Nematodes in cod collected from NAFO Division 2J, 3K, 3L and 3Ps in autumn, 1983

by

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ABSTRACT

Cod from eastern and southern Newfoundland waters were examined to determine occurrence and abundance of nematodes in fillets and napes and to compare results with those of an earlier study. From the 1101 cod examined nematodes were found in 5% of the fillets and 20% of the napes. Approximately 85% of the total numbers of nematodes found were located in the napes. There was no significant difference in the rate of infestation by nematodes in cod fillets in the present study as compared with the earlier study. Anisakis was the predominant nematode in the napes while Phocanema was the most abundant nematode in the fillets.

RÉSUME

On a examiné des morues provenant des eaux situées à l'est et au sud de Terre-Neuve pour dénombrer les nématodes dans les filets et les nuques et comparer ces résultats à ceux d'une étude antérieure. Sur les 1 101 morues examinées, on a trouvé des nématodes dans 5 % des filets et dans 20 % des nuques. Environ 85 % de tous les nématodes se trouvaient dans les nuques. Le taux d'infestation par les nématodes des filets de morue était peu différent de celui de l'étude précédente. L'Anisakis est le nématode dominant dans les nuques tandis que c'est le Phocanema qui domine dans les filets.

INTRODUCTION

To determine whether any trend was apparent in the abundance of nematodes in cod off eastern and southern Newfoundland since the study of Templeman et al. (1957), samples of napes and fillets were examined especially for the presence of Anisakis simplex and Phocanema decipiens.

MATERIALS AND METHODS

Cod were collected from research vessel catches in NAFO Div. 2J,3K, and 3L and from an inshore vessel in Div. 3Ps (Table 1). The geographical positions from which samples were taken (Fig. 1) indicate cod were taken widely over the area except in Div. 3Ps. Fish were selected over a wide range of lengths (14-141 cm), but attention here is given only to cod of 41 cm and greater for ease of comparison with the findings of Templeman et al. (1957). Skinned napes and fillets were examined over glass using two 100 watt bulbs. All fillets except the smaller ones were sliced into thin strips during the course of the examination and the location of nematodes in the flesh was recorded on a grid (Fig. 2). Duplication of the methodology for finding nematodes in the flesh described by Templeman et al. (1957) was assured by strict adherance to advice received from several workers who had been directly involved in examination of cod for that study. Weights of fillets and napes were recorded separately to the nearest tenth of a gram. Nematodes were preserved in alcohol for later identification.

RESULTS

NUMBER OF NEMATODES FOUND

Of the 1101 cod examined, about 5% had nematodes in the fillets and about 20% had nematodes in the napes (Table 2). There were 83 nematodes in the fillets and 461 in the napes. Thus about 85% of the nematodes found were located in the napes. Of the 842 cod measuring 41 cm and greater, 46(5%)had nematodes in the fillets and 258(24%) had nematodes in the napes. There were 67 nematodes in the fillets and 443 in the napes. For cod of 41 cm and greater, about 84% of the nematodes found were located in the napes.

The nematodes in the napes are apparently not localized (Fig. 2). Since the total number of nematodes found in the fillets was only 83, a figure from Templeman et al. (1957) is included to show the distribution of nematodes in fillets (Fig. 3). In their study, most nematodes tended to be in an arc in the foreward part of the fillet roughly contiguous with the position of the napes; the results of this study conform with the earlier study although they suggest that a slightly larger proportion of the nematodes in this study were located nearer the posterior end of the fillet (Fig. 2 and 3).

COMPARISON OF RESULTS WITH THOSE OF TEMPLEMAN ET AL (1957) FOR FILLETS FROM COD OF 41 CM AND GREATER

The percent of cod with infested fillets was very similar to that found by Templeman et al (1957) for each of the NAFO Divisions (Table 3). The average number of nematodes in the fillets was similar in NAFO Div. 2J,3K, and 3L but in NAFO Subdiv. 3Ps the average reported by Templeman et al (1957) was significantly higher than that of the present study (Table 4). Ratio estimates of the number and associated standard deviations of worms per kg of fish and corresponding results from the study by Templeman et al. (1957) are given in Table 5. The analyses indicate that values for Div. 3K, 3L and Subdiv. 3Ps are similar while that for Div. 2J is significantly less in the present study.

