# Intestinal Trematode Parasites (Trematoda : Digenea) and Food of Yellowtail Flounder (*Limanda ferruginea* (Storer 1839)) from the Scotian Shelf and Gulf of St. Lawrence

by J. S. Scott

FISHERIES AND MARINE SERVICE
SERVICE DES PÊCHES ET DES SCIENCES DE LA MER

TECHNICAL REPORT No.
RAPPORT TECHNIQUE N° 584

1975

Environment Canada
Fisheries and Marine Service

Environnement Canada
Service des pêches et des sciences de la mer

## Technical Reports

Technical Reports are research documents that are of sufficient importance to be preserved, but which for some reason are not appropriate for primary scientific publication. Inquiries concerning any particular Report should be directed to the issuing establishment.

## Rapports Techniques

Les rapports techniques sont des documents de recherche qui revêtent une assez grande importance pour être conservés mais qui, pour une raison ou pour une autre, ne conviennent pas à une publication scientifique prioritaire. Pour toute demande de renseignements concernant un rapport particulier, il faut s'adresser au service responsable.

Department of the Environment
Fisheries and Marine Service
Research and Development Directorate

TECHNICAL REPORT NO. 584

(Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. The series name was changed with Report number 457).

Ministère de l'Environnement
Service des Pêches et des Sciences de la mer
Direction de la Recherche et Développement

RAPPORT TECHNIQUE N°. 584

(Les numéros 1-456 dans cette série furent utilisés comme Rapports Techniques de l'office des recherches sur les pêcheries du Canada Le nom de la série fut changé avec le rapport numéro 457).

# Intestinal trematode parasites (Trematoda:Digenea) and food of yellowtail flounder *(Limanda ferruginea* (Storer 1839)) from the Scotian Shelf and Gulf of St. Lawrence

by

J. S. SCOTT

This is the eighty-eighth
Technical Report from the
Research and Development Directorate
Biological Station
St. Andrews, N.B.

Ceci est le quatre-vingt huitième
Rapport Technique de la Direction de la
Recherche et Développement
Station biologique
St-Andrews, N.-B.

1975

## ABSTRACT

Scott, J. S. 1975. Intestinal trematode parasites (Trematoda: Digenea) and food of yellowtail flounder *(Limanda ferruginea* (Storer 1839)) from the Scotian Shelf and Gulf of St. Lawrence. Fish. Mar. Serv. Res. Dev. Tech. Rep. No. 584, 12 p.

Six species of digenetic trematodes were collected from the intestines of 375 yellowtail flounder *(Limanda ferruginea)* from the Scotian Shelf and Gulf of St. Lawrence. *Lecithaster gibbosus* and *Steganoderma formosum* were new records for this host. Overall incidence of infection was moderate to high for *Derogenes varicus* (37%), *Fellodistomum furcigerum* (29.8%), *Lecithaster gibbosus* (24.8%) and *Stenakron vetustum* (76.8%), and low for *Podocotyle atomon* (6.1%) and *Steganoderma formosum* (2.1%). Intensity of infection was low (1.1-7.7 parasites per fish) for all trematodes. In those parasites with moderate-to-high incidence, level of infection was not influenced by host seg, but was heterogeneously distributed among fish length groups except in the case of *Fellodistomum furcigerum.* Incidences of infection of most parasites varied with geographic location but did not show sufficient variation to be useful as biological tags. Parasite species compositions indicated that yellowtail flounder and small American plaice *(Hippoglossoides platessoides)* share common food resources.

## RÉSUMÉ

Scott, J. S. 1975. Intestinal trematode parasites (Trematoda: Digenea) and food of yellowtail flounder *(Limanda ferruginea* (Storer 1839)) from the Scotian Shelf and Gulf of St. Lawrence. Fish. Mar. Serv. Res. Dev. Tech. Rep. No. 584, 12 p.

