number of species recorded by Walters (1955) along Canada's northern mainland coast.

The other species shown in Fig. 2 occurred only intermittently in the catches. Saffron cod, *Eleginus gracilis*, and capelin, *Mallotus villosus*, were abundant for short periods, whereas the lake trout, *Salvelinus namaycush*, northern pike, *Esox lucius*, and burbot, *Lota lota*, were caught only as solitary specimens. Arctic grayling, *Thymallus arcticus*, may also occur in the fishery. The record in Fig. 2 is based on a collection of three young specimens.

Annotated list of species

Cisco, *Coregonus artedii* Le Sueur

1 specimen, fall of 1954, at Bernier Bay, Baffin Island, obtained from an Eskimo trading into Arctic Bay.

This is the northernmost record for a coregonid fish in the Canadian Arctic substantiated by a preserved specimen. Arctic records for this species are so rare that Bernier Bay is probably near the northern limit of its distribution.

A closely related, if not conspecific fish, *C. sardinella* (Walters 1955), has been reported from slightly higher latitudes on the north coast of Banks Island.

Lake whitefish, *Coregonus clupeaformis* (Mitchill)

1 specimen, July 5, 1954, at Coppermine, gill-netted in delta,

1 specimen, July 26, 1954, at Coppermine, gill-netted in delta.

The stomach of the July 5 specimen contained a variety of marine invertebrates, including gastropods, amphipods, and pelecypods. The stomach of the other specimen contained sand, fish eggs, and decomposed small fish, possibly capelin (see p. 185). Presumably, both fish had entered the delta from the sea shortly before being netted.

Broad whitefish, *Coregonus nasus* (Pallas)

1 specimen, June 29, 1954, Coppermine, gill-netted in delta.

Specimens of this species, also of *C. clupeaformis*, and of *Prosopium cylindraceum*, none of which were specifically identified in the field, were all taken in the Eskimo fishery on the Coppermine River, both before and after the warm period in July.

The following quotation from a letter to me by the Venerable J. H. Webster, for many years Anglican missionary at Coppermine, shows that the large whitefish may be

very abundant: "the greater number of these fish go upstream just at freeze-up time to spawn and they are full of roe. Much heavier than the char. I do not know where they spawn but thousands of them are obtained in Itchen's Lake. They go up the small river which flows from the Itchen's Lake to the Coppermine River near to Red Rock Lake. None of these fish has been found in Red Rock or Point Lakes. They seem to be peculiar to Itchen's Lake. They seem to come back after freeze-up until about January. Their return is slow. In the fall just at freeze-up time they go upstream in thousands."

Round whitefish, *Prosopium cylindraceum* (Pallas)

1 juv. specimen, July 18, 1954, Coppermine, in delta.
1 specimen, July 23, 1954, Coppermine, gill-netted in delta.

See remarks under *Coregonus nasus*.

Juvenile Coregonidae

39 specimens, June 10 to July 17, 1954, Coppermine, in streams draining into Coppermine River.

1 specimen, July 27, 1954, Coppermine, in river delta.

Juvenile salmonidae were common in shallow fresh water around Coppermine, at the edges of the main river, in backwaters and pools on the flood-plain, and in tributary streams. They appeared to include arctic char, grayling, and a variety of coregonids.

The first collection was a *Coregonus* or *Prosopium*, eggs of which had hatched in early June. The other specimen collected appeared to be either a juvenile *C. nasus* or a *C. clupeiiformis*.

Arctic char, *Salvelinus alpinus* (L.)

Head of one specimen, June 29, 1954, Coppermine, gill-netted in delta.

2 juveniles, July 2, 1954, Coppermine, stream draining into Coppermine River.

13 juveniles, July 14, 1954, Port Epworth, shallow tidal water.

1 juvenile, fall 1954, Admiralty Inlet, from stomach of larger char obtained from an Eskimo.

Heads of 6 specimens, fall 1954, Admiralty Inlet, lake, reported by Eskimos to be land-locked.

1 juvenile, July 14, 1955, Eclipse Sound, 1 m. W of Pond Inlet; shallow tidal water near river mouth.

7 juveniles, July 18, 1955, Eclipse Sound; 1 m. W of Pond Inlet, shallow tidal water near river mouth.

The data on arctic char are being prepared as a separate publication.

Lake trout, *Salvelinus namaycush* (Walbaum)

1 specimen, July 27, 1954, Coppermine, gill-netted in delta.

The stomach of the single specimen examined contained small fish, apparently capelin, suggesting that the trout had gone out from the delta into salt or at least brackish water (see p. 185 on capelin).

At Spence Bay, on September 3, 1954, I saw two lake trout that had been netted in a river draining Lake Netchilik, a few miles to the south, during the char fishery. This species was well-known in that region.

