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Preliminary Results From Feeding Analysis For Abundant Commercial Fishes on the Newfoundland Bank in April-May 1991

by

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ABSTRACT

Data on feeding intensity and stomach content of cod , Greenland halibut and American plaice obtained in spring-summer bottom fish surveys carried out on the Grand Newfoundland Bank were presented. Length composition of main food objects of abundant commercial fishes has been examined. American plaice along with cod and Greenland halibut was shown to be also an active consumer of capelin.

INTRODUCTION

Studying of trophic interrelations between commercial fishes and their quantitative estimation give an opportunity to present functioning of marine ecosystem as united whole. Necessity in similar information grows while fisheries intensity increases in general since it is a base for multispecies populational analysis and regulation of fishery on its basis.

Transition from single species to multispecies populational analysis is possible only detailed long-term data on trophic interrelations between commercial fishes inhabiting vast areas (whole area of any species) by all seasons are available. Information on predator size preference relative to different prey species is of a great importance when modelling interspecific relations.

Materials presented in the paper characterize the peculiarities of feeding of the Grand Newfoundland Bank abundant fish species - cod, Greenland halibut and American plaice in spring. Analysis for size preference of the species mentioned is the focus of attention.

MATERIAL AND METHODS

Materials on feeding of abundant commercial fishes have been obtained in cruise conducted by RV "Vilnyus" in April-May 1991. Besides traditional field analysis for feeding the quantitative-weight analysis for feeding of cod, Greenland halibut and American plaice from Div. 3LNO has been done.

Samples for the quantitative-weight analysis for feeding of abundant commercial fishes have been obtained over the whole area surveyed (Fig. 1). The data have been treated in the cruise. Size, weight, sex and gonad maturity stages have been determined in fish collected for the analysis. Food objects - fish, squid, shrimp, crab, euphausiids and hyperiids were determined , if possible, to a species, other crustaceans - to order or suborder ; sponge, Actiniaria, polychaetes, mollusks, Ophiura, Ascidiacea and other organisms - to higher taxa. When treating much prominence was given to the size of food objects when treating. Size of strongly digested fish was estimated by a length of its spine. After sorting and measuring a food object was dried on filtering paper and weighed by taxonomic groups.

To characterize the fish feeding intensity the total and partial indices of stomach fullness were calculated: relationship between the total weight of food (or weight of any food object) and fish body weight , expressed in °/₀₀. Daily dynamics of fish feeding was determined by variations of the total indices of stomach fullness per a day.

Total material obtained in Divs. 3LNO and treated by quantitative-weight method in the cruise is presented in Table 1.

RESULTS

Tables 2-16 present the preliminary results from analysis for feeding of commercial fishes. As can be seen from the tables all the three species, the feeding of which has been analysed in the cruise, were active consumers of capelin. Besides capelin the total food objects for species given are sand eel, crabs, shrimp, hyperiids, Gammaridae and euphausiids. Therefore, the comparative analysis of pressure from cod, Greenland halibut and American plaice predation upon the food objects given is of essential interest. Biomass values for food objects being in stomachs of commercial fishes (with allowance for their stock and size composition) evidence a comparative intensity of predation pressure (Table 17). As can be seen in the table the pressure from American plaice predation upon capelin stock proves to be quite comparable to a pressure from halibut predation as well as from cod in the south of the Grand Newfoundland Bank.

According to observations from the previous years the size composition of capelin from stomachs of abundant commercial fish spe-

cies, as a rule, reflect the size structure of capelin population.

By the data on trophic analyses 60% of abundance and over 70% of capelin biomass consumed by predators on the Grand Newfoundland Bank in April-May 1991 are presented by fish 13-16 cm long , which, apparently, make up a spawning stock bulk for this year (Table 18).

CONCLUSION

The analysis showed an importance of fish food in American plaice feeding to be significant in spring. In particular, American plaice, along with cod and Greenland halibut, is an active consumer of capelin. Apparently, the pressure from American plaice predation should be considered when estimating natural mortality of capelin in future.

Conclusion about prevalence of fish 13-16 cm long in feeding of abundant commercial fishes on the Grand Newfoundland Bank is a main result of the analysis conducted. By the results from acoustic survey capelin from the size group given did not practically manifest itself, however, its availability in fish feeding evidences its existence in population.

