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THE METAZOAN PARASITES OF THE HETEROSOMATA OF THE
GULF OF THE ST. LAWRENCE
VII. NEMATODA AND ACANTHOCEPHALA

by

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THE METAZOAN PARASITES OF THE HETEROSOMATA OF THE GULF OF THE ST. LAWRENCE

VII. NEMATODA AND ACANTHOCEPHALA¹

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Abstract

The nematode and acanthocephalan fauna of six species of flat fish from the Gulf of St. Lawrence is described.

Introduction

This paper, the final one in the series describing the parasite fauna of the six species of flat fish found in the Gulf of St. Lawrence and vicinity, includes a description of the incidence of the nematode and acanthocephalan species in 100 specimens of *Glyptocephalus cynoglossus* (von Linne, 1758), *Hippoglossoides platessoides* (Fabricius, 1780), *Hippoglossus hippoglossus* (von Linne, 1758), *Limanda ferruginea* (Storer, 1839), *Pseudopleuronectes americanus* (Walbaum, 1792), *Scophthalmus aquosus* (Mitchill, 1814), and 60 specimens of *Liopsetta putnami* (Gill, 1854).

Materials and Methods

The methods used to capture the hosts were varied and included all common fishing methods. The survey was started late in 1954 when a few specimens were taken and continued until July of 1956.

The flat fish were usually infected with nematodes which were often found in the axial muscles. In the examination of the fillets the same technique was followed as that used in the study of cod fillets (18). This procedure made use of the fluorescent phenomenon of the dead nematode. The fish were measured and filleted; the fillets weighed and then examined in a darkened room with the aid of a "black-light" lamp.

The nematodes were killed by freezing the fish for at least 24 hours at -25° C (20). The dead nematode was then clearly seen by its blue-white fluorescence energized by the ultraviolet lamp.

The nematodes were stored in 70% ethyl alcohol with 25% glycerine. As many of these were held for a considerable period of time in this medium, the study of the internal organs was facilitated, because the glycerine permeated the cuticle and the nematodes became transparent. For poorly cleared specimens, lactophenol d'Amann or beechwood creosote was used to obtain clear visibility through the cuticle. *En face* views were made in several cases using the technique described by Basir (1).

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The Acanthocephala were placed in an isotonic solution (2 parts distilled to 1 part seawater) and left overnight to relax. The specimens were stained by either Grenacher's, Mayer's, and Best's carmines or combination haematoxylin (25). The clearing was carried out in seven stages using methyl salicylate, methyl benzoate, terpeneol, and balsam mixtures (14). A useful technique for handling great numbers of specimens was devised. The vials were standardized at 4 cm in length and 1.8 cm in diameter (capacity 8 ml). These vials were held in racks and processed as a unit. The vials were filled by using a 5-ml burette connected to a reservoir of whatever medium was being used. To empty the vials a small-diameter porosity tube, modified by the removal of one lip, was inserted in the vial. A rubber hose was attached to the uncut end of the tube; this hose was joined to the inlet of a thick-walled jar; from the outlet of this jar another hose led to an aspirator pump. As a vacuum was produced in the jar, the fluid in the vial was sucked off. Specimens were then held against the porosity plate and upon closure of the clamp the suction ceased and the specimens fell back into the vial. This method enabled the operator to handle thousands of microscopic specimens without resorting to handpicking under the microscope and without the loss of specimens.

Results

PHYLUM: Nematoda

SUPERFAMILY: Ascaridoidea (Railliet & Henry, 1915)

FAMILY: Stomachidae (Johnston & Mawson, 1945,
subfam. Hartwich, 1957)

SUBFAMILY: Stomachinae Johnston & Mawson, 1945

GENUS: *Contracaecum* Railliet & Henry, 1912

Contracaecum gadi (Müller, 1776)

Hosts: *G. cynoglossus*, *H. platessoides*, *H. hippoglossus*, *L. ferruginea*, *P. americanus*.

Location: Intestinal tract, encysted on all internal organs.

Locality: Grande-Rivière, Magdalen Islands, Miscou Bank, Orphan Bank, Bradelle Bank.