On November 11, 1954, an Eskimo at Arctic Bay reported that sometime during the fall he had taken a fish as large as a seal from a lake near Bernier Bay on western Baffin Island. A freshwater fish of this size in the archipelago is most likely to be a lake trout; and the report adds one more piece of evidence to support the possibility that this species occurs in Baffin Island (Manning 1942).

Between December 1954 and February 1955, when I was travelling around the Eskimo camps of Admiralty Inlet and Foxe Basin, I was told repeatedly that large, rapacious fish occur in Hall Lake and the larger lakes of the nearby Crozier River. These are likely to be either lake trout or pike.

Arctic grayling, *Thymallus arcticus* (Richardson)

3 juveniles, July 2, 1954, Coppermine, stream flowing into Coppermine River.

Two of these specimens were taken from a stream flowing over the Coppermine River floodplain and joining the river about half a mile south of the village. The other specimen was taken from a school of small fish at the junction of this stream and the river.

The two smallest specimens bear parr marks.

Capelin, *Mallotus villosus* (Müller)

9 specimens, July 13, 1954, Coppermine, from stomachs of arctic char netted in the delta.
1 specimen, July 16, 1954, Coppermine, on beach west of village.

Capelin were first seen on July 12 in the stomachs of saffron cod found floating dead in the Coppermine River delta (see p. 186). The next day nine mature females were taken almost undigested from the stomach of a char netted in the delta. On July 15 the Eskimos gathered bucket-loads of spawning capelin off the nearby beaches. A single male was collected the next day.

In southern regions capelin tend to spawn on shore at night. This is not possible at Coppermine in July, as there are then 24 hours of daylight.

After the mass-spawning period capelin were taken from the stomachs of a variety of predatory fish until at least July 27. These included arctic char, saffron cod, and starry flounder.

The surface water temperatures during the spawning period varied from about 15°C. in the delta to 13°C. among the offshore islands. Salinities were low near Coppermine village. The capelin spawned in brackish water away from the immediate vicinity of the river mouth. Although they spawned in unusually warm and low-saline water, they may not have been subjected to these conditions for long, as they could have approached the shore in the cooler and more salty water that characteristically underlies arctic river outflows.

Lengths of collected specimens were as follows: male 14.2 cm.; females 13.5, 15.0, 13.0, 11.5, 12.5, 11.8, 12.0, 13.5, 13.0 cm.; mean 12.9 cm. These are greater than lengths quoted by Schultz (1937) for the Pacific capelin, *Mallotus catervarius* (Pennant). Schultz gives a formula for determining a character index as an aid to identifying single capelins. This index has a value of 35 for the July 16 specimen (the only complete one), indicating again that the Coppermine specimens cannot be *M. catervarius*. Walters (1955) notes that *M. catervarius* and *M. villosus* may be distinct subspecies rather than species, and also mentions that more than one race of capelin may exist in any area.

Northern pike, *Esox lucius* L.

1 specimen, July 27, 1954, Coppermine, gill-netted in river delta.

The Rev. J. Sperry, Anglican missionary at Coppermine in 1954, reported that he occasionally caught pike in the delta.

Previous writers put the northern range of the pike as the mainland coast of Labrador and Quebec, the Churchill River, and the mainland coast west of Burnside River. It was therefore interesting to find that Eskimos in the Igloodik area recognized photographs of pike. They stated that similar fish live in Hall Lake and the lakes of other nearby rivers. It is therefore possible that pike occur north to the mainland coast throughout arctic Canada.

Longnose sucker, *Catostomus catostomus* (Forster)

1 specimen, June 30, 1954, Coppermine, gill-netted in the delta.

Longnose suckers were taken regularly in the Coppermine fishery from the end of June throughout July. It was the one species caught regularly in the delta during the warm period in July when catches generally declined (see p. 183).

The stomachs of three specimens were examined. All were packed with mud and unidentifiable detritus.

Arctic cod, *Boreogadus saida* (Lepechin)

- 1 specimen, July 5, 1953, Frobisher Bay, dead on shore.
- 1 specimen, July 6, 1953, Frobisher Bay, dead on shore.
- 5 specimens, June 28, 1955, Eclipse Sound, from stomach of arctic char.
- 8 specimens, June 30, 1955, Eclipse Sound, from stomach of arctic char.

The two Frobisher Bay specimens had probably stranded on the shore, alive or dead, during the preceding high water.

Between June 28 and July 14, 1955 the stomachs of 46 arctic char, gill-netted in Eclipse Sound around the mouth of the Salmon River were examined; 20 of them contained small cod, which in the two collections made were identified as this species. The remainder were presumably the same, which were therefore sufficiently abundant off the mouth of the Salmon River to permit extensive foraging by the hundreds of char there at that time.

