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Metazoan Parasites of Northwest Atlantic Redfishes (*Sebastes* spp.)

by

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Abstract

Four hundred and forty-three redfishes (209 Sebastes fasciatus, 123 S. marinus and 111 S. mentella) obtained from NAFO Divisions (2H, 2J, 3K, 3L, 3M, 3O and 3Ps) during 1980-82 were examined for metazoan parasites, with 182 (87.1%) S. fasciatus, 120 (97.6%) S. marinus and 103 (92.8%) S. mentella being infected.

Seventeen species of parasites were recovered (12 from S. fasciatus, 16 from S. marinus and 11 from S. mentella), 22 of which were new host records. Quantitative data, including prevalence and intensity of infection, are given for each parasite by host species and NAFO Division.

Introduction

Redfishes, Sebastes fasciatus, S. marinus and S. mentella compose the third largest groundfish nominal catch in the Northwest Atlantic (NAFO 1980). Unfortunately due to the confusion associated with redfish systematics in past decades (Templeman and Sandeman 1957; Barsukov 1968, 1972; Barsukov and Zakharov 1972; Litvinenko 1974, 1980; Templeman 1980) and the great depths at which these fish live, it is not surprising that little is known about their biology, movement and to a lesser degree, their parasite fauna. However, NI (1982a and b) and NI and McKone (1983) reported on the area - depth distribution of each species in the

Northwest Atlantic and proposed hypothetical stock units.
Jones (1970) and Gaevskaya and Umnova (1977) reported on the parasite fauna of S. marinus and S. mentella respectively in the Atlantic. Other workers (Sinderman 1959, Templeman 1960, Yanulov 1962) reported on selected parasites of redfish with the idea of stock discrimination in mind. Unfortunately, the data from these studies are of limited use as S. fasciatus could not be separated confidently from S. mentella until the work of NI (1981a and b) and smaller S. marinus could not be identified faithfully till Power and NI (1982). Therefore past records of the parasites of different species of redfish may be erroneous.

This study is the first quantitative study on the Northweest Atlantic Sebastes spp. and the first study to report on the parasites of S. fasciatus. Realizing the aforementioned facts and the renewed possibility of stock discrimination, a pilot study was initiated to ascertain the parasite fauna of each species and to determine if any previously unrecorded parasites could further our knowledge of redfish as far as their biology is concerned.

Materials and Methods

A total of 443 specimens of three redfish species (209 S. fasciatus, 123 S. marinus, and 111 S. mentella) were examined for metazoan parasites. These specimens were collected from 7 NAFO divisions (see Fig. 1) at various depths and dates (Table 1) during Canadian research groundfish surveys. Depth data are given on the collection of redfish as each species exhibits a depth preference.

For aid in identification of parasites, 30 redfish were eviscerated at sea and their alimentary tracts were frozen in a dry ice-ethanol mixture. These alimentary tracts were then placed in separate plastic bags and deep frozen with their respective fish. The remainder of

the specimens were deep frozen, within 60 min. of capture, and later thawed prior to laboratory examination.

Fork length, sex and weight data were obtained for each host. The alimentary tract of each fish was removed and divided into sections: esophagus, stomach, pyloric caecae, intestine (anterior, middle, and posterior) and rectum. These sections, as well as the various organs, were then placed in individual petri dishes in normal saline awaiting examination under a dissecting microscope. Parasites were preserved in 70% ethanol or 70% glycerine alcohol. Nematodes were identified in temporary mounts of glycerine. All other helminths were stained with Borax Carmine and/or Mallory's Trichome stain and mounted in Canada Balsam. To verify identifications, specimens of all helminths except nematoda and monogenea were sectioned. Copepoda were either identified whole or cleared and mounted in Canada Balsam.

The redfish species were identified utilizing the extrinsic gasbladder musculature (NI 1981a, Power and NI 1982). While dissecting the gasbladder muscle, the left fillet of each fish was macroscopically examined for old heads of Sphyrion lumpi and encysted larval nematodes.