TABLE 1. Total number of stomachs obtained in Divs. 3LNO in April-May 1991 and treated by quantitative - weight method

Species	Div.			TOTAL
	3O	3N	3L	
Cod	213	235	416	864
Greenland halibut	54	143	315	512
American plaice	77	169	55	301

TABLE 2. Frequency of occurrence of different food objects in feeding of cod from the Grand Newfoundland Bank in April-May 1991 (by results from field analysis for feeding)

Area	Cod length, cm	No. of stomachs analysed	Frequency of occurrence (% of total number of stomachs)														Empty stomachs, %
			Polychaetes	Ophiuras	Molusks	Caprella	Amphipods	Hyperiids	Euphausiids	Shrimp	Crabs	Cumacea	Capelin	Sand eel	Am. plaice	Cod	
3NO	9-17	33	3.0	-	-	9.1	30.3	-	6.1	-	3.0	-	21.2	-	-	-	36.4
	18-26	227	4.4	1.3	-	12.8	26.9	6.6	3.5	5.3	9.7	-	7.5	3.1	-	-	27.3
	27-35	90	5.6	4.4	-	4.4	5.6	4.4	2.2	11.1	13.3	-	16.7	3.3	2.2	-	33.3
	36-44	127	3.1	5.5	-	3.2	6.3	0.8	0.8	7.9	5.5	-	7.1	3.2	0.8	-	69.3
	45-53	77	1.3	1.3	-	1.3	5.2	1.3	1.3	3.9	5.2	-	9.1	2.6	-	1.3	74.0
	54-62	44	2.3	4.6	-	-	-	2.3	-	6.8	2.3	-	-	-	-	-	77.3
	90-98	38	-	2.6	-	-	-	-	2.6	2.6	2.6	-	-	2.6	-	7.9	76.3
	99-107	35	-	-	-	-	-	-	-	8.6	11.4	-	2.9	5.7	5.7	11.4	65.7
	108-116	39	-	2.6	-	-	5.1	-	-	2.6	5.1	-	2.6	7.7	-	5.1	74.4
	117-125	40	-	2.5	-	-	-	-	-	-	5.0	-	2.5	5.0	7.5	10.0	75.0
	126-134	24	-	-	-	-	-	-	-	-	-	-	8.3	8.3	-	4.2	79.2
3L	18-26	71	8.5	-	2.8	16.9	39.4	4.2	4.2	7.0	15.5	4.2	8.9	-	-	-	16.9
	27-35	152	5.9	-	5.3	13.2	22.4	5.3	0.7	10.5	12.5	3.9	28.3	0.7	0.7	-	18.4
	36-44	237	4.2	-	5.9	5.5	11.4	3.4	0.4	9.3	14.3	0.4	39.2	3.8	0.8	-	16.0
	45-53	247	2.0	-	2.8	-	10.9	6.5	-	10.5	12.1	-	47.8	2.0	0.4	-	15.4
	54-62	146	2.1	-	4.1	-	15.1	3.4	0.7	14.4	12.3	-	51.4	5.5	2.7	-	8.9
	63-71	73	-	-	2.7	-	13.7	2.7	-	16.4	17.8	-	63.0	9.6	-	-	6.8
	72-80	71	-	-	1.4	-	8.4	1.4	-	21.1	15.5	-	36.6	9.9	1.4	-	23.9
	81-89	41	-	-	2.4	-	4.8	-	-	7.3	17.1	-	53.7	24.4	-	-	17.1
	90-98	16	-	-	-	-	6.3	-	-	6.3	18.8	-	50.0	6.3	6.3	-	25.0

TABLE 3. Weight composition of food in con from the Grand Newfoundland Bank in April-May 1991 (by results from weight-quantitative analysis for feeding)