Previous identification (4) of nematodes from *Gadus callarias* and other fish taken in the Gulf of St. Lawrence was based on the work of Punt (17). Punt placed those nematodes having both the oesophageal appendix and an intestinal caecum in the species *C. aduncum* Rudolphi (1802). Dollfus (2), in a critical review of this work, regarded Punt's specimens from *G. callarias* and flat fish as being *C. gadi* thereby following the suggestion of Johnston and Mawson (5). By his doing so, Heller's material from the Gulf (4) became listed in Dollfus's work under the name of *C. gadi*. The arguments of Dollfus seem pertinent and valid and with the exception of the immature forms his classification is therefore followed in this present work.

C. gadi was not present in great numbers in any host species. The highest incidence was in *H. hippoglossus* where 14% were infected with from 1 to 15 nematodes. Ten of the 100 specimens of both *P. americanus* and *H. platessoides* carried from one to three nematodes in 9% of the specimens examined. One specimen of *L. ferruginea* was infected and then only by a single nematode.

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The nematodes measured from 24 mm to 69 mm in length and from 0.15 mm to 0.39 mm in width. Margolis (10) indicated doubt about Kahl's (7) and Punt's (17) claims that the largest specimens of *C. gadi* (= *C. aduncum*) are to be found in the largest of the hosts. The 69-mm nematode recorded here was taken from an 80 mm long specimen of *H. platessoides* substantiating Margolis's statement.

Contracaecum sp. (Larvae)

Hosts: *G. cynoglossus*, *H. platessoides*, *H. hippoglossus*, *L. ferruginea*, *P. americanus*, *S. aquosus*.

Location: External surface of the internal organs, usually attached to mesenteries, musculature.

Locality: Gulf of St. Lawrence.

The presence of both the oesophageal appendix and the anterior directed intestinal caecum are diagnostic for the genus. There was little variation in the size of these nematodes from those of *C. gadi*, but it was felt inadvisable to classify larval forms specifically.

Host species records were not kept for the incidence of *Contracaecum* sp., but a pooled sample of the six hosts gave a mean figure of 17%. The apparent lack of correlation between this figure and that reported elsewhere should be noted. Templeman and his colleagues (22) have shown an absence of infection in both *H. platessoides* and *G. cynoglossus* based on an examination of washed fillets. Those nematodes, however, attached to, or actually present in, the visceral organs, as well as those parasites lying in the body cavity would be washed off during the candling preparations.

GENUS: *Terranova* Leiper and Atkinson, 1914

The taxonomic status of this genus has received considerable attention in recent years. Hartwich (3) made a critical study of the group to which it belongs. He concluded that although *Terranova* can be separated from *Porrocaecum* by its lack of interlabia, the group *Terranova* is a distinct entity based on the shape of the excretory system, sinistrally unilateral and band-shaped, with a ventriculus which, in contrast to that of *Porrocaecum*, has a dorsal and ventral suture. Myers (15) subsequently, however, placed the species *decipiens* in a new genus, *Phocanema*, on the basis of its host relationships with seals and possibly other sea mammals, and on differences in the head and tail regions. In her opinion, *Porrocaecum* is confined to birds and *Terranova* to elasmobranchs.

It is felt, however, by the present writer that the two genera *Terranova* and *Porrocaecum* are adequate to cover nematodes utilizing homoeothermic pinniped and avian definitive hosts. If a division must be made, it would be better made between the above forms and those utilizing a poikilothermic elasmobranch as a definitive host. This suggestion is also based on the larval reaction of *T. decipiens* to various temperature gradients, which strongly indicate that there are species-specific limitations which are dependent on the definitive host's body temperature (20).

Terranova sp.

Hosts: *G. cynoglossus*, *H. platessoides*, *H. hippoglossus*, *L. ferruginea*, *L. putnami*, *P. americanus*, *S. aquosus*.

Location: Axial musculature, body cavity, exterior of pyloric caeca, and intestine.

Locality: Gulf of St. Lawrence.

The parasites described here are those that were more than 28 mm in length with an oesophagus divided into an anterior muscular region and a posterior ventriculus; and in which an intestinal caecum was always present. Larvae that did not fall into this category are placed under the heading of *Stomachinae* or have already been described under the heading of *Contracaecum*.

Although it has been shown that probably only one species of *Terranova* exists in the Atlantic cod, *G. callarias* (21), this has not been substantiated for the nematodes in flat fish, although there is every reason to suspect a similar condition.