RELATIVE NUMBERS OF NEMATODES IN NAPES AND FILLETS

It is quite clear that the proportion of cod infested and the average number of nematodes found is much greater in the napes than in the fillets (Table 6 & Fig. 2). When the difference in weight of napes and fillets is considered, the intensity of infestation per kilogram of flesh ranges from 10 times to 86 times greater in the napes than in the fillets (Table 6). In the present study it was determined that there was no statistical correlation between the number of nematodes in the napes and in the fillets of each fish (Table 7). Thus, numbers of nematodes from one portion of the flesh cannot be used as an indication of the number in the other.

SPECIES COMPOSITION OF THE NEMATODES FOUND

The two major species of nematodes found were Anisakis simplex and Phocanema decipiens. The napes were infested more heavily by Anisakis than by Phocanema by a factor of 3 in Div. 3K and a factor of about 10 in the other Divisions (Table 8). There were very few of both Anisakis and Phocanema in the fillets from all Subdivisions except 3Ps, where about 4% of cod examined were infested with Anisakis compared with about 14% with Phocanema (Table 9). From the present study it was determined using correlation analysis that there was little or no relationship between the number of Phocanema and Anisakis present in each fish (Table 10).

CONCLUSIONS

1) There was no significant difference in the rate of infestation by nematodes in cod fillets in the present study as compared to that of Templeman et al (1957) for cod 41 cm and greater except in Subdivision 3Ps where the current rate is lower.
2) Napes were more heavily infested with nematodes than are fillets.
3) Anisakis is the predominant nematode in the napes but is of low incidence in the fillets.
4) There is little or no relationship between the number of nematodes in the napes and the fillets or between the number of Phocanema and Anisakis per fish.

REFERENCE

Templeman, W., H.J. Squires, and A.M. Fleming. 1957. Nematodes in the Fillets of Cod and other Fishes in Newfoundland and neighbouring areas. J. Fish. Res. Bd. Canada. 14(6). pp. 831-897.

Table 1. Place, time, and method of capture of cod examined for nematodes

NAFO Division	Ship	Trip	Dates(1983)	Gear	Number of Cod
2J	Gadus Atlantica	86	Oct.30-Nov.09	Otter Trawl	280
	"	87	Nov.10-Nov.14	Otter Trawl	58
3K	Gadus Atlantica	87	Nov.17-Nov.22	Otter Trawl	156
	"	88	Nov.27-Dec.03	Otter Trawl	208
3L	Wilfred Templeman	7	Oct.13-Oct.17	Otter Trawl	56
	"	8	Oct.21-Oct.31	Otter Trawl	58
	"	9	Nov.11-Nov.14	Otter Trawl	134
3Ps	Inshore	-	Sept.26-Sept.29	Linetrawl	151
All areas combined					1101

Table 2. Number of nematodes in cod fillets and napes.

A. All cod.

NAFO Div.	Number of Cod Examined	Number of Cod With Nematodes in Fillets	Number of Nematodes in Fillets	Weights of Fillets (KG)	Number of Cod with nemtodes in napes	Number of nematodes in napes	Weight of napes (KG)
2J	338	13	15	225.2	47	87	59.2
3K	364	10	11	259.2	96	147	73.5
3L	248	5	6	172.6	66	108	50.3
3Ps	151	30	51	67.7	64	119	17.8
Total	1101	58	83	724.7	273	461	200.8

B. Cod of 41 cm and larger

2J	247	7	8	215.8	44	83	56.9
3K	286	9	10	250.9	94	145	71.4
3L	169	3	4	165.2	59	100	48.6
3Ps	140	27	45	65.9	61	115	17.3
Total	842	46	67	697.8	258	443	194.2

Table 3. Infestation rates by nematodes in fillets of cod of length 41 cm and greater. The results of the present study are compared with those of Templeman et al. (1957) using the normal approximation to the binomial. (NS = not significant).

NAFO Div.	Present Study Percent Infested	Present Study Number Examined	Templeman et al. (1957) Percent Infested	Templeman et al. (1957) Number Examined	z	Two-tailed significance probability	Significance
2J	2.8	247	3.1	851	-.241	.81	NS
3K	3.1	286	3.0	699	.146	.88	NS
3L	1.8	169	2.6	2200	-.674	.50	NS
3Ps	19.3	140	24.3	551	-1.383	.17	NS
Total		842		4301			

Table 4. Average number of nematodes in the fillets per cod examined of length 41 cm and greater. The results of the present study are compared with those of Templeman et al. (1957) using the Poisson test. (S = significant: NS = not significant).