Area	Cod length, cm	No. of stomachs with food	Mean weight of haddock in stomach, g	Weight, % of total weight of food in stomachs of cod from size class given														
				Polychaetes	Ophiura	Molluska	Caprella	Cumacea	Amphipods	Hyperiids	Euphausiids	Shrimp	Crabs		Capelin	Sandeel	Plaice	Cod
													H.areneus	Ch.opilio				
3NO	9-17	20	0.36	2.1	-	-	-	4.4	13.0	-	0.8	-	8.3	-	65.0	-	-	-
	18-26	127	0.67	2.2	1.1	-	-	15.5	8.4	2.3	2.8	4.8	6.4	4.7	25.8	12.8	-	-
	27-35	40	3.38	1.5	0.1	-	-	1.7	0.4	0.2	0.5	4.0	26.9	13.1	24.7	6.1	4.2	-
	36-44	30	4.28	1.3	1.9	-	-	0.3	0.4	-	0.1	9.7	36.2	9.6	17.7	10.7	2.7	-
	45-53	16	13.05	0.1	-	-	-	0.5	0.4	-	0.5	3.0	3.8	5.1	37.4	10.9	-	38.3
	54-62	6	5.63	1.9	-	-	-	-	-	35.2	-	1.6	-	27.6	-	-	-	-
	90-98	5	29.67	-	-	-	-	-	-	-	0.1	-	-	64.0	-	10.3	-	24.9
	99-107	10	294.69	-	-	-	-	-	-	-	-	0.1	-	1.8	3.2	8.9	2.5	72.5
	108-116	10	121.19	-	0.5	-	-	-	-	-	-	-	0.5	3.4	57.9	4.0	-	28.7
	117-125	7	110.20	-	0.6	-	-	-	-	-	-	-	-	20.9	15.6	22.6	1.4	17.3
	126-134	4	144.28	-	-	-	-	-	-	-	-	-	-	-	60.7	33.2	-	6.1
3L	18-26	38	0.80	7.0	-	4.5	1.5	11.4	13.1	1.0	2.1	4.7	11.0	-	31.6	-	-	-
	27-35	66	3.46	3.1	-	0.8	0.2	5.0	3.6	3.9	0.1	2.6	2.6	3.8	59.7	5.0	0.5	-
	36-44	75	15.20	0.3	-	0.9	-	0.8	1.3	1.1	-	1.7	1.5	2.2	51.4	31.1	0.8	-
	45-53	47	33.86	0.1	-	0.3	-	-	0.4	1.0	-	2.6	1.2	1.0	85.4	2.8	-	-
	54-62	46	61.86	0.3	-	0.8	-	-	0.3	0.1	-	2.3	0.1	5.5	57.4	22.5	0.1	-
	63-71	38	71.37	-	-	0.6	-	-	0.3	-	-	0.8	1.7	1.9	79.1	9.3	-	-
	72-80	31	40.59	-	-	0.1	-	-	-	-	-	1.9	1.1	16.1	44.7	16.8	1.3	-
	81-89	25	61.68	-	-	-	-	-	0.2	-	-	1.1	0.7	2.5	33.8	37.1	-	-
	90-98	8	78.11	-	-	-	-	-	0.5	-	-	0.7	-	11.1	20.1	-	0.8	-

TABLE 4. Abundance and size composition of capelin in food of cod from Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs of cod from each size class)

Area	Cod length, cm	Capelin length, cm												n	$\bar{l}$
		6.I-7.0	7.I-8.0	8.I-9.0	9.I-I0.0	I0.I-II.0	II.I-I2.0	I2.I-I3.0	I3.I-I4.0	I4.I-I5.0	I5.I-I6.0	I6.I-I7.0	I7.I-I8.0		
3NO	9-I7			5										5	8.5
	I8-26	I	2	I	I			3						8	9.6
	27-35		2		I0			2	I0	2	2			28	II.8
	36-44			4	I4			4			4			26	I0.7
	45-53			6	6			I8	24	I8	I8	6		96	I3.5
	99-I07					9	I8	I8	45	9				99	I2.8
	I08-II6					I0		50	200	I30	80	30		500	I4.I
	II7-I25							I7	50	50				II7	I3.8
	I26-I34						25	I25	I25	I75	I00	25		575	I4.0
3L	I8-26					3	5	3						II	II.5
	27-35			2	6	5	6		I2	5	3			39	I2.2
	36-44				I	I	4	4	24	I7	37	3	I	92	I4.4
	45-53				23	2I	36	43	72	49	74	28	9	355	I3.6
	54-62			2	I8	7	20	45	I09	80	57	23	2	363	I3.7
	63-7I			5	32	35	4I	5I	I22	87	II9	57	8	557	I3.8
	72-80				37	50	7	23	63	37	67	7	7	298	I3.I
	8I-89					I3	25	8	75	46	83	I3	8	27I	I4.2
	90-98					I3	50	I3	I50	38	63	I3	I3	353	I3.8