Six espèces de trématodes digéniens ont été prélevées de l'intestin de 375 limandes à queue jaune *(Limanda ferruginea)* du plateau continental Scotian et du golfe Saint-Laurent. C'était la première fois que *Lecithaster gibbosus* et *Steganoderma formosum* étaient identifiés chez cet hôte. La fréquence de l'infection variait de modérée à élevée pour les espèces *Derogenes varicus* (37%), *Fellodistomum furcigerum* (29.8%), *Lecithaster gibbosus* (24.8%) et *Stenakron vetustum* (76.8%); d'autre part, elle était faible pour *Podocotyle atomon* (6.1%) et *Steganoderma formosum* (2.1%). Dans tous les cas, l'intensité de l'infection était faible (de 1.1 à 7.7 parasites par poisson). Pour les parasites dont la fréquence variait de modérée à élevée, le degré d'infection n'était pas influencé par le sexe de l'hôte, mais la distribution de ces parasites selon les divers groupes de longueur des poissons était hétérogène sauf pour le *Fellodistomum furcigerum.* La fréquence de l'infection pour la plupart des parasites variait

selon la situation géographique, mais pas suffisamment pour qu'on puisse s'en servir comme indicateur biologique. Les espèces de parasites de la limande à queue jaune et de la plie du Canada *(Hippoglossoides platessoides)* indiquent que ces deux poissons ont des ressources nutritives communes.

## INTRODUCTION

The yellowtail flounder *(Limanda ferruginea* (Storer 1839)) is a shallow-water flatfish which shows limited movement within its range of occurrence (Bigelow and Schroeder 1953). On the Scotian Shelf and in the Gulf of St. Lawrence it is largely confined to the shoal waters of the offshore banks (Scott, 1971), to some inshore areas and to the Magdalen Shallows. The restricted depth distribution of the yellowtail on the Scotian Shelf (Scott, 1971), and the consequent separation into local groups on each of the banks may result in differences in composition and availability of food organisms which should be reflected in the parasite fauna of the fish. The purpose of this study was to make a preliminary investigation of the abundance of the intestinal trematode parasites of yellowtail in relation to fish sex, length, food and geographic location.

Ronald (1959) published a list of known records of metazoan parasites of the Hetersomata in which he recorded four digeneans from *L. ferruginea* from the northwest Atlantic. Three of these species *(Cymbephallus vitellosus, Homallometron pallidum* and *Podocotyle atomon)* were previously recorded by Linton (1901, 1940) from the Woods Hole region. Wolfgang (1954) reported metacercariae of *Stephanostomum baccatum* from various localities of eastern Canada. Later Ronald (1960) examined flatfishes from the Gulf of St. Lawrence and added 10 species to the Digenea of *L. ferruginea*. Apart from Wolfgang's (1954) study, there are no records of Digenea from the whole of the Scotian Shelf. The present study, therefore, extends the records of trematode occurrence in *L. ferruginea* to cover most of the area between the Gulf of St. Lawrence in the north and Woods Hole in the south.

## MATERIALS AND METHODS

In the summers of 1971 and 1972 yellowtail flounder samples were collected by trawl on randomly selected fishing stations in each of the International Commission for the Northwest Atlantic ICNAF Divisions 4X, 4W, 4V, 4T (Fig. 1). These Divisions are named Browns, Western, Banquereau and southern Gulf of St. Lawrence, respectively, in the text.

A total of 375 yellowtail were frozen immediately after capture and later measured to the nearest millimetre, sexed, dissected and examined for food and parasites in the laboratory. Helminth parasites recovered from the alimentary tract of each fish were preserved in 7% formalin. The general categories of food items found in the gut contents of each fish were recorded.

Digenetic trematodes were identified to species, counted and measured for length under a stereoscopic microscope with screw micrometer eyepiece (1 eyepiece unit (EPU)= 0.03 mm). Identification was made by detailed examination of representative individuals from specimens provisionally identified by gross examination. For preparation of length frequency distributions, lengths of *L. gibbosus* and *S. vetustum* were grouped in 5 EPU groups, and *S. furciger* in 10 EPU groups.