Results and Discussion

Parasitological investigation of 443 specimens of three redfish species revealed 17 species of parasites belonging to six taxonomic groups: Monogenea (1), Digenea (7), Nematoda (3), Cestoda (3), Acanthocephala (1) and Copepoda (2).

Table 2 summarizes data on the number of infections and prevalence of parasites of each host species by individual parasites. Of the 17 species of parasites recovered, S. marinus harboured 16 with an overall prevalence of 97.6% while S. fasciatus harboured 12 with an overall prevalence of 87.1% and S. mentella harboured 11 with an overall prevalence of 92.8%. This study yielded 6 new host records for S. marinus and S. mentella respectively (see Table 2). This is the first parasitological study on S. fasciatus and, therefore, all parasites recovered are new host records. The likelihood ratio chi-square G^2 test (the BMPD4F program, Dixon et al. 1981) revealed a significant difference in the prevalence of parasites of each host species ($p<0.001$).

It is evident that there are many pronounced differences in the occurrence, intensity of infection, prevalence and mean intensity of individual parasites in different hosts in different areas (Tables 3, 4, and 5). Some possible reasons for these differences may be: differenes in the biology of host species i.e. diet, movements etc.; the fact that many specimens were collected at less than optimal depth for their species (refer to Table 1); the time span over which collections were made, and the size range of the hosts may influence their parasite fauna. However, it appears that redfish in Div. 3M (Flemish Cap) appear to be a separate group unto themselves; this is illustrated by the high prevalence and mean intensity of Contracaecum sp., the majority of which were encysted. This evidence supports the hypothesis of NI (1982, 1983) that separate stocks of each redfish species exist on the Flemish Cap. In addition, the prevalence of parasites for each host species in Divisions 2H, 2J, 3K and 3L are most closely associated to fish within these areas than to fish in other areas (Tables 3-5). While this study is inconclusive to the stocks of redfish that exist it seems likely the redfish in areas 3M and 2H, 2J, 3K and 3L form separate two stocks. However to fully realize this potential more work is needed on the effect of depth, season and area on the parasite burden of redfish. The use of parasites as indicators of redfish stocks is of even more importance when one realizes that tagging is impossible (due to the great depths at which these fish live) in Sebastes off eastern Canada.

Redfish seem to have a noteworthy parasite fauna; of the 17 species of parasites harboured by redfish, only 1, C. nodosus, is known to be restricted to the genus Sebastes. However, S. lumpi (in the Northwest Atlantic) and Microcotyle (in the Pacific) are commonly encountered parasites of Sebastes and can be considered characteristic of this genus. Of the other 14 parasites, 4 were larval forms that mature in other hosts (mammals or birds, elasmobranchs and other fish) e.g. Anisakis, Contracacecum, Scolex and Acanthocephala. Of the remaining 10, 8 have little apparent host specificity and are found as adults in other fish while Opecoelidae and Abothrium are somewhat restricted. Therefore, Sebastes in the Northwest Atlantic harbour one strictly host specific parasite, two species which show a high affinity for Sebastes, four larval forms, and 10 forms which use a variety of fish for definitive hosts. This pattern follows the general trend that parasites of northern marine fish exhibit a broad range of host specificity Poljansky (1955) and, hence, all parasites recorded in this study may not be equally adapted to redfish.

When life-cycles of these parasites are considered, we see that 3 have a direct life-cycle (i.e. the ectoparasites) and the other 14 have complex life-cycles. The intermediate hosts of all these are pelagic invertebrates (Euphasiids, Amphipods, and Copepods, etc.), thereby suggesting that the major diet of Sebastes in the Northwest Atlantic is pelagic in nature. The work of Konchina (1970) verifies that pelagic material is very important in the diet of Northwest Atlantic redfish.