$\underline{n}$ - total number of capelin specimens in 100 cod stomachs

$\bar{l}$ - mean capelin length

TABLE 5. Abundance and size composition of sand eel in food of cod from Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs from each cod size class)

Area	Cod length, cm	Sand eel length, cm																			n	$\bar{l}$
		6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0	10.1-11.0	11.1-12.0	12.1-13.0	13.1-14.0	14.1-15.0	15.1-16.0	16.1-17.0	17.1-18.0	18.1-19.0	19.1-20.0	20.1-21.0	21.1-22.0	22.1-23.0	23.1-24.0			
3NO	18-26				1		2														3	10.8
	27-35			5	3		3														11	9.5
	36-44				3	3										3					9	13.5
	45-53				6	6	6		6												24	11.3
	90-98		20					20							20						60	13.2
	99-107		10	10	70	150	220	60	20	10		10	10	50	20	10	20				670	12.5
	108-116								10	10	10			40	10						80	17.1
	117-125					14	14	14	28	14			43	43	14	43	57	14	42		340	18.5
	126-134						50	25	50	75	50	25	75	150	175	175	25	50	75		1000	18.4
3L	27-35													2							2	18.5
	36-44		4	11	21	11	1	3	1			1	4	4	7	5	4		1		78	13.0
	45-53						4	2							4						10	14.9
	54-62		4	20	46	33	11	2			2	2	20	13	11	7	13	7			191	13.5
	63-71			5	16	3		5					3		8	5	5				50	14.2
	72-80	3	6	42	58	52	39	10	6	3	6	3	10	3		3		3	3		250	11.2
	80-89	4	16	32	116	132	52	12	8	16	8	12	20	12	40	12	8				500	12.2

TABLE 6. Abundance and size composition of Ch.opilio in food of cod from Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs from each cod size group)

Area	Cod size, cm	Crab length, mm																n	$\bar{l}$
		6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95		
3NO	18-26	I		2																3	I4.7
	27-35		3	3	I5	3														24	21.8
	36-44			I7	7	3														27	20.4
	45-53								6											6	43.0
	90-98											20								20	58.0
	99-107										I0			I0						20	60.5
	108-116							I0						I0						20	53.0
3L	27-35		3	3	2															8	I7.4
	36-44		9	7	I															I7	I5.7
	45-53		2	2	2															6	I8.0
	54-62			4	4	4		4	4			2								22	32.5
	63-71				3	5	3	3												I4	30.I
	72-80			3		I0		3	3	3			3						3	28	42.5
	81-89				I6	8			4											28	27.3
	90-98											I3				I3				26	68.0

TABLE 7. Abundance and size composition of H.araneus in food of cod from Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs from each size class of cod)

Area	cod size,cm	Crab length, mm								n	$\bar{l}$
		6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	
3NO	9-17		5	5							10 / 15.5
	18-26	3				I					4 / 13.0
	27-35			8	10	3		3			24 / 23.8
	36-44		3	7	13	10	7				40 / 24.4
	45-53		6	6			6				18 / 21.3
	108-116				10			10			20 / 30.5
	117-125				14						14 / 23.0
3L	27-35	9	3	2						I	15 / 13.0
	36-44	8	3	7	I						19 / 13.3
	45-53	4	6	2							12 / 12.2
	54-62			2							2 / 18.0
	63-71				5		5	3			13 / 30.3
	72-80										-
	81-89				4		4				8 / 28.0

TABLE 8. Abundance and size composition of Pandalus sp. in cod food on the Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs from each cod size class)

