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Greenland halibut (*Reinhardtius hippoglossoides*) in NAFO Subarea 2 and Divisions 3KLMNO: stock trends based on annual Canadian research vessel survey results.

M.J. Morgan
NW Atlantic Fisheries Centre
St. John's, Newfoundland, Canada

Abstract

An overview of survey results for Greenland Halibut from Canadian spring and fall surveys through 2017 is provided. The biomass index from the Canadian fall survey of Divs. 2J3K has declined steadily since 2014. In 2017 it is the second lowest point in the time series. The abundance index from the fall survey declined in 2012 and has since been at this lower level, below the series average. Abundance and biomass indices from the Canadian spring surveys in Div. 3LNO declined from relatively high values in the late 1990s and have been relatively low in most years thereafter. The spring survey in 2006, 2015 and 2017 are not presented as they are not considered representative of the stock due to missed strata. From 2015 to 2017 in the Canadian autumn surveys in Div. 3LNO there has been some increase in both abundance and biomass but both remain at relatively low levels. Data from this survey are not presented for 2014 due to missing strata. In 2012-2017, index values for ages 1 through 4 are all below the Campelen time-series average. The total abundance over ages 1-4 has been low in the Div. 3LNO spring survey since the good year classes of the mid 1990s. Since 2005 the number of fish 1-4 in the Div. 3LNO combined autumn series has been below the average of the time series in all but 2011 and 2017. The recruitment signal (< 30cm class) from Divs. 2J3K combined was low in 2012 -2017. The results of the abundance at age and length all indicate that recruitment has been low in recent years.

Introduction

Greenland halibut are widely distributed throughout the waters adjacent to Labrador and eastern Newfoundland. The stock was managed using a harvest control rule from 2011-2016. The harvest control rule



was abandoned for the setting of the TAC that was set for 2017. A new management strategy evaluation was conducted during 2018 and a new harvest control rule developed. The harvest control rule is based on 5 survey indices, three of which (fall 2J3K, fall 3LNO to 730 m and spring 3LNO) are Canadian and are updated here.

Abundance and biomass estimates for Greenland halibut in NAFO Subarea 2 and Divisions 3KLMNO from random-stratified spring and autumn multi-species trawl surveys conducted by Canada are updated with results from spring and fall surveys conducted during 2017.

Methods

Canadian Research Vessel Surveys

The current survey design is stratified random, with the survey area stratified by depth in each NAFO division. The number of survey sets allocated to each stratum is proportional to the area of that stratum, with at least two sets in each survey stratum. A Campelen 1800 shrimp-trawl with a 44 mm codend mesh size and 12.7 mm liner is towed for 15 minutes at a speed of 3.0 knots after bottom-contact is established. The gear geometry is monitored constantly throughout each tow using net-mounted sensors. McCallum and Walsh (1996) provide further technical specifications of the Campelen 1800 survey trawl (as well as previous trawls employed in Canadian surveys).

Survey Coverage and Timing

There have been a number of years recently where surveys have been incomplete and are not considered to be representative. These have been mainly due to mechanical issues with the survey vessels. In the fall 2J3K survey, 2008 was incomplete and is not included as a survey index. For spring 3LNO, 2006, 2015 and 2017 were all incomplete. The fall survey index for 3LNO was not completed in 2014. In addition, decisions to eliminate deep water coverage in 3NO from the survey in order to have sufficient time to complete the survey in other areas and the lack of time to cover the deepwater in 3L in 6 of the last 10 years, means that this index can only be produced to 730 m, limiting the usefulness of this index for this species. Survey coverage in 2H has been too variable to include this area as an index. There have also been reductions in coverage in some years. For example, in 2014, major mechanical issues with the spring survey vessel required an *a priori* reduction of 46 sets (primarily from Divisions 3NO) as well as the deployment of our second research vessel. See Rideout and Ings (2018) for more details on survey coverage.

Trends in Stock Size

Survey estimates of abundance and biomass and mean numbers and weights per tow are computed using standard stratified estimators. Approximate confidence intervals (95%) are provided for the stratified mean number and weight per tow; computational details can be found in Smith and Somerton (1981). Note that there

are some instances when the lower confidence bound of these indices is negative. This is a consequence of violating the distributional assumptions used to produce these confidence intervals. This result commonly arises when a limited number of large catches are taken by the survey.

For the age-disaggregated results in Divisions 2J3K combined, otoliths from Divisions 2J and 3K only were applied. To produce survey results at-age from spring and fall surveys of Div. 3LNO, an age-length key from all samples in Divisions 3LNO in each season were used.