Saffron cod, *Eleginus gracilis* (Tilesius)

- 5 specimens, July 12, 1954, Coppermine, floating dead in river delta.

Five small specimens, all female, were picked up with 60 others, not preserved, as they floated dead in the channel of the Coppermine River delta by the village. Their size ranged from 17.1 to 40.4 cm., the mean of 65 specimens being 23.4 cm. Four of the largest specimens had the remains of capelin in their stomachs. A school of cod had presumably been feeding on capelin, which were then offshore (*see* page 185); part or all of this school had been killed in some way, possibly through the shock of entering warm river water (18°C. on July 18), had floated to the surface and drifted up to the village with the strong northwest wind then blowing.

The species must have remained in the vicinity of Coppermine for some time as another large individual was gill-netted in the delta on July 27.

Greenland cod, *Gadus ogac* (Richardson)

- No specimens collected.

I first saw rock cod at Padloping Island on August 13, 1953, when sports fishermen using spoons took about twelve offshore. The locality was well-known as a good fishing spot, and there is presumably a local population of cod there.

The next specimen seen was a decaying corpse on the beach west of Coppermine on July 16, 1954. On August 6, 1954 I saw six large cod (about 60 cm.) swimming in Cambridge Bay near the surface, and the next day examined one gill-netted at the head of the bay. Four specimens netted in Spence Bay on August 27, 1954 were also examined. They had been feeding on small fish and isopods.

There is necessarily some doubt about the identity of these fish as none were brought back to the laboratory for identification. They are referred to this species in view of their large size. It is conceivable, although unlikely, that the Padloping Island stock could be Atlantic cod, *Gadus calliarus*.

According to Eskimo reports large cod occur in scattered, locally abundant populations throughout the Coronation Gulf-Spence Bay Region.

Burbot, *Lota lota* (L.)

- 1 specimen, June 24, 1954, Coppermine, gill-netted in delta.

Burbots are taken occasionally in the Coppermine River fishery. The specimen collected had an empty stomach.

Rat-tail, *Coryphaenoides rupestris* Gunner

- 1 specimen, June 13, 1955, Eclipse Sound, on ice beside seal hole, partly eaten.

This identification is necessarily tentative due to the specimen's condition. Neither this species nor the closely related genus *Macrourus* have been previously recorded from the Canadian Arctic Archipelago. The Eskimos apparently did not know this fish, which is probably either a deep-water form or a stray. It evidently can serve as food for the ringed seal, *Phoca hispida*.

Ninespine stickleback, *Pungitius pungitius* (L.)

- 4 specimens, July 2, 1954, Coppermine, in a stream.
- 1 specimen, July 3, 1954, Coppermine, outflow from tidal pool in delta.
- 2 specimens, August 4, 1954, Bathurst Inlet, shallows of Burnside River.
- 1 specimen, August 16, 1954, Cambridge Bay, in a stream.

Sticklebacks were first seen on July 2, 1954 in a stream south of Coppermine. Four were collected and kept alive in aquaria by feeding with whitefish fry. Sticklebacks were seen frequently in shallow streams and pools near Coppermine, Bathurst Inlet, Cambridge Bay, Spence Bay, and Pond Inlet.

The northern limit of this species is still uncertain, but it is so ubiquitous wherever it has been looked for in the Arctic Archipelago that it may well be found wherever there is unfrozen fresh water all year.

Arctic staghorn sculpin, *Gymnocanthus tricuspis* (Reinhardt)

- 1 specimen, June 19, 1953, Frobisher Bay, dredge haul from 5 m.
- 1 specimen, June 28, 1953, Frobisher Bay, dredge haul from 5 m.
- 2 specimens, July 4, 1953, Frobisher Bay, dredge haul from 5 m.
- 1 specimen, September 18, 1953, Padloping Island, dredge haul from 5 m.
- 1 specimen, November 26, 1954, Arctic Bay, grab haul from 7 m.

This species was collected along the east and north coasts of Baffin Island in shallow water.

Twohorn sculpin, *Icelus bicornis* (Reinhardt)

- 1 specimen, July 25, 1955, Eclipse Sound, grab haul from 9.5 m. off river mouth.

One specimen only taken in shallow water in northern Baffin Island.

Fourhorn sculpin, *Myoxocephalus quadricornis* (L.)

- 2 specimens, July 2, 1954, Coppermine, delta channel (fresh water).
- 2 specimens, August 6, 1954, Cambridge Bay, mouth of small stream.
- 1 specimen, July 11, 1955, Eclipse Sound, mouth of Salmon River.
- 2 specimens, July 18, 1955, Eclipse Sound, mouth of Salmon River.