NAFO Div.	Present Study Av. No. of Worms	Templeman et al. (1957) Average Number of Worms	One-tailed significance probability	Significance
				NS
2J	.032	.034	0.54	NS
3K	.035	.030	0.34	NS
3L	.024	.026	.55	NS
3Ps	.321	.570	.00002	S

Table 5. Average number of nematodes per kg of cod fillets of cod 41 cm and greater in length. Ratio estimates compared using standard normal probabilities. (S = significant; NS = not significant).

NAFO Division	Present Study	S. D.	Templeman (1957) Study	Z	Two-tailed Significance probability	Significance
2J	0.037	.0133	0.070	2.481	.0134	S
3K	0.040	.0129	0.046	0.465	.6428	NS
3L	0.024	.0142	0.030	0.423	.6732	NS
3Ps	0.683	.0963	0.709	0.270	.7872	NS

Table 6. Comparison of infestation by nematodes of napes and fillets of cod of length 41 cm and greater.

NAFO Div.	% of Cod Infested		Average No. of Nematodes per cod		Ratio Nape/ Fillet	Average # of Nematodes per kg.		Ratio Nape/ Fillet	# of Cod Exam.
	Fillet	Nape	Fillet	Nape		Fillet	Nape		
2J	2.8	17.8	.032	.336	11	.037	1.46	39	247
3K	3.1	32.9	.035	.507	14	.040	2.03	51	286
3L	1.8	34.9	.024	.592	25	.024	2.06	86	169
3Ps	19.3	43.6	.321	.821	3	.683	6.65	10	140
Total									842

Table 7. The relationship of the abundance of nematodes per nape and fillet of cod from NAFO Divisions 2J, 3K, 3L and Subdivision 3Ps.

Div.	No. of nematodes in Fillets	No. of nematodes in Napes 0	1	2	3	4	5	6	...20	Total no. of Fish	r.
2J	0	283	22	13	3	3	1			325	0.142
	1	7	1	2	1	-	-			11	
	2	1	-	-	-	-	1			2	
	Total	291	23	15	4	3	2			338	
3K	0	262	65	17	8	-	-	2		354	0.052
	1	5	1	1	-	2	-	-		9	
	2	1	-	-	-	-	-	-		1	
	Total	268	66	18	8	2	-	2		364	
3L	0	178	49	10	3	1	1	-	1	243	-0.021
	1	4	-	-	-	-	-	-	-	4	
	2	-	1	-	-	-	-	-	-	1	
	Total	182	50	10	3	1	1	-	1	248	
3Ps	0	72	29	6	8	1	4	-	-	120	0.150
	1	12	3	1	-	1	1	-	-	18	
	2	2	2	3	-	-	-	-	-	7	
	3	-	2	1	-	-	-	-	-	3	
	4	2	-	1	-	-	-	-	-	3	
	Total	88	36	12	8	2	5	-	-	151	

Table 8. Species composition of nematodes examined to date from cod 41 cm and greater. Anisakis is Anisakis simplex, Phocanema is Phocanema decipiens, Other includes unidentifiable nematodes as well as other species.

NAFO Div.	Nematode	Napes		Fillets		Total cod examined
		Number of cod infested	Number of nematodes	Number of cod infested	Number of nematodes	
2J	Anisakis	39	69	1	1	247
	Phocanema	4	7	4	5	247
	Other	4	7	2	2	247
	Total	44	83	7	8	247
3K	Anisakis	83	120	1	1	286
	Phocanema	12	19	7	8	286
	Other	7	7	1	1	286
	Total	94	146	9	10	286
3L	Anisakis	56	72	0	0	169
	Phocanema	6	25	1	1	169
	Other	3	3	3	3	169
	Total	59	100	3	4	169
3Ps	Anisakis	56	101	6	7	140
	Phocanema	7	8	19	30	140
	Other	6	6	8	8	140
	Total	61	115	27	45	140

Table 9. Comparison of infestation of nematodes in the napes and fillets of cod 41 cm and greater (≥41 cm).

NAFO	Nape				Fillet				Total cod examined
	% Infestation		Average Number of Worms per cod		% Infestation		Average Number of Worms per cod		
	Anisakis	Phocanema	Anisakis	Phocanema	Anisakis	Phocanema	Anisakis	Phocanema	
2J	15.8	1.6	.279	.028	.4	1.6	.004	.020	247
3K	29.0	4.2	.420	.066	0.4	2.4	.004	.028	286
3L	33.1	3.6	.426	.148	0	.6	0	.006	169
3Ps	40.0	5.0	.721	.057	4.3	13.6	.050	.214	140

Table 10. The relationship of Anisakis and Phocanema abundance per fish for cod in NAFO Divisions 2J, 3K, 3L, and Subdivision 3Ps.