Results and Discussion

Trends in Stock Size

Figure 1 shows the area covered by Canadian surveys. Healey et al. (2012) also provide illustrations of the current survey stratification scheme used in Canadian surveys.

The biomass index from the Canadian fall survey of Divs. 2J3K increased from 2010 to 2014 to reach the highest levels of the time series, but has declined steadily since then (Figure 2). In 2017 it is the second lowest point in the time series. The abundance index from the fall survey declined in 2012 and has since been at this lower level, below the series average.

Abundance and biomass indices from the Canadian spring surveys in Div. 3LNO (Figure 3) declined from relatively high values in the late 1990s and has been lower in most years thereafter. In 2013, 2014, and 2016, both abundance and biomass were below the time-series average. The survey in 2006, 2015 and 2017 are not presented as they are not considered representative of the stock due to missed strata.

The abundance index from the Canadian autumn surveys in Div. 3LNO (Figure 4) declined from relatively high values in the late 1990s. The biomass index declined from 1998 to 2002 and then increased to 2005, to a level near that of the beginning of the time series. From 2015 to 2017 there has been some increase in both abundance and biomass but both remain at relatively low levels.

Age and Size Composition

Recent work (Treble et al, 2008; Dwyer et al., 2013) suggest that current aging techniques – reading of whole otoliths - may underestimate ages for individuals of length greater than 60cm. This corresponds to a whole otolith age of about 10 years old. Therefore the age-disaggregated results for fish older than 9 years old are likely to be biased, and multiple cohorts may be within the assigned ages. Considerable efforts continue to be directed towards improving methodologies and results; and to incorporate these methods into current aging protocols (see ICES, 2011; Dwyer et al., 2013; Albert et al., 2009).

Annual stratified mean number per tow at age compositions from the Divisions 2J and 3K combined time series from 1978-2015 are presented in Table 3a and 3b. Note that the two tables are not directly comparable because of a change in the in length grouping used in the age length key. Survey catches are typically dominated by fish aged 1 to 6 years old. In 2012-2017, index values for ages 1 through 4 are all below the Campelen time-series average. Indices for ages 6-9, have declined since 2014, and are only half the 1995-2017 average in 2017.

Age compositions for the Div 3LNO combined spring series (Table 4) demonstrate that in most years, younger age groups (ages 1-4) are typically most abundant in this survey. Larger, older fish are may be found in depths greater than those covered by the spring survey (732m). The total abundance over ages 1-4 has been low since the good year classes of the mid 1990s. The surveys in 2006, 2015 and 2017 are not presented as they are not considered representative of the stock due to missed strata.

Age compositions for the Div. 3LNO combined autumn series (Table 5) show that there are few fish older than age 8 in this survey, which like the spring survey is presented only to 730 m in depth. Since 2005 the number of fish 1-4 has been below the average of the time series in all but 2011 and 2017. The survey in 2014 is not presented as it is not considered representative of the stock due to missed strata.

Figure 5 shows trends in mean numbers per tow for Greenland halibut <30 cm, between 31-69 cm and ≥70 cm over 1996-2017. The value of 30 cm was chosen as it is approximately equal to the mean length at age 4 for Greenland halibut surveyed in Divisions 2J and 3K; it represents the pre-recruitment trend. The value of 70 cm was chosen because it is considered to be an approximation of the length at 50% maturity in female Greenland halibut.

The recruitment signal (< 30cm class) from Divs. 2J3K combined was low in 2012 -2017. The MNPT values for the 30-70cm group increased fairly steadily from 2010 to 2013 as the higher numbers of fish in the <30 cm size class in 2009-2011 grew. The number in the 30-70 cm size group has been declining since 2013. Although the magnitude of the indices for the greater than 70 cm class is small compared to the other size classes, the abundance of this size class has increased. There was a decline in this length class in 2017 but the 2017 value, along with those from 2012-2016, are the highest in the 1996-2017 time series.

The results of the abundance at age and length all indicate that recruitment has been low in recent years.