In discussing the parasites of Sebastes spp. S. marinus in Barents Sea shares seven genera and two species of parasites with S. marinus in the Northwest Atlantic. The majority of Sebastes species occur in the Pacific where their parasite faunae are more varied (i.e. S. alutus has had 46 species of metazoan parasites recorded from it (see Margolis and Arthur 1979)). However, there is a high degree of similarity among the parasites of Pacific and Atlantic redfish as most genera present in the Atlantic occur in Pacific redfish, as well as some species. Previous studies on northern marine fish parasites indicate a high degree of association between North Pacific and North Atlantic waters with fewer endemics in the latter (Polyansky 1955, Manter 1955, 1967, Appy and Burt 1982). This with the number of endemic species of parasites present in redfish in the Pacific seems to agree with the hypothesis of Barsukov and Zaharov (1972) that Atlantic redfish came from a Pacific stock of redfish.

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Table 1. Collection details and length of redfish (Sebastes spp.) examined in the study.

NAFO Division	Species	No. of specimens	Approx. depth of capture (m)	Collection date	Fork length range in cm ($\bar{X}$)
2H	S. fasciatus	1	505-506	Oct. 81	24 (24)
	S. mentella	18	505-506	Oct. 81	23-38 (29)
2J	S. fasciatus	14	240-292	Nov. 82	23-31 (26)
	S. marinus	21	236-420	Nov. 82	29-60 (44)
	S. mentella	32	236-426	Nov. 82	20-37 (29)
3K	S. fasciatus	2	686-702	Nov. 81	27 (27)
	S. marinus	16	307-309	Nov. 82	37-53 (47)
	S. mentella	44	686-702	Nov. 81	27-42 (34)
3L	S. fasciatus	24	291-301	Nov. 81	23-41 (34)
	S. marinus	16	291-301	Nov. 81	32-46 (37)
3M	S. fasciatus	48	255-269	Feb. 82	27-40 (33)
	S. marinus	31	255-269	Feb. 82	33-52 (46)
	S. mentella	4	255-269	Feb. 82	32-35 (46)
3Ø	S. fasciatus	54	404-560	Sept. 81	22-39 (28)
	S. mentella	9	404-560	Sept. 81	33-40 (35)
3Ps	S. fasciatus	66	147-472	June 82	13-49 (27)
	S. marinus	39	147-472	June 82	23-58 (43)
	S. mentella	4	147-472	June 82	30-41 (36)

Table 2. Number of infections and prevalence of metazoan parasites of Sebastes spp.

	S. fasciatus (n=209)	S. marinus (n=123)	S. mentella (n=111)
Monogenea			
Microcotyle templemani	-	3(2.4)*	-
Digenea			
Brachyphallus crenatus	-	1(0.8)	-
Derogenes varicus	19(9.1)*	56(45.5)	15(13.5)*
Hemiurus sp.	10(4.8)*	15(12.1)	5(4.5)
Lecithaster gibbosus	2(1.0)*	19(15.4)*	2(1.8)*
Lecithophyllum botryophorum	17(8.1)*	28(22.7)	17(15.3)*
Podocotyle reflexa	48(22.9)*	86(69.9)	46(41.4)
Opecoelidae	-	1(0.8)	-
Nematoda			
Anisakis sp. l.	73(34.9)*	81(65.9)	64(57.7)
Contracaecum sp. l.	85(40.2)*	63(51.2)	18(16.2)
Hysterothylacium aduncum	1(0.5)*	3(2.4)	6(5.4)*
Cestoda			
Abothrium sp.	-	1(0.8)*	-
Bothriocephalus scorpii	28(13.4)*	27(21.9)*	29(26.1)*
Scolex pleuronectis l.	23(11.0)*	31(25.2)*	26(23.4)*
Acanthocephala l.	2(1.0)*	2(1.6)*	-
Copepoda			
Chondracanthus nodosus	4(1.9)*	28(22.7)	-
Sphyrion lumpi	-	-	7(6.3)

*Indicates new host record.

Table 3. Infection details for *Sebastes fasciatus* by NAFO area (sample size).