Sculpins were seen at almost every collecting station in shallow water, but few of those collected were large enough to identify. This was the commonest sculpin collected between Coppermine and northern Baffin Island, and also the only one identified from fresh water.

Arctic sculpin, *Myoxocephalus scorpioides* (Fabricius)

- 1 specimen, June 28, 1953, Frobisher Bay, dredge haul from 5 m.
- 1 specimen, July 28, 1953, Cape Farrington, on shore near low water.
- 2 specimens, August 6, 1953, Cumberland Sound, on shore near low water.
- 2 specimens, August 11, 1953, Pangnirtung, on shore near low water.
- 1 specimen, August 14, 1953, Padloping Island, on shore near low water.

This species was taken only in southeastern Baffin Island near low tidal levels and in shallow water.

Shorthorn sculpin, *Myoxocephalus scorpius* (L.)

- 2 specimens, June 28, 1953, Frobisher Bay, dredge haul from 5 m.
- 1 specimen, July 3, 1953, Frobisher Bay, dredge haul from 5 m.
- 3 specimens, July 4, 1953, Frobisher Bay, dredge haul from 5 m.
- 2 specimens, July 14, 1953, Frobisher Bay, on sandy beach near low water.
- 6 specimens, July 28, 1953, Cape Farrington, on rocky shore near low water.
- 6 specimens, August 5, 1953, Pangnirtung, on sandy beach near low water.
- 1 specimen, August 6, 1954, Cambridge Bay, mouth of small stream.

Found quite frequently in southeastern Baffin Island on shore near low water or in shallow water. The one specimen from Cambridge Bay is distributionally interesting, as it is from an area in which this species had not previously been recorded.

Cyclopteropsis jordani Soldatov

1 specimen, March 1955, Admiralty Inlet, found dead on sea-ice.

Tentative identification of a specimen, 6.5 cm. long, picked up by an Eskimo beside a seal's breathing hole. The Eskimo had no name for the fish. It had presumably been brought on to the ice by a ringed seal, *Phoca hispida*, and would have been eaten if the seal had not been disturbed.

This is the first record for the Canadian Arctic.

Leatherfin lumpsucker, *Eumicrotremus derjugini* Popov

1 specimen, August 18, 1953, Padloping Island, dredged at 5 m.

Tentative identification of a small larva, 1.3 cm. long, taken from sandy bottom.

Striped sea snail, *Liparis liparis* (L.)

1 specimen, June 22, 1953, Frobisher Bay, tide pool near low water.

1 specimen, July 5, 1953, Frobisher Bay, on shore near low water.

1 specimen, July 13, 1953, Frobisher Bay, on shore near mid-tide level.

Tentative identification of specimens found only during intertidal collecting in southeastern Baffin Island.

Fish-doctor, *Gymnelis viridis* (Fabricius)

1 specimen, July 28, 1953, near Cape Farrington, on shore near low water level.

1 specimen, August 5, 1953, Pangnirtung, on shore near low water level.

1 specimen, August 8, 1953, Padloping Island, dredged at 5 m. among algae.

1 specimen, July 24, 1955, Eclipse Sound, on shore.

The first two specimens were taken on shore in southeastern Baffin Island under loose boulders. No others were collected on shore during the extensive intertidal collecting in 1953, and this species probably occurs only occasionally on shore at levels where it can hide successfully among rocks and algae during low water.

Lycodes sp.

1 head, August 4, 1955, Pond Inlet village, washed on to the beach.

The single specimen was picked up on the beach after three days of strong onshore winds. The Eskimos had no name for the fish, which was presumably either a straggler from the south or a deep-water form.

Arctic flounder, *Liopsetta glacialis* (Pallas)

1 specimen, July 2, 1954, Coppermine, in river delta.

Of three arctic flounders examined, two had empty stomachs and one contained the remains of isopods and gastropod shells. All specimens seen were dextral.

This species was caught regularly in the Coppermine fishery and was also seen in shallow water of Burnside Inlet, near Bathurst Inlet village, on August 4, 1954.

Starry flounder, *Platichthys stellatus* (Pallas)

No specimens collected.

This species was taken frequently in the Eskimo fishery of the Coppermine River, especially in June before the river warmed extensively. Many were caught outside the delta in July. A series of nine specimens was examined between July 13 and 27. Stomachs of the three largest, lengths 38.6, 36.0 and 37.7 cm., contained capelin. A medium-sized specimen, length 29.5 cm., had isopod remains in its stomach. Three small specimens, lengths 29.2, 22.6, and 20.4 cm., had only sand grains in their stomachs.

All specimens examined were sinistral.

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