## RESULTS

Six species of digenetic trematodes were collected from the intestines of yellowtail flounder: *Derogenes varicus* (Mueller, 1784) Loos 1901, *Fellodistomum furcigerum* (Olson, 1868) *(=Steringophorus furciger)*, *Lecithaster gibbosus* (Rud. 1802) Luhe 1901, *Podocotyle atomon* (Rud. 1802) Odhner 1905, *Steganoderma formosum* Stafford 1904, and *Stenakron vetustum* Stafford 1904. *Lecithaster gibbosus* and *S. formosum* had not been recorded previously from yellowtail.

In combined summer samples from the Scotian Shelf, levels of parasite infection in male and female *L. ferruginea* (Table 1) were similar. Comparison of the observed frequencies of occurrence by the normal approximation to the binomial test (Brownlee, 1960) showed no significant differences ($P>.05$) in incidence of parasite infection with host sex.

The incidence of infection of *D. varicus*, *L. gibbosus* and *S. vetustum* was heterogeneously distributed ($P<.05$) among the length groups of *L. ferruginea*, but there was no significant difference in the incidence of *F. furcigerum* with fish length (Chi-square analysis)(Table 2). In *D. varicus*, incidence increased (28.00-46.58%) with increasing fish length throughout the length range of fish examined, but the increase was negligible (43.15-46.58%) in fish longer than 27.0 cm. In *L. gibbosus*, there was a decrease in incidence (34.00-13.68%) to the 27.0-29.9 cm length group then an increase (24.41-35.62%) on longer fish. Incidence of *S. vetustum* was uniform (90.00-87.21%) in all length groups except that of the largest fish, where it decreased (58.90%).

Levels of intensity of infection in fish length groups were generally uniform for each species of parasite (Table 2). The relatively high values for *F. furcigerum* observed in the 27.0-29.9 cm and 30.0-32.9 cm fish length groups resulted from exceptionally high numbers of parasites in a few individual fish. In the 27.0-29.9 cm group the range of numbers per fish was 1-26 except for one fish with 154 parasites. In the 30.0-32.9 cm group numbers ranged from 1-18 except for three fish with 28, 54 and 68 parasites respectively.

Examination of contents of the alimentary tract showed no consistent correlation between fish length and prey (Table 3) although the largest yellowtail, more than 40.0 cm in length, showed evidence of preference for fish (86.2% incidence compared to 52.0-58.6 in smaller fish) and tube worms (48.3% against 4.7-10.0%). In contrast to these trends, crustacean incidence in gut contents was lower in 40+ cm fish (55.2%) than in smaller fish (71.3-87.9%).

Variation in parasite abundance between areas was examined by comparing aggregated fish samples from each of the areas investigated (Table 4) on the Scotian Shelf. *Stenakron vetustum* showed consistently high incidence, but with a lower level to the southwest (Browns 53.0%; other areas 83.2-89.0%) and a corresponding decrease in intensity (5.6 and 6.6-9.5, respectively). Abundance of *D. varicus* also decreased to the southwest. *Fellodistomum furcigerum* did not have a trend to the southwest but reached peak values in Western (incidence 38.4%, intensity 4.3) compared with Browns and Banquereau (15.6-18.0%, and 4.2-3.8). *Lecithaster gibbosus* showed comparatively little variation in incidence and intensity between areas (incidence 31.3-35.9%; intensity 2.3-3.7) and *S. formosum* and *P. atomon* showed consistently low degrees of infection in all areas.

Levels of infection in the Gulf of St. Lawrence samples fell within the ranges found over the Scotian Shelf (Table 3) except for *L. gibbosus* which showed notably low levels in the Gulf, and *P. atomon* with comparatively high incidence in the Gulf compared to the negligible levels over the Shelf.

Length frequency distributions of the abundant trematodes *F. furcigerum* and *L. gibbosus* showed modes indicating a preponderance of the smaller length groups (Fig. 2). *Fellodistomum furcigerum*, in particular, showed a principal mode at about 3 mm, the middle of its length range, but also a second important mode at about 0.75 mm in the smallest length group observed for the species. In *S. vetustum* the mode in the unimodal, normal distribution was about the middle of the length range.

