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Biomass Estimates for Cod and Greenland Halibut Beyond the Canadian
200-mile Economic Zone in NAFO Division 2J+3KL

by

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INTRODUCTION

This paper provides information, in response to the fisheries commission request, on cod, Greenland halibut, and roundnose grenadier distribution as it relates to the Canadian 200 mile fishery zone in NAFO Div. 2J3KL. The data used were extracted from Canadian research vessel surveys during spring (since 1977 excluding 1983 and 1984), fall (since 1981) and winter (1985 and 1986). Table 1 gives the area in square nautical miles by depth zone in Div. 3L and Table 2 gives the totals for Div. 2J, 3K, and 3L. Only in Div. 3L does the survey area extend beyond 200 miles (Fig. 1) and this is about 9% of the Division area. The percentage area outside 200 miles for Div. 2J3KL is 3.5%. The proportion of the area outside the fishery zone for strata which overlap the 200 mile boundary were derived from planimeter readings and these proportions were applied to biomass totals for appropriate strata.

Cod

Tables 3 and 4 give estimates of biomass for cod outside 200 miles by stratum in Div. 3L. For the spring survey series there was no coverage beyond 200 fathoms for the period 1977-84, but examination of 1985 survey results shows that the amount of biomass in these depth zones is minimal at this time of year. Poor coverage was also experienced in the earlier years of the fall series for these same depth zones. Table 5 provides a summary of the results for Div 3L. It is evident that the percentage biomass outside 200 miles is consistent for spring and fall and averages about 3%. During winter a portion of the stock migrates to the slopes of the Grand Banks and the percentage rises to about 25%. The percentage of biomass outside 200 miles for Div. 2J3KL (about 1%) was calculated using only data from fall surveys, as only during this season were surveys conducted in all three divisions (Table 6). Table 7 gives total annual biomass from fall surveys in Div. 2J, 3K, and 3L with associated percentages. On average Div. 2J comprises 42% of the total biomass, Div. 3K-30%, and Div. 3L-28%.

Greenland Halibut

Estimates of biomass for Greenland halibut outside the Canadian 200 mile fishery zone in Div. 3L are presented in Table 8. Only the seasonal surveys in 1984 and 1985 were used in the analysis since the spring surveys did not cover the more important depth zones inhabited by Greenland halibut. There was a strong seasonal trend in the survey results with abundance being proportionally higher outside the zone in winter time (Table 8) at 58.6% in 1985 and 78.1% in 1986. During other seasons the proportion outside the zone was fairly constant at about 24-32%. It should be noted that while the proportion of estimated biomass outside the zone is much higher during winter the total estimated biomass is much lower at this time particularly when compared to the summer and fall estimates (Table 8). It is possible that during winter Greenland halibut may go much deeper than at other times and may in fact be beyond the depth range of the surveys.

As a percentage of the estimated biomass for Div. 2J, 3K, and 3L during the fall of 1985 the proportion outside the 200 mile fishery zone is equal to 3.5%. Assuming the minimum trawlable biomass for Div. 2GH is still about 200,000t as suggested by the 1978, 1979, and 1981 surveys then the proportion outside the zone relative to whole stock area of Subarea 2 and Div. 3KL is about 1.6%.

Roundnose Grenadier

Since the surveys do not cover the depths inhabited by roundnose grenadier, no information is available on the proportion of roundnose grenadier in Div. 3L compared to Div. 2J and 3K. However, based upon the commercial fishery there is likely to be relatively few roundnose grenadier in Div. 3L.

Table 1. Proportion of area (square nautical miles) outside the 200 mile fishery zone in NAFO Div. 3L by depth range.

Depth (fm)	Depth (m)	Area Total	Area Outside	% Outside
31-50	56-91	8552	0	0
51-100	92-183	17452	933	5
101-150	184-274	6918	791	11
151-200	275-366	3855	768	20
201-300	367-549	1142	636	56
301-400	550-732	804	554	69
Unstratified shoreward		3542	0	0
Total		42265	3682	9

Table 2. Area in square nautical miles in Div. 2J, 3K, and 3L.

Division	Survey area (mi ²) (0-750m)	Percentage
2J	27,633	26
3K	36,545	34
3L	42,265	40
Total	106,443	100

Table 3. Estimates of cod biomass outside the 200 mi. fishery zone in Division 3L by strata and depth zone from surveys conducted in the spring over the period 1977-85.

Strata	Depth zone (fath)	% Area outside 200 mi. zone	ATC 262 (102) 1977	ATC 276 (94) 1978	ATC 290 (141) 1979	ATC 304-305 115 1980	ATC 317-318 (77) 1981	ATC 329 (103) 1982	WT 28-30 (221) 1985
385	51-100	5	21	4	56	314	21	0	104
390	"	55	278	437	1,169	1,539	275	119	144
389	101-150	62	833	659	681	4,292	296	1,031	3,825
391	"	100	634	356	1,048	2,064	1,212	95	429
387	151-200	37	45	68	170	95	90	871	7,952
388	"	99	1,169	179	346	107	188	1,308	343
392	"	100	30	66	189	0	128	256	2,237
729	201-300	100	not surveyed beyond 200 fathoms						35
731	"	100							36
733	"	50							158
730	301-400	100							0
732	"	100							0
734	"	67							0
Biomass outside 200 miles			3,010	1,769	3,659	8,411	2,210	3,680	15,263
Total 3L biomass			70,877	78,118	129,116	139,030	218,214	140,578	267,515
% outside 200 miles			4.3	2.3	2.8	6.1	1.0	2.6	5.7

Table 4. Estimates of cod biomass outside the 200 mile fishery zone in Division 3L by strata and depth zone from surveys conducted in fall and winter during the periods 1981-85 and 1985-86 respectively.

