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Parasitic Fauna of Some Macrouridae in the Northwest Atlantic

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Abstract

The parasitic fauna of three species of grenadier in the Northwest Atlantic revealed 33 species of parasites related to seven taxonomic groups: Myxosporidia, Monogenoidea, Cestoda, Trematoda, Nematoda, Acanthocephala and Crustacea. Roundnose grenadier, *Coryphaenoides rupestris* Gunnerus, from Davis Strait, Labrador and northern Grand Bank were infested by 14 species of parasites, half of which occurred in all three areas. The greater incidence of infestation by parasites whose intermediate hosts are pelagic animals indicate that the latter form a significant part of the diet. The roughhead grenadier, *Macrourus berglax* Lecepede, from Flemish Cap and northern Grand Bank were infested by a diverse group of 21 species of parasites, many of which are the intermediate hosts of benthic animals and fish. The common grenadier, *Nezumia bairdi* Goode and Bean, from Flemish Cap and northern Grand Bank were infested by 11 species of parasites whose intermediate hosts are mainly planktonic organisms. Very distinct between-area differences in parasitic infestation of the latter two species of grenadier indicate that the samples were from separate populations. Myxosporidian spores were found in one specimen of *Chalimura brevibarbis* caught on Flemish Cap.

Introduction

Ecological studies on Macrouridae are difficult due to the great depths at which these fish live, and thus it is not surprising that information on the parasitic fauna of this group of fishes in the Northwest Atlantic is rather scanty. Wilson (1920) found the copepod *Chondracantus radiatus* in roundnose grenadier, *Coryphaenoides rupestris*. More recently, this fish was found to be infested by *Dolichoenterum* sp. and *Gonocerca crassa* (Szuks, 1975), and by *Myxidium melanostigmum*, *M. melanocetum*, *M. profundum*, *Zschokkella hildae*, *Auerbachia* sp., *Diclidophora macruri*, *Scolex pleuronectis* l., *Bothriocephalus* sp., *Hemiurus macrouri*, *Derogenes varicus*, *Gonocerca macrouri*, *Aporocotyle simplex*, *Contracaecum aduncum*, and *Anisakis* sp. (Zubchenko, 1976, 1981; Zubchenko and Krasin, 1980). The parasites of roughhead grenadier, *Macrourus berglax*, are known to include *Sphyrion lumpi* (Templeman and Squires, 1960), *Clavellomimus macruri* (Kabata, 1969), *Eineria* sp., *Glugea berlgax*, *Myxidium melanostigmum*, *M. melanocetum*, *Auerbachia pulchra* and *Davisia newfoundlandia* (Yoshino and Noble, 1973; Lom *et al.*, 1975; Lom and Laird, 1976; Moser, 1977; Moser and Noble, 1977a; Zubchenko and Krasin, 1980; Gayevskaya *et al.*, 1980). The common grenadier, *Nezumia bairdi*, is known to be infested by the parasites *Auerbachia pulchra* and *Zschokkella globulosa* (Moser and Noble, 1977a, 1977b).

All of the papers mentioned above deal mainly with systematics. This paper presents data on the parasitic fauna of three species of grenadier commonly found in the Northwest Atlantic and considers the ecological implications.

Materials and Methods

The fish specimens were collected during 1974–79 from various areas of the Northwest Atlantic extending from Davis Strait to the northern slope of Grand Bank and Flemish Cap. A total of 353 specimens of three species of grenadiers, *Coryphaenoides rupestris* (300), *Macrourus berglax* (30) and *Nezumia bairdi* (23), were examined by the method of complete parasitological dissection (Dogiel, 1933). One specimen of *Chalinura brevibarbis* from the Flemish Cap area was also examined.

Results and Discussion

Parasitological investigation of 353 specimens of three species of Macrouridae (roundnose grenadier, roughhead grenadier and common grenadier) revealed 32 species of parasites related to seven taxonomic groups: Myxosporidia (7), Monogenoidea (2), Cestoda (4), Trematoda (10), Nematoda (4), Acanthocephala (1), and Crustacea (4).

Roundnose grenadier, *Coryphaenoides rupestris*

Eighteen species of parasites were found in the 300 specimens of roundnose grenadier examined (Table 1), of which eight species in three groups (Myxosporidia, Monogenoidea and Crustacea) have a direct

TABLE 1. Parasitic fauna of roundnose grenadier, *Coryphaenoides rupestris*, in the Northwest Atlantic.