## DISCUSSION

Four of the six trematodes found were previously recorded by Ronald (1960) from yellowtail flounder in the Gulf of St. Lawrence. The remaining two, *L. gibbosus* and *S. formosum* were previously unrecorded in yellowtail. Incidence of *L. gibbosus* was moderately high on the Scotian Shelf but low in the Gulf of St. Lawrence (Table 4). *Steganoderma formosum* was recorded from all areas except Banquereau, but at low levels on incidence and intensity. These results were similar to

those found by Scott (1975) for incidence of the same trematodes in American plaice *(Hippoglossoides platessoides)*. The absence of *L. gibbosus* from Ronald's (1960) material may have resulted from differences in sampling locations between the two surveys. It does not appear to be due to differences in fish length groups sampled because *L. gibbosus* was well represented in all fish length groups examined.

The absence of a relationship between fish length and parasite abundance indicates that there were no length-related changes in food preference in yellowtail. This was supported by the similarity of food organisms found throughout the length range of fish sampled.

Unlike American plaice, the yellowtail flounder is a small-mouthed flatfish and even the larger specimens are not adapted to ingest large prey. It is not to be expected, therefore, that yellowtail would be host to all the parasite species which are characteristic of the larger American plaice. Accordingly, the more common Digenea of *L. ferruginea* are those which Scott (1975) reported as being most prevalent in smaller American plaice: *D. varicus*, *F. furcigerum*, *L. gibbosus*, and *S. vetustum*. The similarity in parasite species compositions indicates that yellowtail flounder and smaller American plaice exploit the same food resources in areas where they occur together.

Comparison of stomach contents of the samples of yellowtail with those reported by Scott (1975) for American plaice supports the parasitic evidence of similarity between diets of yellowtail and smaller American plaice. Crustaceans, fish, polychaetes and lamellibranchs were among the most common food items in both fishes. Brittle star was important in plaice but was of comparatively minor importance in yellowtail. Relevant to previous comments on the size of yellowtail prey, the brittle stars, sea urchins and sand dollars found in yellowtail were very small specimens in comparison with those found in American plaice. Difference in size of prey may be reflected in the incidence of parasites for which the invertebrates are intermediate hosts.

The trematode *Zoogonoides viviparus* was abundant in American plaice (Scott, 1975) but absent from yellowtail flounder. Studies by Orrhage (1973) indicate that the second intermediate host of *Z. viviparus* on the west coast of Sweden is a polychaete *Trochochaeta multisetosa*. The absence of *Z. viviparus* in yellowtail and its abundance in plaice is of interest because polychaetes are important food items in both fishes. The trematode is more prevalent in large than small plaice (Scott, 1975), and it is possible that the intermediate host is restricted to deeper water frequented by *H. platessoides* but not by *L. ferruginea*. Alternatively, *L. ferruginea* may be highly selective in its feeding on polychaetes and may not

utilize the intermediate host of *Z. viviparus*. Both explanations are open to question as *Z. viviparus* has been recorded from a great variety of fish hosts in Britain (Dawes, 1968), including both shallow- and deep-water fishes.

The length frequency distributions of the trematodes indicated differences in recruitment of the different parasite species. The length frequency distributions of *F. furcigerum* and *L. gibbosus*, with modes disposed towards the smaller length groups of the parasites, showed that there was a preponderance of the younger trematodes in the parasite population, indicative of a recent surge in recruitment of the parasites. The mode at the smallest length group of *F. furcigerum* indicated that periodic infection with this parasite was occurring at, or shortly before, the time of capture of the fish host. In the case of *S. vetustum*, the length frequency distribution indicated a mature population with steady recruitment and no recent increase in infection rate.