	2H(1)				2J(14)				3K(2)				3L(24)			
	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean
Digenea																
Derogenes varicus	-	-	-	-	9	64.3	1-5	1.9	-	-	-	-	10	41.7	1-4	2.3
Hemiuris sp.	-	-	-	-	6	42.9	1-3	1.7	-	-	-	-	-	-	-	-
Lecithaster gibbosus	-	-	-	-	-	-	-	-	-	-	-	-	2	8.3	1-3	2.0
Lecithophyllum botryophorum	-	-	-	-	-	-	-	-	-	-	-	-	1	4.2	2	2.0
Podocotyle reflexa	-	-	-	-	9	64.3	1-4	1.9	1	50.0	2	2.0	20	83.3	1-5	2.1
Nematoda																
Anisakis sp. l.	-	-	-	-	-	-	-	-	2	100.0	1-2	1.5	13	54.2	1-25	4.3
Contracaecum sp. l.	-	-	-	-	4	28.6	1-3	1.8	1	50.0	1	1.0	2	8.3	1-3	2.0
Hysterothylacium aduncum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cestoda																
Bothriocephalus scorpii	1	100.0	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Scolex pleuronectis l.	-	-	-	-	3	21.4	1-4	2.0	-	-	-	-	13	54.2	1-65	16.2
Acanthocephala l.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copepoda																
Chondracanthus nodusus	-	-	-	-	1	7.1	1	1.0	-	-	-	-	2	8.3	1-2	1.5

Table 3. (Cont'd.)

	3M(48)				3Ø(54)				3Ps(66)			
	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean
Digenea												
Derogenes varicus	-	-	-	-	-	-	-	-	10	15.2	1-3	1.3
Hemiurus sp.	-	-	-	-	-	-	-	-	4	6.1	1-3	2.5
Lecithaster gibbosus	-	-	-	-	-	-	-	-	2	3.0	1-2	1.5
Lecithophyllum botryophorum	-	-	-	-	14	25.9	1-8	2.1	3	4.5	1-9	4.0
Podocotyle reflexa	8	16.7	1-5	1.6	9	16.7	7-2	1.2	23	34.8	1-4	2.2
Nematoda												
Anisakis sp. l.	14	29.2	1-3	1.3	26	48.2	1-6	21	18	27.3	1-8	2.8
Contracaecum sp. l.	48	100.0	1-103	33.4	7	13.0	1-2	1.3	22	33.3	1-5	1.7
Hysterothylacium aduncum	1	2.1	1	1.0	-	-	-	-	-	-	-	-
Cestoda												
Bothriocephalus scorpii	22	45.8	1-5	2.3	4	7.4	1	1.0	1	1.5	1	1.0
Scolex pleuronectis l.	-	-	-	-	7	13.0	1-5	-	-	-	-	-
Acanthocephala l.	-	-	-	-	2	3.7	1	1.0	-	-	-	-
Copepoda												
Chondracanthus nodusus	1	2.1	1	1.0	-	-	-	-	-	-	-	-

Table 4. Infection details for *Sebastes marinus* by NAFO area (sample size).

	2J(21)				3K(16)				3L(16)				3M(31)				3Ps(39)			
	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean
Monogenea																				
Microcotyle templemani	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3.5	1-2	1.3
Digenea																				
Brachyphallus crenatus	-	-	-	-	1	6.3	2	2.0	-	-	-	-	-	-	-	-	-	-	-	-
Derogenes varicus	12	57.1	1-5	1.8	4	25.0	1-5	2.3	5	31.3	1-2	1.6	7	22.6	1-4	2.1	31	79.8	1-10	3.5
Hemiurus sp.	5	23.8	1-3	2.0	-	-	-	-	-	-	-	-	-	-	-	-	10	25.6	1-11	2.5
Lecithaster gibbosus	5	23.8	1-2	1.2	7	43.6	1-8	3.0	6	37.5	1-3	2.3	-	-	-	-	1	2.6	1	1.0
Lecithophyllum botryophorum	3	14.3	1-2	1.7	7	43.6	1-27	11.0	-	-	-	-	7	22.6	1-5	1.6	11	28.2	1-7	2.0
Podocotyle reflexa	17	80.9	1-19	5.9	15	93.8	1-20	7.7	9	56.3	1-4	3.2	6	19.4	1-2	1.2	39	100.0	1-27	6.9
Opecoelidae	1	4.8	3	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nematoda																				
Anisakis sp. l.	7	33.3	1-431	91.4	13	81.3	3-82	24.3	4	25	1-3	1.3	25	27.8	1-18	5.2	32	82.1	1-22	6.3
Contracaecum sp. l.	4	19.0	1-2	1.2	8	50.0	1-4	1.8	3	18.8	1	1.0	28	80.6	1-89	23.4	22	56.4	1-9	2.7
Hysterothylacium aduncum	2	9.5	1-5	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cestoda																				
Abothrium sp.	1	4.8	2	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bothriocephalus scorpii	5	23.8	1-3	2.4	4	25.0	1-4	1.8	1	6.3	2	2.0	12	38.7	1-31	11.1	5	12.8	1-2	1.2
Scolex pleuronectis l.	9	42.9	1-9	4.0	9	56.3	1-32	5.4	11	66.7	1-22	8.0	1	1.5	1	1.0	1	2.6	1	1.0
Acanthocephala l.	-	-	-	-	1	6.3	2	2.0	1	6.3	1	1.0	-	-	-	-	-	-	-	-
Copepoda																				
Chondracanthus nodusus	12	57.1	1-4	2.1	7	43.6	1-3	1.7	5	31.3	1-2	1.2	2	3.1	1	1.0	2	6.5	1	1.0