	Davis Strait (105 spec.)					Labrador (105 spec.)					N. Grand Bank (90 spec.)				
	Specimens infested		Intensity of infestation			Specimens infested		Intensity of infestation			Specimens infested		Intensity of infestation		
Parasites	No.	%	Min	Max	Mean	No.	%	Min	Max	Mean	No.	%	Min	Max	Mean
Myxosporidia															
Auerbachia pulchra	91	86.7	+	+	+	49	46.7	+	+	+	46	51.1	+	+	+
Myxidium melanocetum	—	—	—	—	—	4	3.8	+	+	+	17	18.9	+	+	+
Myxidium melanostigmum	38	36.2	+	+	+	37	35.2	+	+	+	37	41.1	+	+	+
Myxidium profundum	16	15.2	+	+	+	14	13.3	+	+	+	16	17.8	+	+	+
Zschokkella hildae	—	—	—	—	—	1	1.0	+	+	+	—	—	—	—	—
Monogenoidea															
Diclidophora macruri	15	14.3	1	3	0.2	28	26.7	1	5	0.5	1	1.1	1	1	+
Cestoda															
Philobythos atlanticus	34	32.4	1	2	0.4	25	23.8	1	3	0.3	18	20.0	1	2	0.3
Pseudophyllidea gen. sp.	3	2.9	1	1	+	—	—	—	—	—	—	—	—	—	—
Scolex pleuronectis l.	7	6.6	1	2	0.1	2	1.9	1	2	+	—	—	—	—	—
Trematoda															
Aporocotyle simplex	—	—	—	—	—	3	2.9	1	1	+	—	—	—	—	—
Derogenes varicus	—	—	—	—	—	1	1.0	1	1	+	—	—	—	—	—
Glomericirrus macrouri	8	7.6	1	2	0.1	9	8.6	1	2	0.1	12	13.3	1	2	0.2
Gonocerca macroformis	—	—	—	—	—	1	1.0	1	1	+	—	—	—	—	—
Gonocerca macrouri	13	12.4	1	3	0.2	21	20.0	1	84	1.2	24	26.7	1	12	0.8
Nematoda															
Anisakis sp. l.	1	1.0	1	1	+	16	15.2	1	3	0.2	3	3.3	1	2	+
Contracaecum aduncum	1	1.0	1	1	+	—	—	—	—	—	—	—	—	—	—
Contracaecum aduncum l.	1	1.0	1	1	+	4	3.8	1	2	+	3	3.3	1	2	+
Crustacea															
Chondracantus radiatus	—	—	—	—	—	1	1.0	1	1	+	—	—	—	—	—
Clavella adunca	—	—	—	—	—	9	8.6	1	1	0.1	3	3.3	1	1	+

life cycle. Myxosporidia and Trematoda (5 species each) were the most widely represented groups. The incidence of infection was highest for *Auerbachia pulchra* in all areas (47–87%) and somewhat less for *Myxidium melanostigmum* (35–41%) and *Philobythos atlanticus* (20–32%). Among the parasites found, four species (*Myxidium profundum*, *Diclidophora macruri*, *Glomericirrus macrouri* and *Gonocerca macrouri*) are specific to Macrouridae, and four species (*Myxidium melanocetum*, *M. melanostigmum*, *Auerbachia pulchra* and *Philobythos atlanticus*) are specific to deepwater fish only. These eight parasites characterize the parasitic fauna of roundnose grenadier, the remaining 10 species of parasites being common to a large variety of hosts which live at shallower depths.

The presence of parasites with a complex cycle of development indicates that roundnose grenadier feed both on pelagic animals, which are connected with the development of the cestode *Philobythos atlanticus* and the trematode *Glomericirrus macrouri*, and on benthic animals which are connected with the trematode *Gonocerca macrouri*. The low incidence of some common pelagic parasites (i.e. *Scolex pleuronectis* l., *Derogenes varicus*, *Contracaecum aduncum* and *Anisakis* sp.) probably occurred during diurnal vertical migrations of roundnose grenadier to the thermocline zone, where infected intermediate hosts such as copepods, euphausiids, sagittae, ctenophores and cephalopods were eaten. However, infestation by these parasites may have occurred through feeding on benthic animals such as amphipods, decapods and polychaetes, which are also known intermediate hosts of these parasites. The greater incidence of infestation by parasites whose intermediate hosts are pelagic animals and infection by a variety of Myxosporidia suggest that pelagic animals form a significant part of the diet. These observations agree with the results of feeding studies on roundnose grenadier in the Northwest Atlantic (Konstantinov and Podrazhanskaya, 1972; Podrazhanskaya, 1971; Savvatimsky, MS 1969, 1970).