Strata	Depth zone (fath)	% Area outside 200 mi. zone	Fall surveys				Winter surveys		
			ATC 323-325 (96) 1981	ATC 333-334 120 1982	WT 7-9 (125) 1983	WT 16-18 (208) 1984	WT 37-39 (231) 1985	WT 22-24 (182) 1985	WT 42-44 (206) 1986
385	51-100	5	2	2	51	94	5	566	21
390	"	55	5	32	469	622	5	2,941	21
389	101-150	62	- ^a	2,125	-	1,697	1,563	22,223	1,055
391	"	100	-	487	159	79	325	2,710	92
387	151-200	37	494	3,410	-	2,762	1,501	20,034	8,592
388	"	97	-	456	-	610	1892	21,940	2,133
392	"	100	-	220	109	68	106	2,182	902
729	201-300	100	-	-	-	59	0	0	178
731	"	100	-	-	-	49	146	546	-
733	"	50	-	-	-	483	150	2,629	728
730	301-400	100	-	-	-	0	0	0	-
732	"	100	-	-	-	0	0	0	-
734	"	67	-	-	-	0	0	20	-
Biomass outside 200 miles			501	6,732	788	6,523	5,693	75,800	13,722
Total 3L biomass			109,706	87,997	131,267	191,701	165,417	318,563	51,164
% Outside 200 miles			0.5	7.7	0.6	3.4	3.4	23.8	26.8

Table 5. Cod biomass distribution in NAFO Division 3L in relation to the 200 mi. fishery zone from Canadian research vessel surveys.

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	Avg.
<u>Spring</u>											
Biomass outside 200 mi	3,010	1,769	3,659	8,411	2,210	3,680			15,263		
Total 3L	70,877	78,118	129,116	139,030	218,214	140,578			267,515		
% Outside	4.3	2.3	2.8	6.1	1.0	2.6			5.7		3.5
<u>Fall</u>											
Biomass outside 200 mi					501	6,732	788	6,523	5,693		
Total 3L					109,706	87,997	131,267	191,701	165,417		
% Outside					0.5	7.7	0.6	3.4	3.4		3.1
<u>Winter</u>											
Biomass outside 200 mi									75,800	13,772	
Total 3L									318,563	51,164	
% Outside									23.8	26.8	25.3

Table 6. Cod biomass distribution in NAFO Division 2J3KL derived from fall surveys in relation to the 200 mi. fishery zone from Canadian research vessel surveys.

	1981	1982	1983	1984	1985	Avg.
Biomass outside 200 mi	501	6,732	788	6,523	5,693	
Total 2J3KL	513,623	437,986	570,845	548,739	388,169	
% Outside	0.1	1.5	0.1	1.2	1.5	0.9

Table 7. Biomass estimates (000 t) of cod from autumn research vessel surveys in NAFO Divisions 2J, 3K, and 3L.

Div.	000 t 1981	000 t 1982	000 t 1983	000 t 1984	000 t 1985
2J	228.8	216.5	267.1	181.7	136.7
3K	175.0	133.3	172.5	175.3	86.0
3L	109.7	88.0	131.3	191.7	164.4
Total	513.5	437.8	570.9	548.7	387.1

Div.	% 1981	% 1982	% 1983	% 1984	% 1985	% Average
2J	45	49	47	33	35	42
3K	34	31	30	32	23	30
3L	21	20	23	35	42	28
Total	100	100	100	100	100	100

Table 8. Estimates of Greenland halibut biomass outside the 200 mile Canadian fishery zone in NAFO Div. 3L by stratum from seasonal surveys in 1984-1986.