Table 5. Infection details for *Sebastes mentella* by NAFO area (sample size).

	2H(18)				2J(32)				3K(44)			
	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean
Digenea												
Derogenes varicus	4	22.2	1-3	2.0	3	9.4	1-5	2.7	7	16.0	1-2	1.1
Hemiurus					5	15.6	1-6	2.0	-	-	-	-
Lecithaster gibbosus	-	-	-	-	2	6.3	1	1.0	-	-	-	-
Lecithophyllum botryophorum	2	11.1	1-2	1.5	5	15.6	1-5	1.8	-	-	-	-
Podocotyle reflexa	10	55.6	1-13	3.8	16	50.0	1-9	1.9	15	34.1	1-3	1.8
Nematoda												
Anisakis sp. l.	12	66.7	1-7	2.5	10	31.2	1-24	6.1	31	70.5	1-18	5.5
Contracaecum sp. l.	3	16.7	1	1.0	4	12.5	1-2	1.3	5	11.4	1	1.0
Hysterothylacium aduncum					1	3.1	1	1.0	2	4.5	1	1.0
Cestoda												
Bothriocephalus scorpii	6	33.3	1-7	2.3	8	25.0	1-6	1.9	12	27.3	1-6	1.7
Scolex pleuronectis l.	3	16.7	1-9	4.0	11	34.4	1-5	2.3	11	25.0	1-3	1.1
Copepoda												
Sphyrion lumpi	-	-	-	-	2	6.3	1	1.0	5	11.4	1-2	1.4

Table 5. cont'd.

	3M(4)				3Ø(9)				3Ps(4)			
	No.	%	Range	Mean	No.	%	Range	Mean	No.	%	Range	Mean
Digenea												
Derogenes varicus	-	-	-	-	1	11.1	1	1.0	-	-	-	-
Hemiurus	-	-	-	-	-	-	-	-	-	-	-	-
Lecithaster gibbosus	-	-	-	-	-	-	-	-	-	-	-	-
Lecithophyllum botryophorum	-	-	-	-	8	88.9	1-11	3.6	2	50.0	1-10	5.5
Podocotyle reflexa	-	-	-	-	3	33.3	3	3.0	2	50.0	1-5	3.0
Nematoda												
Anisakis sp. l.	-	-	-	-	9	100.0	1-12	4.2	2	50.0	2-9	5.0
Contracaecum sp. l.	4	100.0	1-41	30.7	2	3.7	2-14	8.0	-	-	-	-
Hysterothylacium aduncum	-	-	-	-	1	11.1	1	1.0	-	-	-	-
Cestoda												
Bothriocephalus scorpii	2	50.0	1-4	2.5	1	11.1	1	1.0	-	-	-	-
Scolex pleuronectis l.	-	-	-	-	1	11.1	2	2.0	-	-	-	-
Copepoda												
Sphyrion lumpi	-	-	-	-	-	-	-	-	-	-	-	-