Differences in the incidence of certain parasites in roundnose grenadier were evident in the samples from the three areas (Table 1). Fish of the northern group

(Davis Strait) were not infested by *Myxidium melanocetum*, but they were severely infested by *Auerbachia pulchra* (87%), moderately by *Myxidium melanostigmum* (36%) and *Philobythos atlanticus* (36%) and weakly by *Gonocerca macrouri* (12%) and some other parasites. Fish of the southern group (northern Grand Bank) were less infested by *Auerbachia pulchra* (51%) and *Philobythos atlanticus* (20%) but more heavily infested by *Myxidium melanostigmum* (41%), *Gonocerca macrouri* (27%) and *Glomericirrus macrouri* (13%). Spores of *Myxidium melanocetum*, absent in the northern group, were also found (19%). Infestation of fish of the central group (Labrador) was generally intermediate with respect to the dominant parasites, except for *Diclidophora macruri* and *Anisakis* sp. which were more prevalent than in either the northern or southern group.

These north to south trends in parasite incidence appear to be related to fish size and age in that most of the 42–70 cm fish were severly infested by *Auerbachia pulchra* in the northern area whereas 65–85 cm fish were infested in the southern area. In the case of *Gonocerca macrouri* and *Myxidium melanostigmum*, the larger fish (>65 cm) in the southern area were more heavily infested than the smaller northern fish. Examination of the data for each area by time of sampling indicated a high degree of similarity in the patterns of infestation (Table 2), the most significant exceptions being a decline in the occurrence of *Phillobythos atlanticus* in Davis Strait in the last period and the absence of *Anisakis* sp. also in the last period. The observed changes in infestation of fish by a group of parasites is probably related to migration of the fish, as they grow, from the northern to the southern areas. This supposition is indirectly confirmed by the fact that fish from the southern area are in general larger (mode 69–74 cm) than those from the northern area (mode 62–65 cm). Similar ecologies of roundnose grenadier in the three areas are indicated by the fact that 50% of the parasites occurred in all three areas and that 7 of 8 parasites specific to roundnose grenadier (excluding only *Myxidium melanocetum*) were also present.

Roughhead grenadier, *Macrourus berglax*

Twenty species of parasites were found in the 30 specimens of roughhead grenadier examined (Table 3), of which seven parasites in three groups (Myxosporidia, Monogenoidea and Crustacea) have a direct life cycle. Trematoda (six species) was the most widely represented group. The incidence of infection on Flemish Cap was highest for *Contracaecum aduncum* (73%) and somewhat lower for *Echinorhynchus gadi* (47%), *Clavella adunca* (47%) and *Clavellomimus macruri* (40%). The dominant parasites off southern Labrador were *Echinorhynchus gadi* (73%), *Contracaecum aduncum* (67%), *Genolinea laticauda* (53%) and *Gonocerca crassa* (53%). Among the parasites found, four species (*Davisia newfoundlandia*, *Zschokkella kudoi*, *Cyclocotyloides pinguis* and *Clavellomimus macruri*) are specific to roughhead grenadier, and two species (*Auerbachia pulchra* and *Philobythos atlanticus*) are specific to deepwater fish. The remaining parasites are quite common in a large variety of hosts.

The parasitic fauna of roughhead grenadier from the two areas (Table 3) are very different, due possibly to living conditions at the different depths from which the samples were taken: 400–600 m off southern Labrador and 1,200–1,400 m in the Flemish Cap area. The relatively few parasites in the Flemish Cap specimens

TABLE 2. Percentage infestation of roundnose grenadier, *Coryphaenoides rupestrus*, by time of capture and area in the Northwest Atlantic.