Differences in parasite abundance between areas were not sufficient to demonstrate differences between yellowtail populations on the Scotian Shelf. Only *D. varicus* showed a significant change in incidence and intensity from Banquereau to Browns, but the parasite is so widely distributed among various fishes in all areas that it cannot be regarded as a reliable biological indicator. In comparing the Gulf of St. Lawrence with the Scotian Shelf, only the ubiquitous *L. gibbosus* and *P. atomon* showed noticeable differences in incidence and intensity.

It appears that the intestinal trematode parasites of *L. ferruginea* do not include host-specific species showing sufficient variation in abundance in different areas to serve as biological tags in the Scotian Shelf and southern Gulf of St. Lawrence.

## REFERENCES

Bigelow, H. B., and W. C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish Wildl., Fish. Bull. 74, 53, 577 p.

Brownlee, K. A. 1960. Statistical Theory and Methodology in Science and Engineering. John Wiley & Sons Inc., New York, 570 p.

Dawes, B. 1968. The Trematoda. Cambridge Univ. Press, 644 p.

Linton, E. 1901. Parasites of fishes of the Woods Hole Region. Bull. U.S. Fish. Comm. 19: 405-492.

Linton, E. 1940. Trematodes from fishes mainly from the Woods Hole Region, Massachusetts. Proc. N.S. Nat. Museum 90: 324-337.

Orrhage, L. 1973. Description of the metacercaria of *Zoogonoides viviparus* (Olsson 1868) Odhner, 1902, with some remarks on life cycles in the genus *Zoogonoides* (Trematoda, Digenea, Zoogonidae). Univ. Goteborg, Zool. Scripta 2 (5/6): 179-182.

Ronald, K. 1959. A check list of the metazoan parasites of the Heterosomata. Contrib. 67, Dept. Fish., Quebec, 152 p.

Ronald, K. 1960. The metazoan parasites of the Heterosomata of the Gulf of St. Lawrence. VI. Digenea. Can. J. Zool. 38: 923-937.

Scott, J. S. 1971. Abundance of groundfishes on the Scotian Shelf. Fish. Res. Board Can. Tech Rep. 260, 8 p., 10 tables.

Scott, J. S. 1975. Incidence of trematode parasites of American plaice *(Hippoglossoides platessoides)* of the Scotian Shelf and Gulf of St. Lawrence in relation to fish length and food. J. Fish. Res. Board Can. 32: 479-483.

Wolfgang, R. W. 1954. Studies of the trematode *Stephanostomum baccatum* (Nicoll, 1907): I. The distribution of the metacercaria in Eastern Canadian flounders. J. Fish. Res. Board Can. 11: 954-962.

Table 1. Percentage incidence and intensity (mean per infected fish) of male (M) and female (F) *L. ferruginea* in summer from the Scotian Shelf, 1971-72 (Number of fish examined in parenthesis).

| | Sex | Inc. | Int. |
|---|---|---|---|
| *Derogenes varicus* | M(118) | 37.2 | 3.6 |
| | F(154) | 36.3 | 4.5 |
| *Fellodistomum furcigerum* | M | 23.7 | 4.3 |
| | F | 29.2 | 4.0 |
| *Lecithaster gibbosus* | M | 32.2 | 2.7 |
| | F | 33.1 | 3.0 |
| *Podocotyle atomon* | M | 2.5 | 1.0 |
| | F | 0.0 | 0.0 |
| *Steganoderma formosum* | M | 3.3 | 1.0 |
| | F | 1.2 | 1.5 |
| *Stenakron vetustum* | M | 78.8 | 7.4 |
| | F | 72.7 | 7.0 |

Table 2. Percentage incidence (Inc) and intensity (Int) of infection by trematodes in different length groups of *L. ferruginea* in summer 1971-72, on the Scotian Shelf (Number of fish in parentheses).