Div.	No. of Phocanema per fish	No. of Anisakis per fish 0	1	2	3	4	5	6	Total no. of fish	r.
2J	0	286	23	10	4	3	1		327	
	1	7	-	2	-	-	-		9	
	2	1	-	-	-	-	-		1	
	3	-	-	-	-	-	-			0.078
	4	-	-	-	-	-	-			
	5	-	-	1	-	-	-		1	
	Total	294	23	13	4	3	1		338	
3K	0	266	55	16	6	-	1	1	345	
	1	11	5	-	-	-	-	-	16	
	2	1	-	-	-	-	-	-	1	
	3	-	-	-	-	-	-	-	-	0.046
	4	-	1	-	-	-	-	-	1	
	5	-	-	-	-	-	-	-	-	
	6	1	-	-	-	-	-	-	1	
	Total	279	61	16	6	-	1	1	364	
3L	0	180	49	10	1	1			241	
	1	3	-	-	-	-			3	
	2	1	1	1	-	-			3	0.066
	...									
	18	-	1	-	-	-			1	
	Total	184	51	11	1	1			248	
3Ps	0	76	33	8	6	1	3		127	
	1	5	4	1	3	1	1		15	
	2	2	1	-	-	-	-		3	
	3	2	2	1	-	-	-		5	0.103
	4	-	-	-	-	-	-		-	
	5	-	-	-	-	-	-		-	
	6	1	-	-	-	-	-		1	
	Total	86	40	10	9	2	4		151	