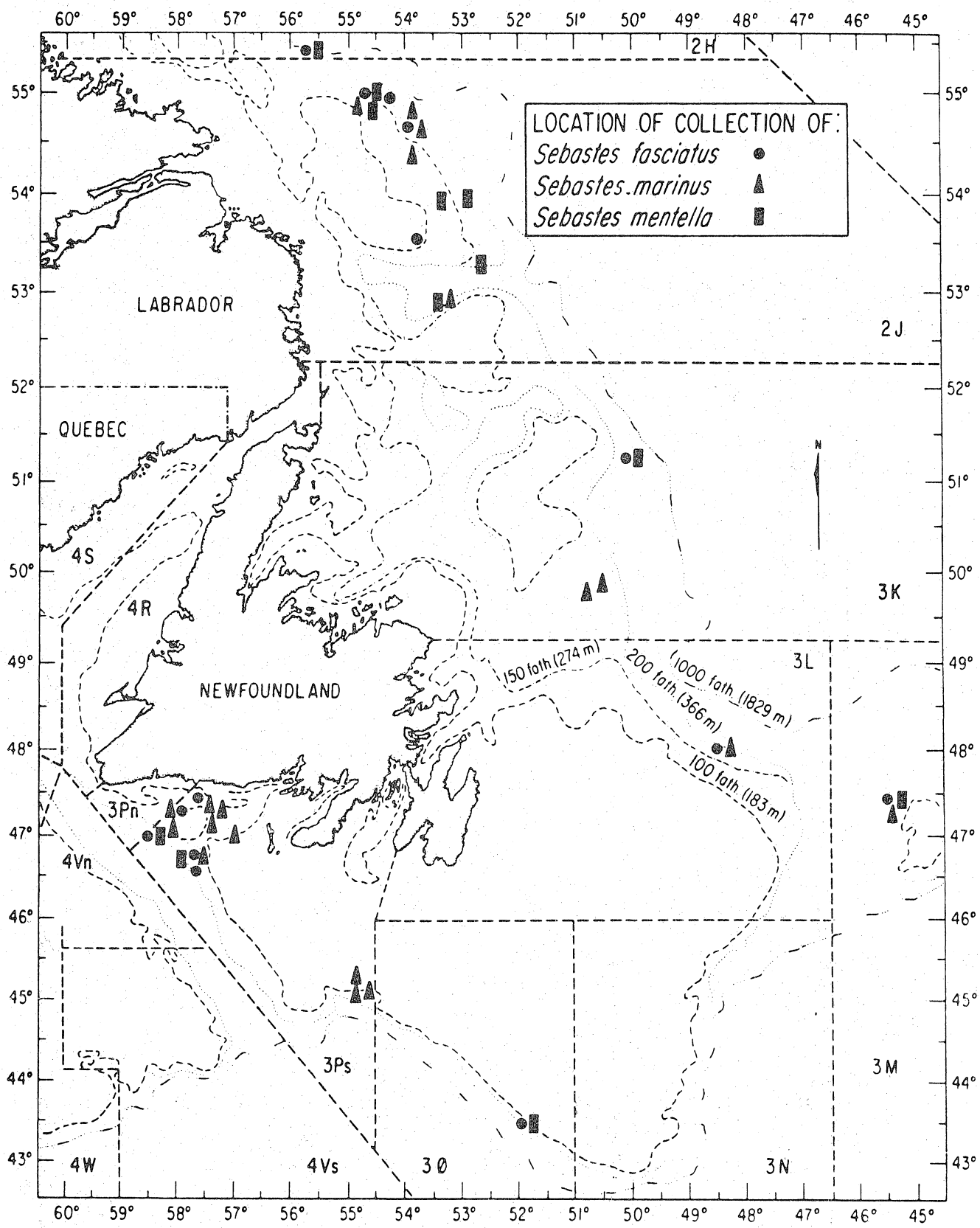

Fig. 1. Details of NAFO Divisons and capture areas of Sebastes examined in this study.