| Parasite | | Fish length group (cm) | | | | |
|---|---|---|---|---|---|---|
| | | ≤23.9 (50) | 24.0-26.9 (71) | 27.0-29.9 (95) | 30.0-32.9 (86) | ≥33.0 (73) |
| *Derogenes varicus* | Inc | 28.00 | 32.39 | 43.15 | 45.35 | 46.58 |
| | Int | 1.69 | 4.48 | 3.42 | 5.56 | 3.68 |
| *Fellodistomum furcigerum* | Inc | 30.00 | 29.58 | 29.47 | 39.53 | 28.77 |
| | Int | 4.36 | 4.21 | 10.65 | 8.19 | 2.90 |
| *Lecithaster gibbosus* | Inc | 34.00 | 26.76 | 13.68 | 24.41 | 35.62 |
| | Int | 2.44 | 3.52 | 2.17 | 2.42 | 2.46 |
| *Stenakron vetustum* | Inc | 90.00 | 84.50 | 84.21 | 87.21 | 58.90 |
| | Int | 5.63 | 6.07 | 7.48 | 9.77 | 7.02 |

Table 3. Percentage frequency of occurrence of common food items in different length groups of *L. ferruginea* from the Scotian Shelf and Gulf of St. Lawrence, 1971-1972 (number of fish examined in parentheses).

| | Fish length group (cm) | | | | | |
|---|---|---|---|---|---|---|
| | ≤24.9 (67) | 25.0-29.9 (133) | 30.0-34.9 (114) | 35.0-39.9 (39) | >40.0 (22) | Total (375) |
| Crustaceans | 71.3 | 86.7 | 87.9 | 72.0 | 55.2 | 80.9 |
| Polychaetes | 57.5 | 61.3 | 56.8 | 42.0 | 62.1 | 57.3 |
| Fish | 58.6 | 54.9 | 52.0 | 58.0 | 86.2 | 56.9 |
| Lamellibranchs | 20.7 | 48.0 | 42.6 | 26.0 | 44.8 | 39.0 |
| Sand dollar | 12.6 | 22.5 | 25.0 | 14.0 | - | 19.3 |
| Gastropods | 11.5 | 21.4 | 19.6 | 18.0 | 3.4 | 17.7 |
| Sea urchin | 3.4 | 13.3 | 17.6 | 6.0 | 3.4 | 12.1 |
| Brittle star | 12.6 | 13.3 | 10.8 | 10.0 | - | 11.3 |
| Tubeworms | 8.0 | 6.3 | 4.7 | 10.0 | 48.3 | 9.0 |

Table 4. Percentage incidence (Inc.) and intensity (Int.) of trematode infection of *L. ferruginea* from different areas of the Scotian Shelf and in the southern Gulf of St. Lawrence in summer, 1971-72 (number of fish examined in parentheses).

| | Browns (83) | | Western (125) | | Banquereau (64) | | Gulf of St. Lawrence (103) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inc. | Int. | Inc. | Int. | Inc. | Int. | Inc. | Int. | Inc. | Int. |
| *Derogenes varicus* | 13.2 | 1.1 | 28.0 | 2.4 | 84.3 | 5.9 | 37.8 | 3.5 | 37.0 | 3.9 |
| *Fellodistomum furcigerum* | 18.0 | 3.8 | 38.4 | 4.3 | 15.6 | 4.2 | 37.8 | 10.7 | 29.8 | 6.4 |
| *Lecithaster gibbosus* | 31.3 | 3.7 | 32.0 | 2.3 | 35.9 | 2.9 | 3.8 | 1.5 | 24.8 | 2.8 |
| *Podocotyle atomon* | 1.2 | 1.0 | 1.6 | 1.0 | 0.0 | 0.0 | 19.4 | 1.6 | 6.1 | 1.5 |
| *Steganoderma formosum* | 3.6 | 1.3 | 2.4 | 1.0 | 0.0 | 0.0 | 1.9 | 1.0 | 2.1 | 1.1 |
| *Stenakron vetustum* | 53.0 | 5.6 | 83.2 | 6.6 | 89.0 | 8.8 | 80.5 | 9.5 | 76.8 | 7.7 |