Distribution

The distribution of Greenland halibut biomass by depth is given in Tables 6-13. These tables also give an overview of the survey coverage in each year. In the fall survey in Div. 2J most of the biomass is found in 200-750 m depth. The main distribution has a narrower depth range in Div. 3K, with the bulk of the biomass being found between 300 and 500 m. In Div. 3L in the spring the bulk of the biomass in most years is in 275-731 m. From 2005-2007 there was also a significant biomass in 184-274 m. In most years in the spring survey in Div. 3N the bulk of the

biomass is found between 367 and 731 m. In the spring survey in Div. 30 Greenland halibut distribution is more variable from year to year. In general there are two peaks of distribution, the first between 93 and 274 m and the second in the deepest strata surveyed from 550-731 m. The deepest strata are not surveyed in the spring and the presence of a large proportion of the biomass in the 550-731 m depth range in each of the Divisions indicates that there are fish deeper than the survey. Note that the spring surveys in 2006 and 2015 are not considered to be representative of the stock and are not presented in the tables. The bulk of the biomass in Div. 3L in the autumn in most years is in the depth range of 184-366 m, shallower than in the spring. In Div. 3N in the autumn most of the biomass is distributed in depths greater than 275 m, with substantial biomass in the deepest strata in many years, indicating the distribution of fish deeper than the survey. In Div. 3O in the autumn the bulk of the biomass is often in the deepest strata covered.

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Table 1. Summary of successful sets in autumn surveys in Sub-Areas 2+3 in 2017. Depth range is given in meters, number of sets for the trip in parantheses. All sets conducted in the survey are included.

Fall 2017

Division	Ship		Total
	<i>Teleost</i>	<i>A.Needler</i>	
2G	Not surveyed		
2H	98-640(68)		68
	122-1399		
2J	(114)		114
	133 - 1384		
3K	(65)	162-672(88)	153
3L	902-1379(2)	62-712(141)	143
3N		42-652(70)	70
3O		59-698(73)	75
			623

Table 2. Summary of successful sets in spring surveys in Divs. 3LNO in 2017. Depth range is given in meters, number of sets for the trip in parantheses. All sets conducted in the survey are included.

Spring 2017

Division	Ship		Total
	<i>Teleost</i>	<i>A.Needler</i>	
3L		60 - 158 (32)	32
3N		44-658(68)	68
3O		63-702(71)	71
			171

Table 3a. Greenland halibut stratified mean number per set at age from Canadian fall surveys conducted in Divisions 2J and 3K combined during 1978-1994. Only otoliths collected in Div. 2J or 3K are used in the analysis. Numbers expressed in Campelen 1800 units.

Age (yrs)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
0	0.48	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.06	0.00	2.17	0.66	0.00	0.00	0.92	1.05	16.90
1	9.61	10.81	6.78	19.39	4.75	1.66	4.47	24.59	17.21	5.04	8.82	7.10	1.34	13.80	5.69	8.08	29.79
2	40.24	18.07	6.53	22.99	5.10	4.45	7.11	14.67	13.96	11.21	10.54	12.54	5.26	5.59	23.78	43.64	21.62
3	33.37	13.47	6.20	15.42	12.78	10.56	9.56	8.71	16.62	29.44	15.04	23.84	9.95	6.08	20.40	64.00	22.61
4	19.52	7.15	5.58	6.01	10.81	11.41	10.29	6.87	14.64	12.17	17.03	25.22	23.39	13.32	13.59	19.28	18.90
5	12.50	7.47	7.07	6.58	8.09	10.45	15.34	9.50	9.49	9.62	14.90	17.40	15.38	9.05	4.84	5.56	7.22
6	8.34	7.21	7.56	7.25	5.76	7.45	7.74	8.86	11.04	6.89	7.82	9.95	9.21	5.41	3.11	1.76	1.32
7	5.15	3.50	4.72	5.15	6.06	7.56	5.44	5.98	9.54	6.39	5.65	5.34	4.81	1.29	1.27	0.74	0.61
8	2.26	1.41	1.59	2.21	6.29	5.67	3.50	2.26	3.19	3.27	1.65	1.36	0.83	0.26	0.12	0.23	0.19
9	1.27	0.67	0.71	1.02	2.65	2.19	1.70	1.03	1.00	1.25	0.43	0.40	0.21	0.08	0.02	0.03	0.03
10	0.96	0.64	0.56	0.59	1.02	0.65	0.74	0.75	0.34	0.37	0.16	0.11	0.10	0.05	0.01	0.00	0.01
11	0.81	0.42	0.63	0.48	0.60	0.46	0.35	0.30	0.26	0.19	0.10	0.08	0.09	0.02	0.00	0.00	0.00
12	0.49	0.37	0.41	0.22	0.38	0.33	0.24	0.27	0.23	0.19	0.06	0.02	0.05	0.01	0.00	0.02	0.00
13	0.32	0.31	0.27	0.12	0.27	0.24	0.20	0.12	0.12	0.10	0.05	0.00	0.03	0.00	0.00	0.00	0.00
14	0.10	0.15	0.15	0.06	0.28	0.16	0.18	0.13	0.07	0.08	0.04	0.01	0.02	0.00	0.00	0.00	0.00
15	0.07	0.10	0.06	0.04	0.18	0.07	0.09	0.08	0.08	0.05	0.03	0.01	0.01	0.00	0.00	0.00	0.00
16	0.05	0.09	0.03	0.00	0.09	0.02	0.06	0.04	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00
17	0.03	0.03	0.01	0.00	0.01	0.00	0.03	0.04	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.02	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ages 0-20	135.55	71.89	48.87	87.52	65.12	63.33	67.04	85.44	98.91	86.32	84.53	104.03	70.69	54.94	73.76	144.39	119.19
Ages 1-4	102.74	49.50	25.09	63.81	33.44	28.08	31.43	54.84	62.43	57.86	51.43	68.70	39.94	38.79	63.46	135.00	92.92
Ages 5+	32.33	22.39	23.78	23.71	31.68	35.25	35.61	29.40	35.42	28.46	30.93	34.68	30.74	16.16	9.37	8.34	9.37
Ages 6-9	17.01	12.78	14.58	15.62	20.76	22.86	18.38	18.14	24.77	17.81	15.55	17.04	15.06	7.02	4.52	2.76	2.14