	November–December 1974			January 1975			November–December 1975		
Parasite	Davis St.	Labrador	Grand Bank	Davis St.	Labrador	Grand Bank	Davis St.	Labrador	Grand Bank
Auerbachia pulchra	86.7	48.8	60.0	93.3	40.0	40.0	80.0	50.0	53.3
Myxidium melanocetum	—	4.4	16.7	—	—	20.0	—	6.6	20.0
Myxidium melanostigmum	40.0	33.3	46.7	33.3	33.3	36.6	33.3	40.0	40.0
Myxidium profundum	8.9	8.9	13.3	20.0	20.0	20.0	10.0	13.3	20.0
Zschokkella hildae	—	2.2	—	—	—	—	—	—	—
Diclidophora macruri	15.6	26.6	3.3	13.3	26.6	—	13.3	26.6	—
Philobythos atlanticus	40.0	17.8	13.3	40.0	33.3	33.3	13.3	23.3	13.3
Pseudophyllidea gen. sp.	2.2	—	—	6.6	—	—	—	—	—
Scolex pleuronectis l.	2.2	—	—	13.3	—	—	6.6	6.6	—
Aporocotyle simplex	—	2.2	—	—	3.3	—	—	3.3	3.3
Derogenes varicus	—	2.2	—	—	—	—	—	—	—
Glomericirrus macrouri	6.6	6.6	3.3	6.6	13.3	16.6	10.0	6.6	20.0
Gonocerca macroformis	—	2.2	—	—	—	—	—	—	—
Gonocerca macrouri	13.3	26.6	33.3	6.6	13.3	13.3	16.6	16.6	33.3
Anisakis sp. l.	2.2	17.8	3.3	—	26.6	—	6.6	—	6.6
Contracaecum aduncum	2.2	—	—	—	—	—	—	—	—
Contracaecum aduncum l.	2.2	4.4	3.3	—	—	—	—	13.3	6.6
Chondracantus radiatus	—	2.2	—	—	—	3.3	—	—	—
Clavella adunca	4.4	6.6	3.3	6.6	13.3	—	6.6	6.6	6.6
No. of grenadier examined	45	45	30	30	30	30	30	30	30

TABLE 3. Parasitic fauna of roughhead grenadier, *Macrourus berglax*, in the Northwest Atlantic.

	Flemish Cap (15 spec.)					S. Labrador (15 spec.)				
	Specimens infested		Intensity of infestation			Specimens infested		Intensity of infestation		
Parasites	No.	%	Min	Max	Mean	No.	%	Min	Max	Mean
Myxosporidia										
Auerbachia pulchra	2	13.3	+	+	+	7	46.6	+	+	+
Davisia newfoundlandia	—	—	—	—	—	1	6.6	+	+	+
Zschokkella kudoi	—	—	—	—	—	4	26.6	+	+	+
Monogenoidea										
Cyclocotyloides pinguis	2	13.3	1	2	0.2	—	—	—	—	—
Cestoda										
Philobythos atlanticus	—	—	—	—	—	2	13.3	1	1	0.1
Pseudophyllidea gen. sp.	—	—	—	—	—	1	6.6	3	3	0.2
Scolex pleuronectis l.	—	—	—	—	—	3	20.0	1	20	2.3
Trematoda										
Derogenes varicus	2	13.3	1	1	0.1	2	13.3	1	2	0.2
Genolinea laticauda	—	—	—	—	—	8	53.3	1	24	3.7
Gonocerca crassa	—	—	—	—	—	8	53.3	1	6	1.5
Hemiurus levinseni	—	—	—	—	—	1	6.6	1	1	0.1
Lepidapedon elongatum	—	—	—	—	—	2	13.3	1	1	0.1
Lecithophyllum bothryophorum	—	—	—	—	—	1	6.6	1	1	0.1
Nematoda										
Anisakis sp. l.	—	—	—	—	—	2	13.3	1	6	0.5
Capillaria kabatai	—	—	—	—	—	3	20.0	2	63	6.5
Contracaecum aduncum	11	73.3	1	4	1.1	10	66.6	1	64	11.1
Contracaecum aduncum l.	—	—	—	—	—	6	40.0	1	75	5.4
Acanthocephala										
Echinorhynchus gadi	7	46.6	2	8	2.0	11	73.3	1	48	11.8
Crustacea										
Clavella adunca	7	46.6	1	2	0.5	7	46.6	1	4	0.8
Clavellomimus macruri	6	40.0	1	2	0.5	1	6.6	6	6	0.4
Rebelula bonvieri	1	6.6	1	1	0.1	1	6.6	1	1	0.1