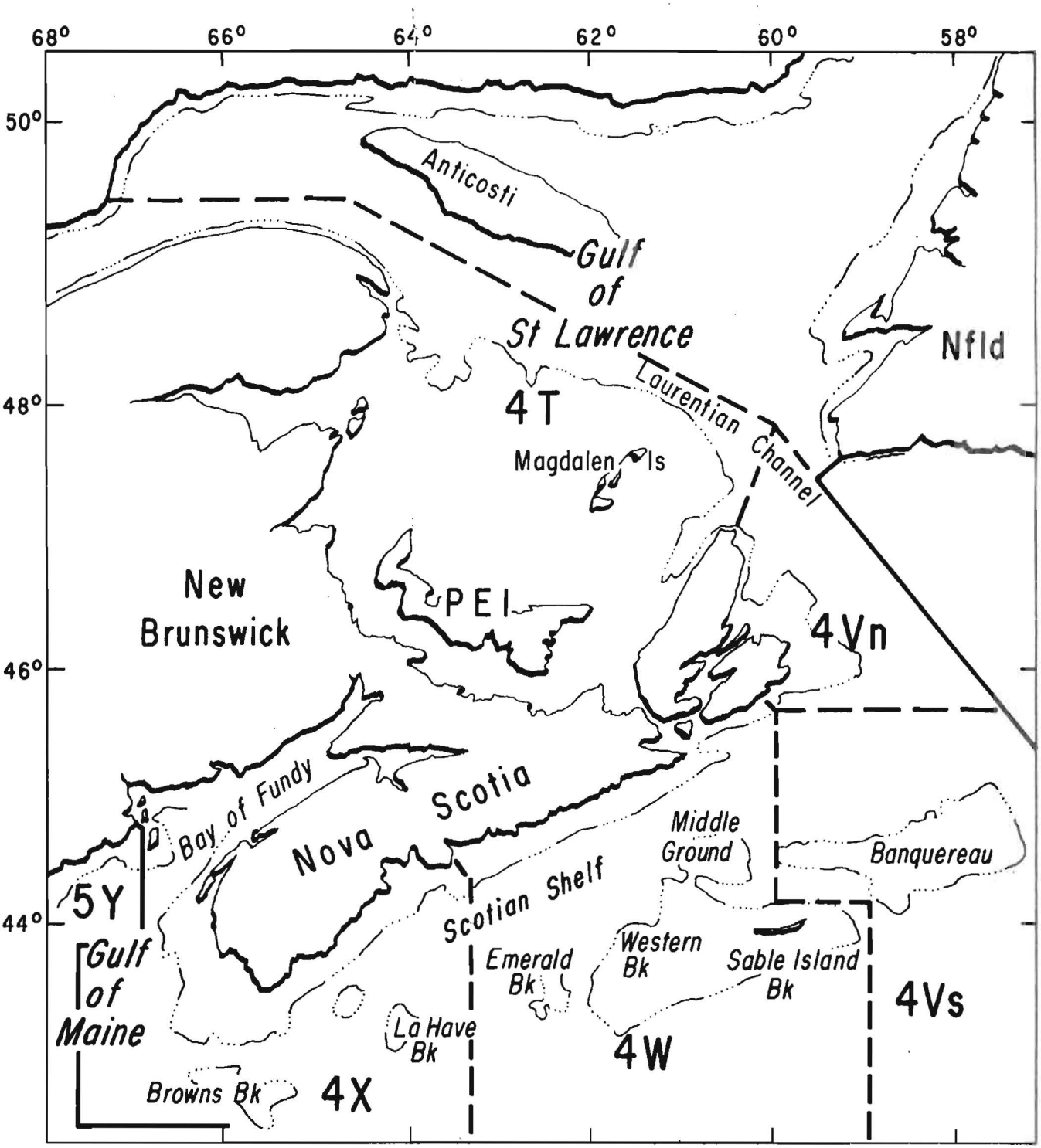


Figure 1. Gulf of St. Lawrence and Scotian Shelf with ICNAF Divisions.