Depth (fm)	Stratum	% Stratum area outside 200 mi. limit	Jul.-Sept.	Jan.-Feb.	Apr.-May	Jul.-Aug.	Oct.-Nov.	Jan.-Feb.
			1984 WT 16, 17, 18	1985 WT 22-24	1985 WT 28-30	1985 WT 32-34	1985 WT 37-39	1986 WT 42-44
51-100	385	5	4(12)	0(11)	3(15)	9(8)	11(12)	0(16)
151-200	387	37	977(3)	137(4)	134(6)	276(3)	843(4)	13(4)
151-200	388	99	644(2)	152(3)	161(2)	1818(2)	664(2)	353(3)
101-150	389	62	736(6)	175(4)	73(5)	654(4)	1024(5)	47(4)
51-100	390	55	0(3)	0(5)	4(9)	62(7)	166(7)	1(11)
101-150	391	100	397(2)	101(2)	32(2)	87(2)	630(2)	0(3)
151-200	392	100	288(2)	82(2)	54(2)	876(2)	272(2)	80(3)
201-300	729	100	988(2)	764(2)	66(2)	335(2)	426(2)	806(2)
301-400	730	100	156(2)	341(2)	86(2)	204(2)	86(2)	0(0)
201-300	731	100	677(2)	754(3)	503(2)	645(2)	243(2)	0(0)
301-400	732	100	219(2)	1400(2)	130(2)	394(2)	364(2)	0(0)
201-300	733	50	224(4)	307(3)	280(3)	1212(2)	629(3)	169(2)
301-400	734	67	203(3)	1367(2)	929(2)	433(2)	424(2)	304(2)
Total biomass outside 200 m limit			5513	5580	2455	7005	5782	1773
Total 3L biomass (No. sets)			17548 (208)	9519 (182)	8684 (221)	21713 (175)	23848 (231)	2269 (202)
% Biomass outside 200 mile limit			31.4	58.6	28.3	32.3	24.3	78.1

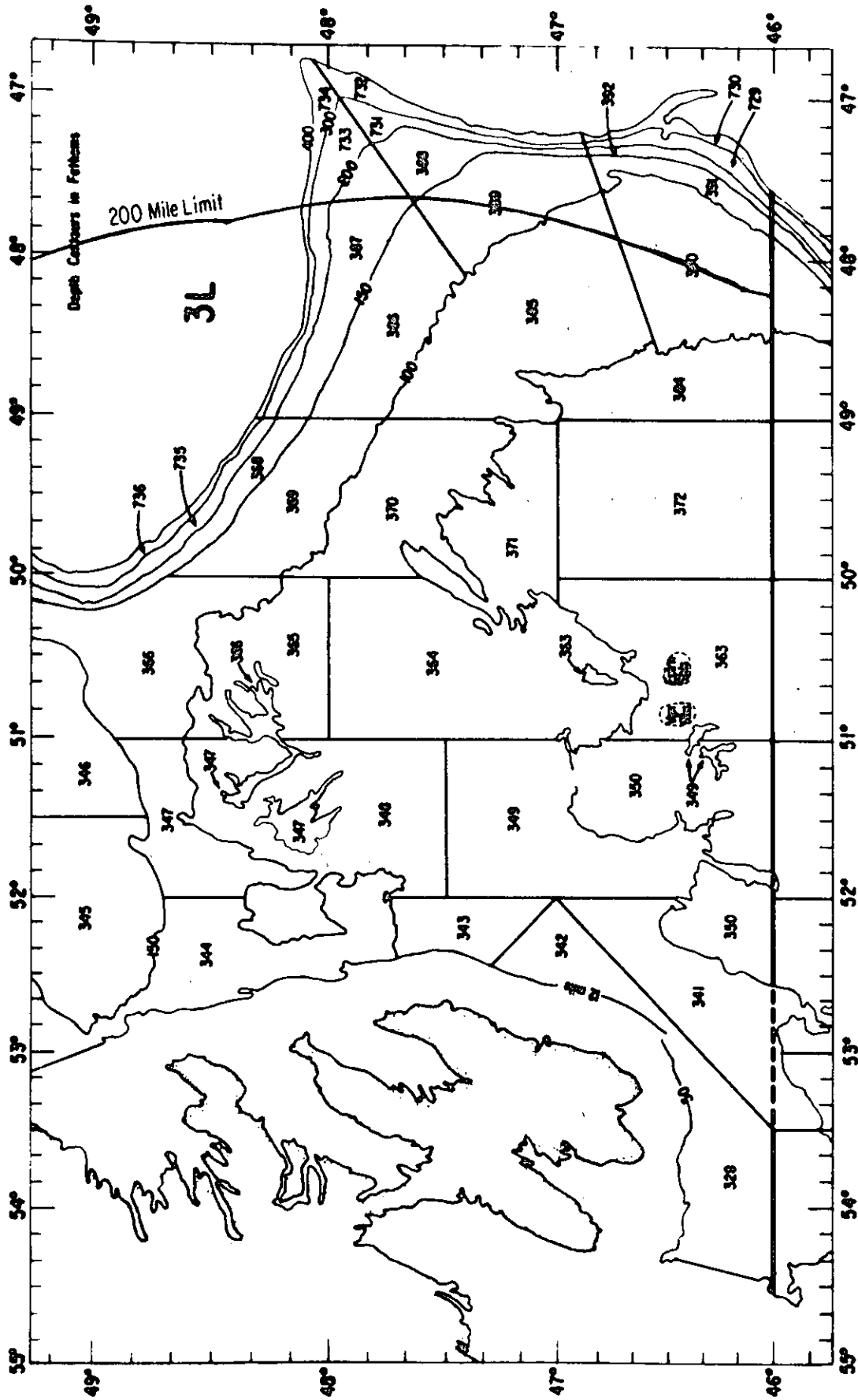


Fig. 1. Stratification scheme for NAFO Div. 3L relative to the 200 mi. economic zone.