In *G. callarias* taken in the same area, the incidence in the smaller inshore fish is higher than that of fish taken in deeper waters. The reverse of this situation was found in the Heterosomata where 13.6% of *L. putnami* were parasitized by 0.46 nematodes per 1000 grams of fillet, 12% of *G. cynoglossus* by 0.40, 9% of *L. ferruginea* by 0.73, 8% of *P. americanus* by 0.25, and 7% of *S. aquosus* by 0.37. In offshore fish a pooled sample of six species showed that 45.5% of the fish were parasitized with 0.48 nematodes per 1000 grams of fillet. This indicates that more offshore fish are parasitized by *Terranova* species than the inshore specimens, but the incidence figure by weight of fillet was higher in some species of Heterosomata from inshore waters.

Stomachinae Larvae

Hosts: *G. cynoglossus*, *H. platessoides*, *H. hippoglossus*, *L. ferruginea*, *L. putnami*, *P. americanus*, *S. aquosus*.

Location: External surface of internal organs, musculature, body cavity.

Locality: Gulf of St. Lawrence.

All larval nematodes that lacked caeca are placed in this group. There is little doubt that specimens of the genera *Terranova* and *Contracaecum* are present. Johnston and Mawson (6) attempted to distinguish the genera by the shape of the cyst and larval position within the cyst. It is not felt, after examining the present material, that this system is of any great value because host cyst formation can be confused with the parasite cyst production; moreover, the rate of infection apparently has some effect on the host reaction, because flat fish only exhibit the often characterized heavy cyst wall in areas where the larvae are numerous; in some cases, several cysts may even become joined together in one large mass. Those cysts that were found measured approximately 1.8 mm in length by 1.4 mm in width. In a few cases the cyst was between the muscle fibers of the gut wall and was not apparent until deep scrapings were made. Some cysts contained two or three small, coiled nematodes.

Eighty percent of *H. hippoglossus* had from 1 to 231 nematodes; 50% of *L. ferruginea* from 1 to 13; 20% of *L. putnami* from 1 to 11; 11% of *S. aquosus*

from 1 to 3; 9% of *P. americanus* from 1 to 14; 5% of *H. platessoides* from 1 to 7, and only 3% of *G. cynoglossus* had a single specimen.

ORDER: Spiruroidea Railliet & Henry, 1915

FAMILY: Cucullanidae Barreto, 1916

SUBFAMILY: Cucullaninae Yorke & Maplestone, 1926

GENUS: *Cucullanus* Müller, 1777

Cucullanus heterochrous Rudolphi, 1802

Hosts: *L. ferruginea* and *P. americanus*.

Location: Intestine of *P. americanus*, stomach of *L. ferruginea*.

Locality: Miscou Bank, Grande-Rivière.

These nematodes were rare parasites of flat fish. A single male specimen was found in the stomach of *L. ferruginea* and three males and one female in the intestines of four specimens of *P. americanus*. Specimens conformed to the description given by Törnquist (23). Margolis has reviewed the species that parasitize flat fish (11).

PHYLUM: Acanthocephala

ORDER: Palaeacanthocephala Meyer, 1931

FAMILY: Echinorhynchidae Cobbold, 1879

GENUS: *Echinorhynchus* Zoega in Müller, 1776

Echinorhynchus gadi Müller, 1776

Hosts: *G. cynoglossus*, *H. platessoides*, *H. hippoglossus*, *L. ferruginea*, *L. putnami*, *P. americanus*, *S. aquosus*.

Location: Digestive tract and encysted in mesenteries of the internal organs.

Locality: Gulf of St. Lawrence.

E. gadi has been described from many hosts including 10 species of Heterosomata. The present record increases this number to 15 with new records for *G. cynoglossus*, *H. platessoides*, *L. ferruginea*, *L. putnami*, and *S. aquosus*.

The literature on acanthocephalan parasites of the Heterosomata is extensive, and the specific determinations in the present work were made by consulting numerous authors (2, 8, 9, 12, 13, 16, 25). *E. gadi* was very common in the flat fish, all harboring this species. The numbers present varied from 1 to 26, 78% of which were females.

Echinorhynchus laurentianus Ronald, 1957

Hosts: *H. platessoides*, *H. hippoglossus*, *P. americanus*, *S. aquosus*.

Location: Digestive tract.

Locality: Gulf of St. Lawrence.

A full description of this parasite has been given elsewhere (19). The type specimens are deposited in the Museum of the Station de Biologie Marine, Grande-Rivière, Quebec. Forty-six percent of the fish examined were parasitized, 61% of these parasites were females, 29% were immature of both sexes.