Area	Cod size, cm	Shrimp size, mm									n	$\bar{l}$
		< 30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110		
3NO	18-26	6	2	1							9	29.4
	27-35	10	8			3					21	34.5
	36-44	13	10	13	7						43	38.3
	45-53	6	13		6	6					31	42.7
	54-62	17									17	25.0
	90-98			20							20	45.0
	99-107		10		10						20	45.0
3L	18-26	3		3							6	35.0
	27-35	2	2					2			6	48.3
	36-44	1	3	8	1		1				14	44.3
	45-53	4		2	4		2	4	4		20	64.0
	54-62			2		2	6	6	4	2	22	80.5
	63-71		3	3		3	11				20	63.0
	72-80		6	3		6	6	3			24	60.0
	81-89			4				8			12	71.7
	90-98				13		13				26	65.0

TABLE 9. Abundance and size composition of cod in cod food in Divs.3NO (recalculation per 100 stomachs from each cod size class) in April-May 1991

Cod length, cm	Cod length, cm						n	$\bar{l}$
	I2-I4	I5-I7	I8-20	2I-23	24-26	27-29		
45-53	6	6		6			I8	I6.6
90-98			80				80	I8.9
99-I07		20	I30	40	40		230	20.4
I08-II6		30	60	30	I0		I30	20.2
II7-I25		I4	43	I4			7I	I9.5
I26-I34			25				25	I9.5

TABLE 10. Frequency of occurrence of different food objects in food of Greenland halibut on Grand Newfoundland Bank in April-May 1991 (by results from field analysis for feeding)

Area	Halibut size, cm	No. of stomachs	Frequency of occurrence, % of total number of stomachs						Empty stomachs %
			Euphausiids	Hyperiids	Amphipods	Shrimp	Squid	Capelin	
3NO	18-23	19	-	-	-	-	-	31.6	57.9
	24-29	55	1.8	5.4	-	1.8	-	43.6	45.4
	30-35	61	3.3	1.6	-	3.3	-	54.1	42.6
	36-41	91	-	-	-	1.1	-	43.9	54.9
	42-47	69	-	1.4	-	-	-	30.4	68.1
3L	24-29	40	-	-	-	-	-	22.5	70.0
	30-35	118	-	-	4.2	0.8	0.8	15.2	74.6
	36-41	176	-	-	2.3	3.4	1.1	15.9	75.6
	42-47	113	-	-	-	0.9	1.8	14.2	79.6

TABLE 11. Weight composition of food of Greenland halibut on the Grand Newfoundland Bank in April-May 1991 (by results from quantitative-weight analysis for feeding)

Area	Halibut size, cm	No. of stomachs with food	Mean weight of food in stomach, g	Weight, % of total weight of food in st.					
				Euphausiids	Hyperiids	Amphipods	Shrimp	Squid	Capelin
3NO	18-23	6	5.40	-	-	-	-	-	100.0
	24-29	28	5.36	0.4	0.2	-	0.3	-	99.1
	30-35	28	8.47	0.2	-	-	0.2	-	95.3
	36-41	27	15.17	-	-	-	0.3	-	99.2
	42-47	14	23.91	-	-	-	-	-	87.7
3L	24-29	9	6.02	-	-	-	-	-	100.0
	30-35	25	6.26	-	-	3.4	-	0.2	95.0
	36-41	34	8.81	-	-	2.3	6.4	1.1	90.2
	42-47	15	14.75	-	-	-	2.1	3.4	66.9

TABLE 12. Abundance and size composition of capelin in feeding of Greenland halibut on the Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs from each halibut size class)

Area	Halibut size, cm	Capelin length, cm 7.I-8,0	8.I-9,0	9.I-I0,0	I0.I-II,0	II.I-I2,0	I2.I-I3,0	I3.I-I4,0	I4.I-I5,0	I5.I-I6,0	I6.I-I7,0	I7.I-I8,0	n	$\bar{l}$
3NO	I8-23						75	25					I00	I2.8
	24-29	4			4	4	8	24	28	8			80	I3.4
	30-35	9	4	9	I3	22	9	39	I7	9	9		I40	I2.5
	36-4I	I5	4	58	38	46	27	27	I5	42			272	II.8
	42-47		I4	29	2I	36	43	50	43	36	2I		293	I2.9
3L	24-29						50	38		I2			I00	I3.2
	30-35		4	4		I2	8	I2	I2	2I	8		8I	I3.6
	36-4I			I2	3	24	I2	2I	I8	32	9	6	I37	I3.6
	42-47			I3		40	I3	33	20	33			I52	I3.I