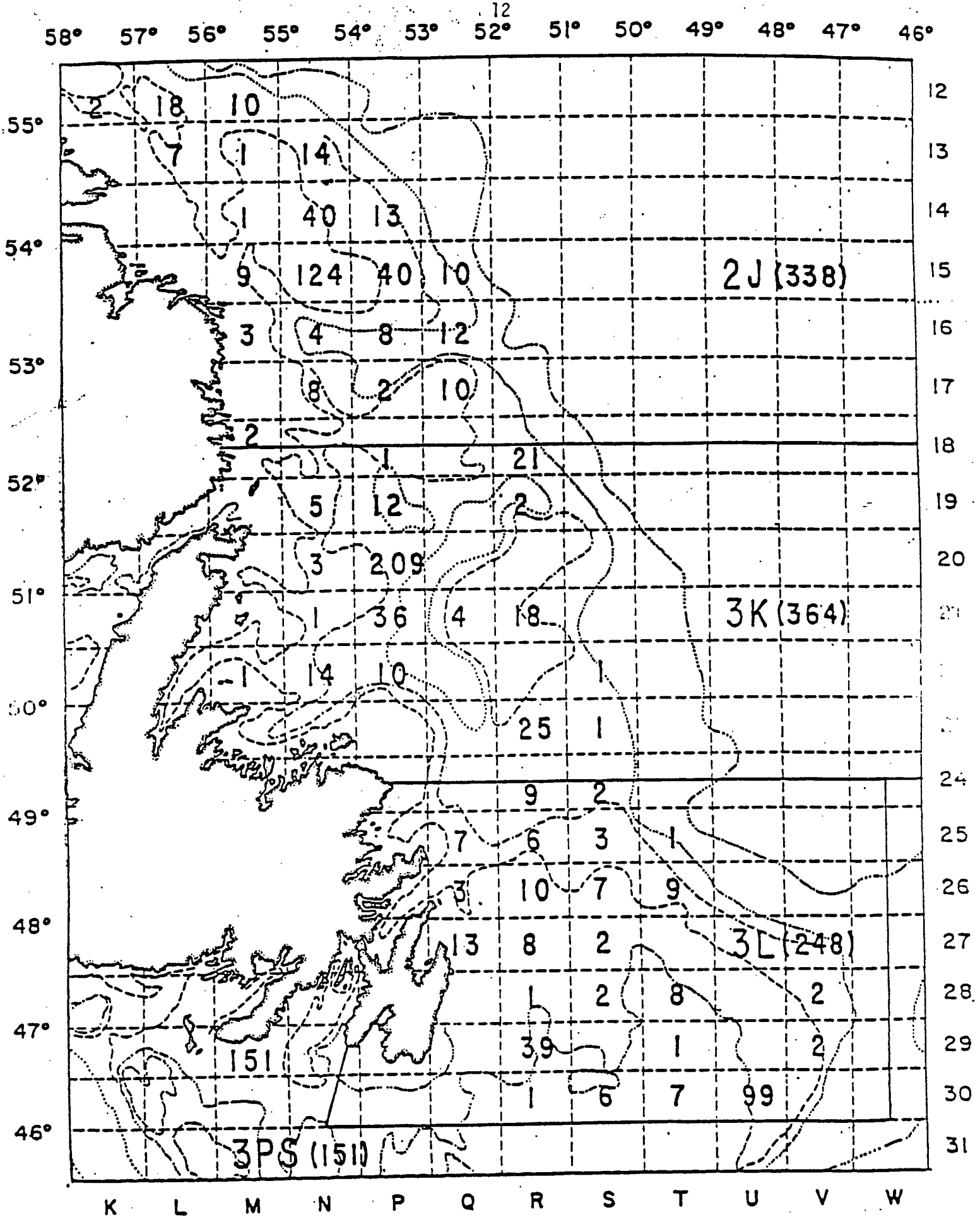

Fig. 1. Positions from which cod samples were taken for nematode studies; the numbers refer to the numbers of cod examined from each position.

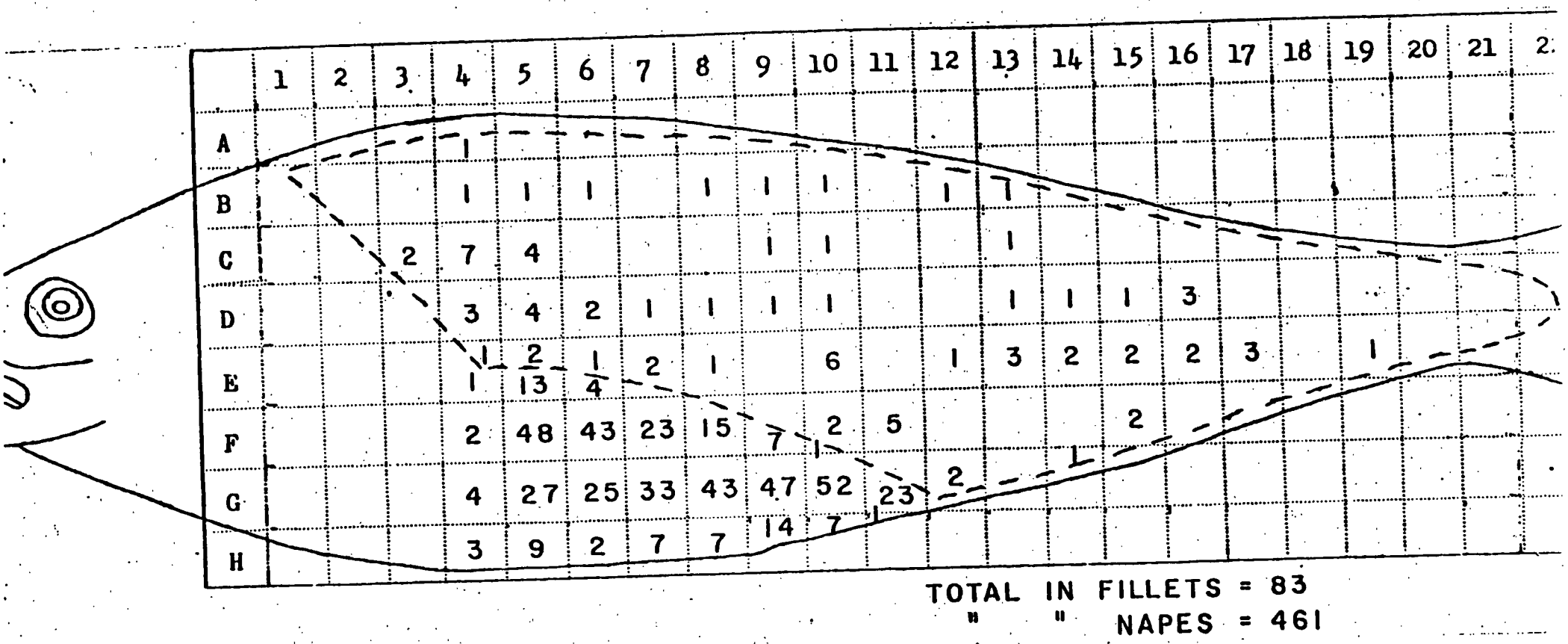

Fig. 2. Position of nematodes in the fillets and napes (both left and right sides) of cod.