FAMILY: Polymorphidae Meyer, 1931

GENUS: *Corynosoma* Lühe, 1904

Corynosoma sp.

Hosts: *G. cynoglossus*, *H. hippoglossus*, *L. ferruginea*, *P. americanus*.

Location: Encysted in mesentery and on the outside of internal organs.

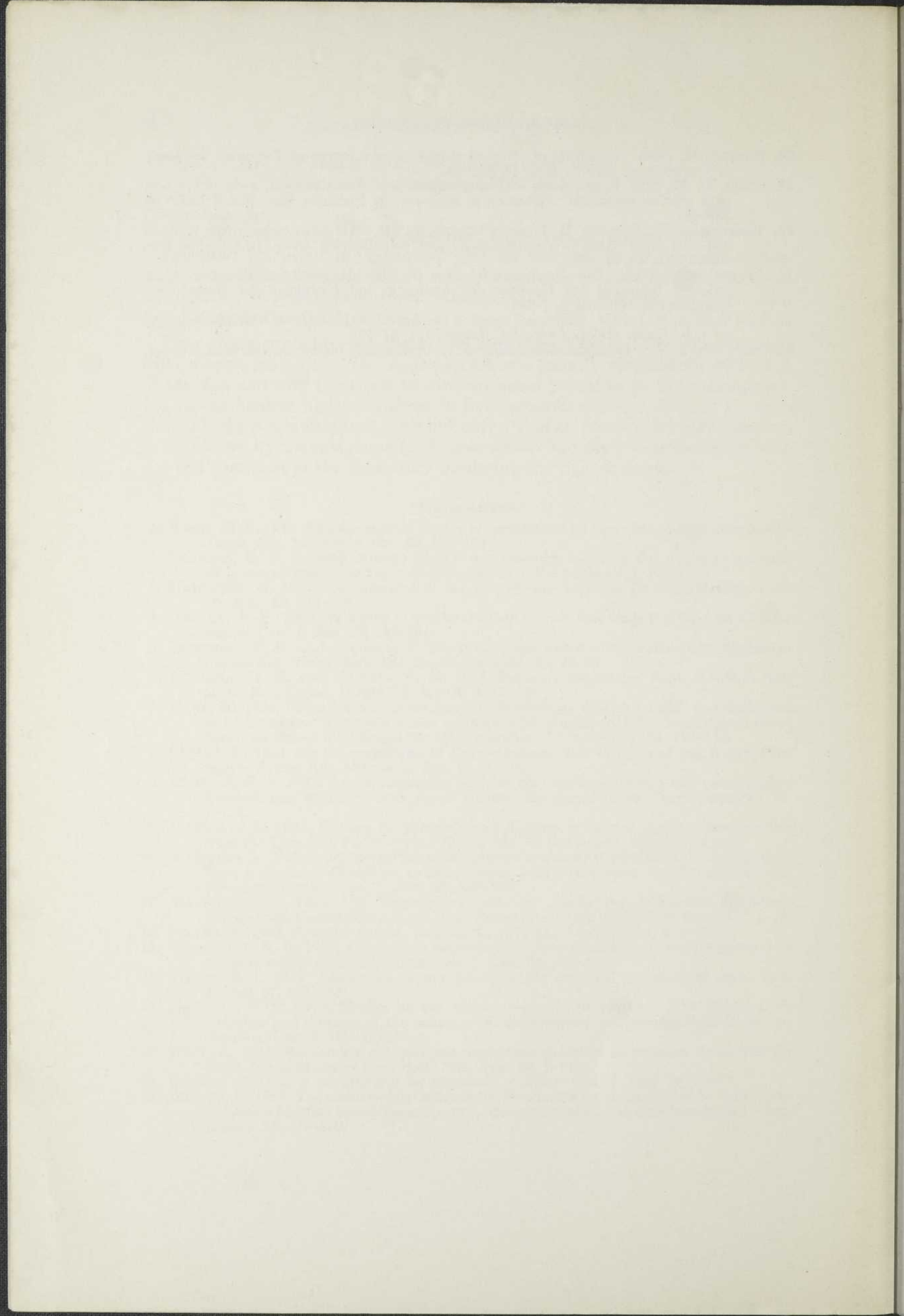
Locality: *H. platessoides* and *P. americanus* from Grande-Rivière, *G. cynoglossus*, *L. ferruginea* from Miscou Bank. *H. hippoglossus* from East Point, Anticosti Island.