TABLE 13. Frequency of occurrence of different food objects in feeding of American plaice on the Grand Newfoundland Bank in April-May 1991 (by results from field analysis for feeding)

Area	Plaice size, cm	No. of stomachs	Frequency of occurrence, % of total number of stomachs							Empty stomachs, %
			Polychaetes	Ophiura	Euphausiids	Amphipods	Crabs	Capelin	Sand eel	
3NO	12-17	33	-	30.8	15.4	15.4	-	-	7.7	46.2
	18-23	123	2.4	6.5	5.7	11.4	0.8	8.1	8.9	59.3
	24-29	294	2.4	10.5	6.1	5.8	-	3.7	3.4	68.0
	30-35	200	2.0	8.5	2.0	-	0.5	4.5	8.0	72.5
	36-41	92	-	10.9	2.2	-	2.2	4.3	6.5	69.6
	42-47	82	-	6.1	-	2.4	1.2	1.2	4.9	80.5
3L	18-23	47	8.5	25.5	-	2.1	2.1	2.1	2.1	63.8
	24-29	221	4.5	12.2	-	0.9	-	2.3	2.3	78.7
	30-35	241	3.7	5.8	-	1.2	-	4.1	3.3	80.1
	36-41	196	3.1	0.5	-	1.5	1.5	5.1	7.6	79.6
	42-47	74	2.7	4.0	-	-	6.8	4.0	4.0	75.7

TABLE 14. Species composition of food in American plaice on the Grand Newfoundland Bank in April-May 1991 (by results from quantitative-weight analysis for feeding)

Area	Plaice size, cm	No. of stomachs with food	Mean weight of food in stomach, g	Weight, % of total food weight						
				Polychaetes	Ophiura	Euphausiids	Amphipods	Crabs	Capelin	Sand eel
3NO	I2-I7	25	0.27	-	I2.I	6I.8	I8.0	-	-	8.0
	I8-23	3I	I.70	-	0.3	I4.4	2.I	0.2	52.4	25.0
	24-29	24	I.68	4.4	4.3	20.7	2.9	-	3I.2	3I.5
	30-35	I6	4.24	0.3	I.6	0.2	-	-	I8.8	74.7
	36-4I	5	3.I8	-	3.4	0.I	0.2	0.I	70.2	25.9
	42-47	5	2.08	-	6.0	-	0.2	0.4	20.3	53.8
3L	I8-23	4	0.94	-	94.I	-	-	-	-	-
	24-29	I2	I.66	I.3	39.0	-	-	-	23.3	36.0
	30-35	9	3.00	I.3	7.5	-	0.2	-	59.3	3I.7
	36-4I	I4	II.43	-	-	-	0.I	0.9	48.6	49.9
	42-47	4	3.39	-	-	-	-	I6.3	52.2	3I.5

TABLE 15. Abundance and size composition of capelin in feeding of American plaice on Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs of plaice from each size class)

Area	Plaice size, cm	Capelin length, cm												n	$\bar{l}$
		6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0	10.1-11.0	11.1-12.0	12.1-13.0	13.1-14.0	14.1-15.0	15.1-16.0	16.1-17.0	17.1-18.0		
3NO	18-23	2		7	13	2	2	2						28	9.5
	24-29	1			7		4	1		1				14	10.4
	30-35		3				3	7	3					16	11.6
	36-41				7	7		7	7	7				35	12.1
	42-47							6						6	12.5
3L	24-29				4	4		4						12	10.8
	30-35		24	5		5			5				5	44	12.7
	36-41		6			6					13	6		31	13.2
	42-47						6			6	6			18	13.8

TABLE 16. Abundance and size composition of sand eel in feeding of American plaice on Grand Newfoundland Bank in April-May 1991 (recalculation per 100 stomachs of plaice from each size class)

Area	Plaice size, cm	Sand eel length, cm																					n	$\bar{l}$
		6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0	10.1-11.0	11.1-12.0	12.1-13.0	13.1-14.0	14.1-15.0	15.1-16.0	16.1-17.0	17.1-18.0	18.1-19.0	19.1-20.0	20.1-21.0	21.1-22.0	22.1-23.0	23.1-24.0					
3NO	18-23	1	1		2	1	5																10	10.1
	24-29			2	2		1	2											1				8	11.6
	30-35						2				2				2	3							9	17.2
	36-41						3					3											6	14.0
	42-47						3			2		2											7	13.8
3L	24-29		7			1	2																10	8.6
	30-35		5	2	5																		12	8.5
	36-41	4	3	5	7	3	2	1				1		3	1	1			1				32	11.3
	42-47		4			2						2											8	10.5
	48-53			5	3	3	14	5	3	3				3	3								42	12.5