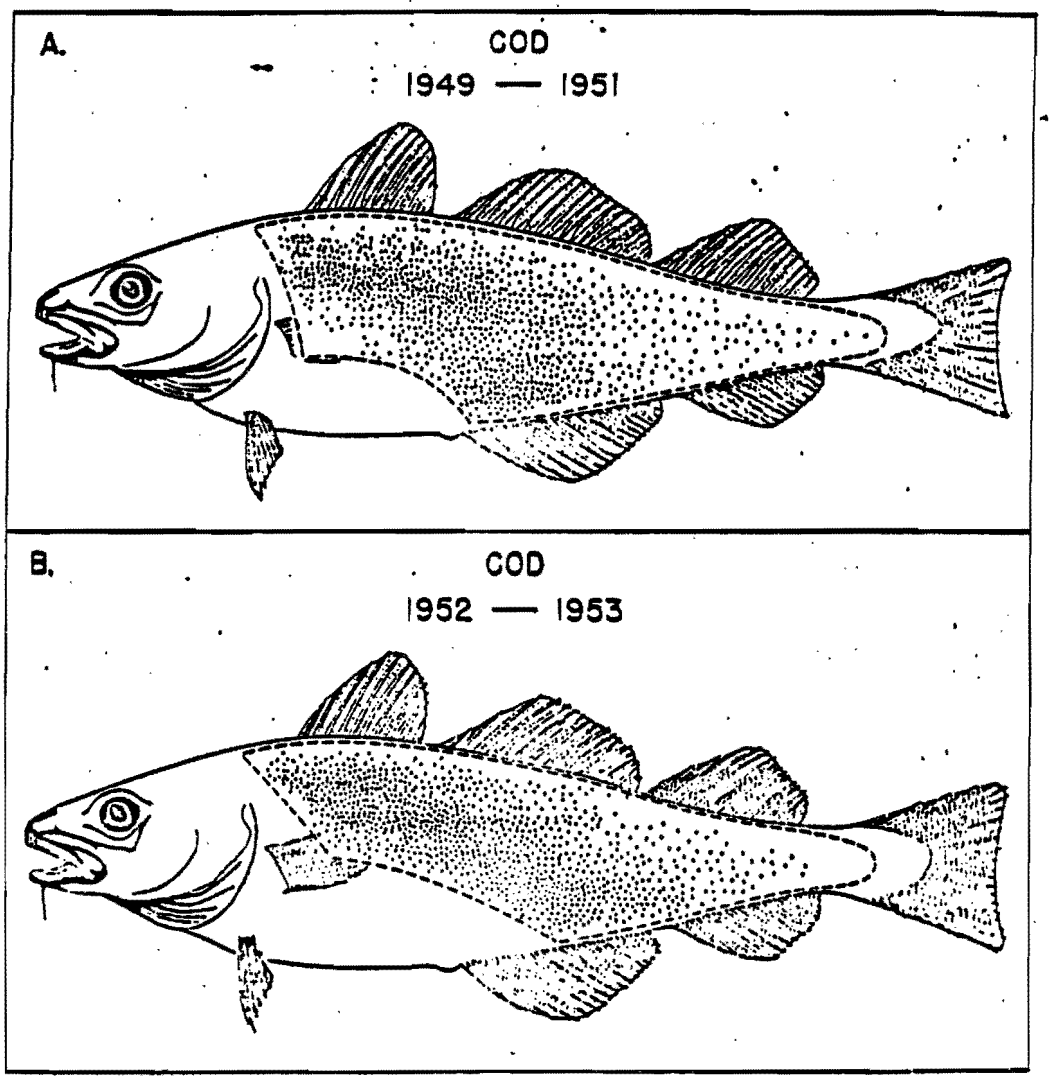

FIGURE 19. Position of nematodes, in cod fillets, per thousand nematodes in each of A and B. (Actual number of nematodes observed in A, 2199 and in B, 1444. This represents the total nematodes in the fillets of over 16,000 cod.)

Fig. 3. Position of nematodes in the fillets of cod examined by Templeman et al (1957).