indicates a restricted diet, composed of amphipods which are the intermediate hosts of *Echinorhynchus gadi* and various fish species which are the hosts of *Contracaecum aduncum*. Parasites common in fish from shallower depths were almost completely absent in the Flemish Cap specimens, indicating a high degree of isolation of these fish. The parasitic fauna of the southern Labrador specimens was more diverse, comprising six trematode species and other groups with a complex cycle of development, which indicates broad trophic relations among the fish of the area. Benthic animals (amphipods and polychaetes) and fish appear to be very important in the diet, as they are the intermediate hosts of *Genolinea laticauda*, *Gonocerca crassa*, *Lepidapedon elongatum*, *Echinorphynchus gadi*, *Contracaecum aduncum*, and possibly *Derogenes varicus*. According to Savvatimsky (MS 1969), fish (12–14%), amphipods (13%) and polychaetes (5%) are important in the diet of roughhead grenadier from the Labrador area, and Geistdoerfer (1976) indicated that amphipods and polychaetes comprised 20 and 17% of the diet respectively. As indicated by the low incidence of *Philobythos atlanticus*, *Scolex pleuronectis*, *Hemiurus levinseni* and *Anisakis* sp., pelagic animals which are intermediate hosts of these parasites are insignificant in the diet of roughhead grenadier. In view of the substantial qualitative and quantitative between-area differences in infestation by parasites, it is likely that there are at least two populations of roughhead grenadier in the areas investigated.

Common grenadier, *Nezumia bairdi*

Eleven species of parasites were found in the 23 specimens of common grenadier examined (Table 4), only two of which (*Auerbachia pulchra* and *Myxidium profundum*) have a direct life cycle. Trematoda and

TABLE 4. Parasitic fauna of common grenadier, *Nezumia bairdi*, in the Northwest Atlantic.

	Flemish Cap (16 spec.)					S. Labrador (7 spec.)				
	Specimens infested		Intensity of infestation			Specimens infested		Intensity of infestation		
Parasites	No.	%	Min	Max	Mean	No.	%	Min	Max	Mean
Myxosporidia										
Auerbachia pulchra	1	6.2	+	+	+	—	—	—	—	—
Myxidium profundum	6	37.5	+	+	+	—	—	—	—	—
Cestoda										
Grillotia erinaceus I.	3	18.8	1	6	0.8	—	—	—	—	—
Scolex pleuronectis I.	—	—	—	—	—	7	100.0	12	83	34.4
Trematoda										
Derogenes varicus	1	6.2	1	1	0.1	—	—	—	—	—
Genolinea laticauda	—	—	—	—	—	2	28.6	1	2	0.4
Glomericirrus macrouri	1	6.2	1	1	0.1	—	—	—	—	—
Nematoda										
Capillaria kabatai	4	25.0	2	8	1.2	3	42.9	1	7	1.4
Contracaecum aduncum I.	9	56.3	2	9	2.9	1	14.3	1	1	0.1
Terranova decipiens	—	—	—	—	—	3	42.9	1	3	0.9
Acanthocephala										
Echinorhynchus gadi	1	6.2	2	2	0.1	—	—	—	—	—

Nematoda (three species each) were the most widely represented groups. The incidence of infestation was highest for *Contracaecum aduncum* I. (50%) in the Flemish Cap area and for *Scolex pleuronectis* I. (100%) off southern Labrador.

The parasitic fauna of common grenadier from the two areas are quite different, due possibly to the different depths from which the specimens were taken: 400–450 m off southern Labrador and 1,100–1,130 m in the Flemish Cap area. However, in contrast to the pattern for roughhead grenadier, a greater varity of parasites occurred in specimens from Flemish Cap. Peculiarly, the Labrador specimens were infested only by those parasites with cycles of development related to planktonic organisms. Plankton is also an important part of the diet in the Flemish Cap area, as indicated by the high incidence of *Contracaecum aduncum* I., but they may also feed on benthos, as indicated by the occurrence of *Echinorhynchus gadi*. In general, the common grenadier may be considered as a typical plankton eater, as evidenced from the parasitic fauna. The between-area differences in infestation by parasites indicate that the samples were very likely from two separate populations of common grenadier.

Chalimura brevibarbis

One specimen of this species was caught in the Flemish Cap area, and spores of the myxosporidian *Auerbachia pulchra* were found in the gall bladder.

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