TABLE 17. Total biomass* of different food objects in feeding of abundant commercial fishes on Grand Newfoundland Bank in April-May 1991

Area	Fish species	Weight of food objects, t						
		Capelin	Sand eel	Crabs	Shrimp	Hyperiids	Gammaridae	Euphausiids
3NO	Cod	81.0	41.6	28.4	1.5	0.7	0.8	0.3
	Greenland halibut	14.2	-	-	0.026	0.003	-	0.009
	American plaice	40.3	44.9	0.08	-	-	1.5	9.8
	Total for area	135.5	86.5	28.5	1.5	0.7	2.3	10.1
3L	Cod	2852.0	627.5	163.9	88.3	27.5	23.4	0.076
	Greenland halibut	37.8	-	-	0.75	-	0.38	-
	American plaice	48.8	43.8	2.3	-	-	0.09	-
	Total for area	2938.6	671.3	166.2	89.05	27.5	23.87	0.076
	Total for Grand Nfl Bank	3074.1	757.8	194.7	90.6	28.2	26.2	10.2

* actual weight

TABLE 18. Abundance (mill.spec.- over line), biomass* (t- below line) and size composition of capelin in feeding of abundant commercial fishes on the Grand Newfoundland Bank in April-May 1991

Area	Fish species	Capelin length (Ls),cm												Total
		6.1-7.0	7.1-8.0	8.1-9.0	9.1-10.0	10.1-11.0	11.1-12.0	12.1-13.0	13.1-14.0	14.1-15.0	15.1-16.0	16.1-17.0	17.1-18.0	
3NO	Cod	0,12	0,03	0,24	0,42	0,12	0,14	1,26	2,35	1,59	0,88	0,27	-	7,42
		0.18	0.06	0.59	1.53	0.63	1.10	14.06	36.57	32.22	24.01	8.62		119.56
	Greenland halibut	-	0,09	0,06	0,30	0,23	0,31	0,34	0,40	0,26	0,28	0,07	-	2,34
			0.2	0.14	1.1	1.2	2.4	3.8	6.2	5.3	7.6	2.1		30.0
	American plaice	0,48	0,22	1,15	3,52	0,67	1,14	1,48	0,57	0,49	-	-	-	9,72
		0.7	0.4	2.9	12.9	3.6	8.8	16.5	8.8	10.0				64.7
	Total for area	0,60	0,34	1,45	4,24	1,02	1,59	3,08	3,32	2,34	1,16	0,34	-	19,48
		0.88	0.66	3.63	15.53	5.43	12.3	34.36	51.57	47.52	31.61	10.72		214.26
3L	Cod	-	-	0,92	18,25	15,86	26,73	34,39	78,03	53,95	75,00	22,64	5,92	331,69
				2.3	67.0	84.0	205.8	383.1	1213.3	1094.6	2055.0	711.0	227.2	6043.4
	Greenland halibut	-	-	0,03	0,22	0,03	0,54	0,42	0,60	0,38	0,70	0,16	0,06	3,14
				0.1	0.8	0.2	4.2	4.7	9.3	7.7	19.2	5.0	2.5	53.6
	American plaice	-	1,90	0,33	0,39	1,02	0,20	0,39	0,33	0,20	0,84	0,30	0,34	6,24
			3.6	0.8	1.4	5.4	1.5	4.4	5.2	4.0	22.9	9.3	12.9	71.4
	Total for area	-	1,90	1,28	18,87	16,91	27,46	35,20	78,97	54,53	76,54	23,10	6,32	341,07
			3.6	3.2	69.3	89.6	211.5	392.1	1227.9	1107.0	2097.1	725.3	242.5	6169.0
	Total for Grand Nfld Bank	0,60	2,24	2,73	23,11	17,93	29,05	38,28	82,29	56,87	77,7	23,44	6,32	360,55
		0.88	4.26	6.83	84.83	95.03	223.8	426.7	1279.5	1154.5	2128.7	736.0	242.5	6383.3