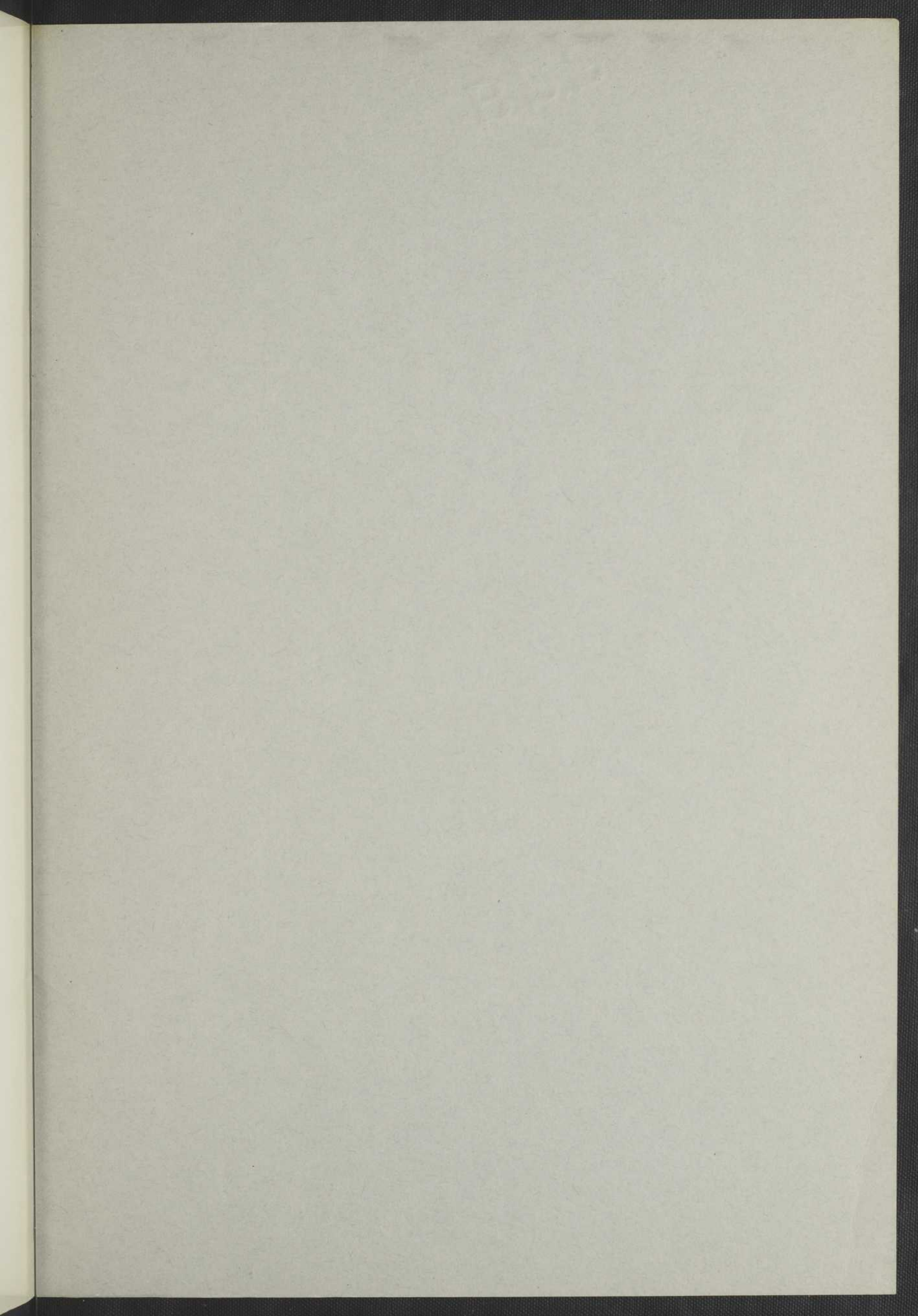
This group probably represents the immature forms of acanthocephalans from marine mammals (14). *L. ferruginea* was heavily parasitized, with 49% of the fish carrying from one to nine encysted parasites in the mesenteries; 7% of the halibut had from three to five parasites present; 20% of *G. cynoglossus* had a single encysted stage but only 2% of *H. platessoides* were infected, in both cases by a single parasite. *P. americanus* had the lowest incidence with a single specimen in the mesentery bordering the pyloric caeca.

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