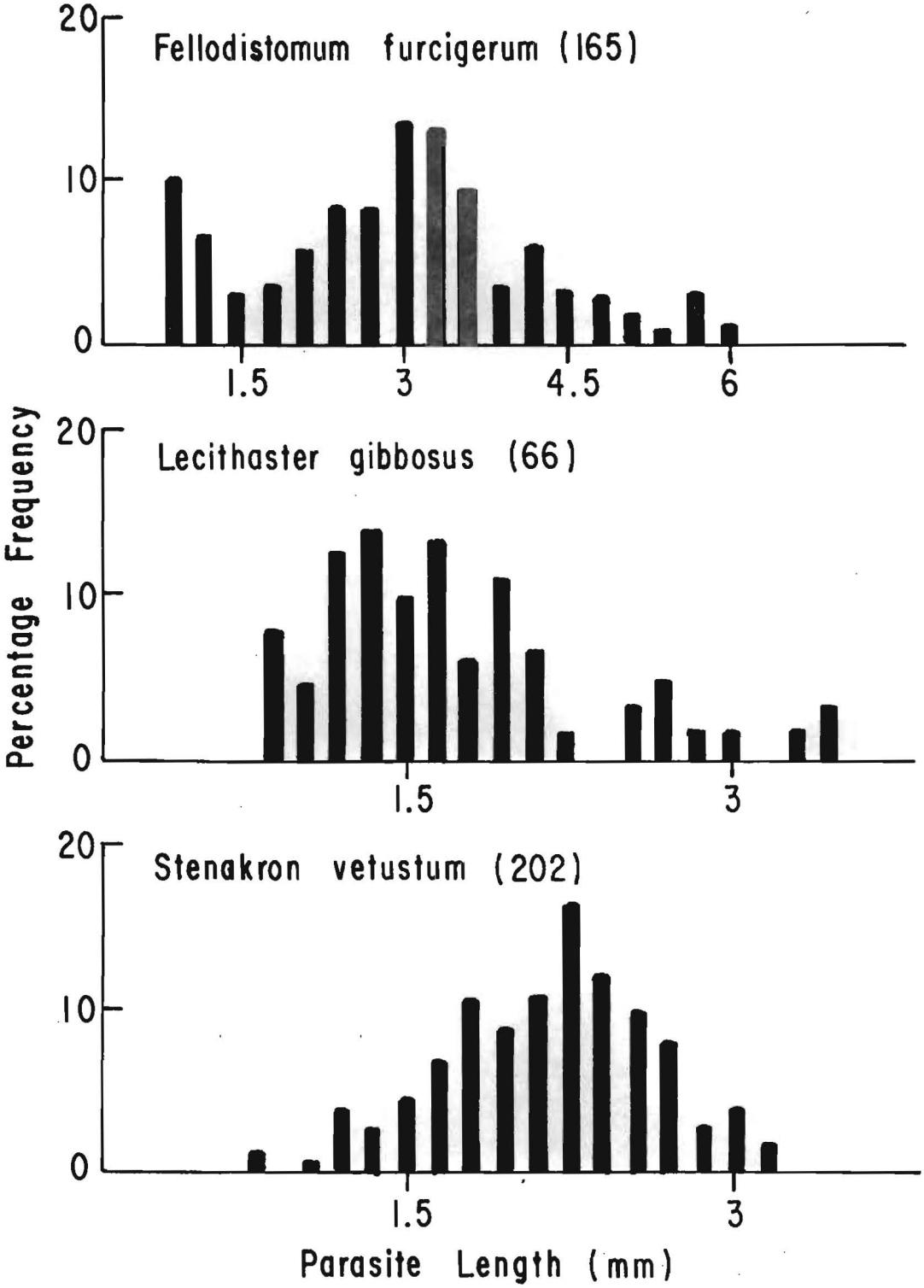


Figure 2. Length frequency distributions of *Fellodistomum furcigerum*, *Lecithaster gibbosus* and *Stenakron vetustum* in summer 1972 (number of parasites in parentheses).