* reconstructed weight

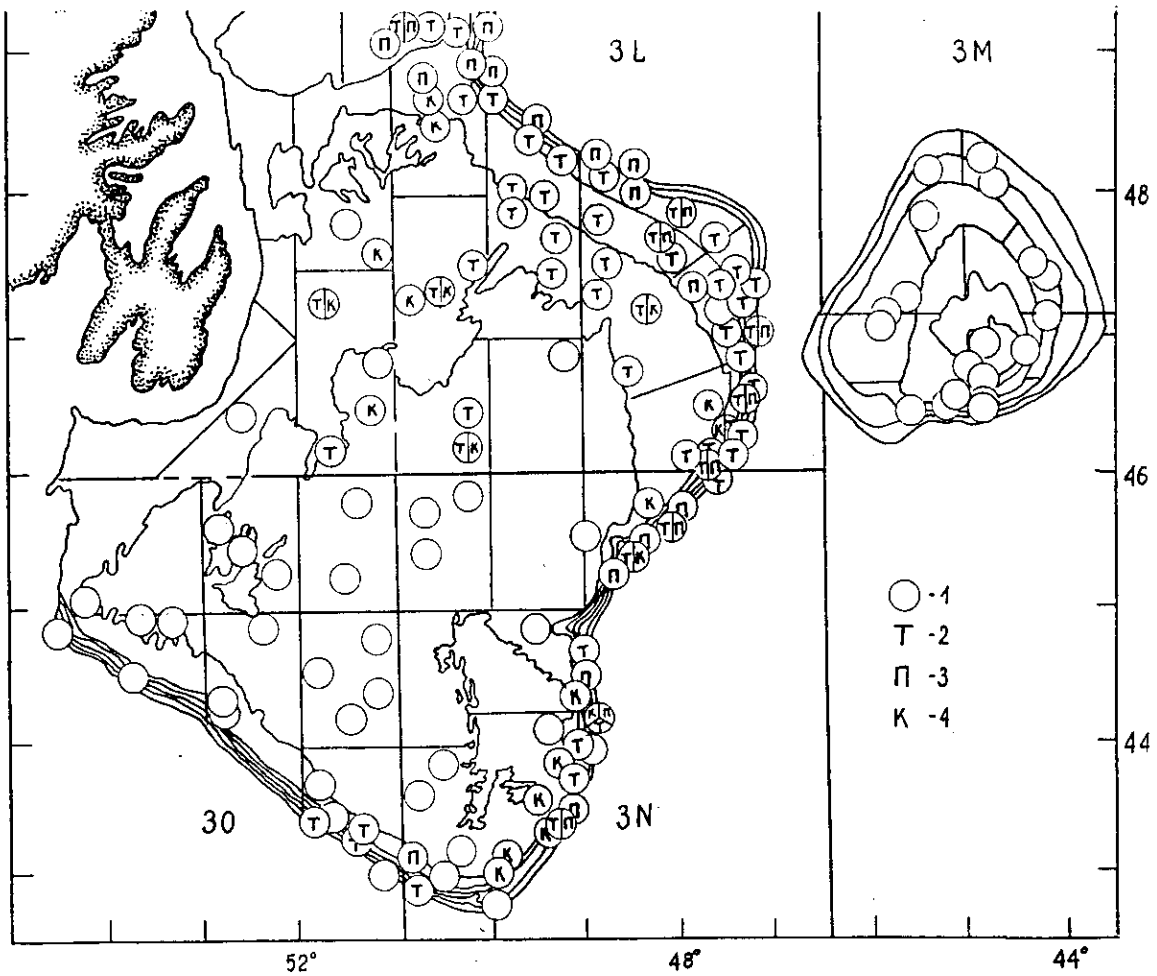

Fig. 1. Capelin occurrence in feeding of abundant commercial fishes on the Grand Newfoundland Bank

1 - sampling for quantitative-weight analysis for feeding;
2- capelin occurrence in cod stomachs;
3 -capelin occurrence in Greenland halibut stomachs;
4 -capelin occurrence in American plaice stomachs.