Table 3b. Greenland halibut stratified mean number per set at age from Canadian fall surveys conducted in Divisions 2J and 3K combined during 1995-2017. Only otoliths collected in Div. 2J or 3K are used in the analysis.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Age (yrs)												
0	10.95	4.92	2.18	1.52	6.46	3.09	8.49	8.30	9.94	4.15	5.07	
1	49.93	98.68	28.05	23.35	15.99	38.57	43.90	40.67	45.70	32.49	16.06	
2	51.10	47.82	58.62	25.07	34.42	21.94	22.72	24.08	26.67	32.93	16.15	
3	15.13	32.01	43.61	31.19	24.07	16.43	17.00	12.50	11.69	13.89	8.56	
4	6.03	9.54	21.13	21.87	28.28	13.20	14.07	9.68	9.49	12.31	13.84	
5	6.63	6.28	10.37	10.86	20.04	13.76	9.77	6.03	6.39	9.21	10.98	
6	1.99	2.47	5.01	4.45	10.53	7.21	7.59	1.97	2.27	2.68	6.85	
7	0.39	0.84	2.00	2.07	3.81	2.16	3.40	0.72	0.89	1.20	3.96	
8	0.12	0.19	0.64	0.57	0.70	0.50	0.69	0.19	0.27	0.36	0.66	
9	0.02	0.18	0.20	0.13	0.14	0.06	0.11	0.04	0.04	0.08	0.12	
10	0.01	0.04	0.06	0.06	0.07	0.03	0.02	0.01	0.02	0.03	0.03	
11	0.00	0.02	0.03	0.03	0.02	0.02	0.01	0.00	0.01	0.01	0.03	
12	0.00	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.01	
13	0.00	0.02	0.01	0.01	0.03	0.00	0.01	0.00	0.00	0.01	0.01	
14	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Ages 0-20	142.30	203.02	171.93	121.20	144.57	116.98	127.80	104.20	113.38	109.36	82.33	
Ages 1-4	122.19	188.05	151.41	101.48	102.76	90.14	97.69	86.93	93.55	91.62	54.61	
Ages 5+	9.16	10.05	18.34	18.20	35.35	23.75	21.62	8.97	9.90	13.58	22.65	
Ages 6-9	2.51	3.67	7.85	7.22	15.18	9.93	11.80	2.92	3.47	4.32	11.59	
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Age (yrs)												
0	3.75	2.21	No Survey	5.49	19.54	4.81	5.16	0.1	3.10	0.50	10.58	6.48
1	32.34	32.61		50.62	50.94	44.14	12.28	24.32	22.08	17.17	29.65	30.76
2	17.98	14.51		19.15	39.25	42.06	9.61	12.92	30.41	13.98	19.47	22.94
3	8.50	12.81		11.40	14.81	20.97	11.27	6.74	11.39	15.14	10.81	10.28
4	17.60	18.77		8.42	9.45	18.79	11.86	7.4	4.54	7.77	8.15	8.82
5	13.03	9.57		9.89	6.74	10.32	10.96	10.91	7.96	6.82	4.83	5.76
6	9.11	10.35		5.40	3.77	5.50	9.03	9.09	7.38	4.18	4.89	2.65
7	4.18	6.17		3.59	2.20	3.15	4.31	7.76	8.92	3.91	3.01	1.27
8	1.15	2.14		1.39	1.02	1.26	1.69	3.96	6.62	3.92	2.09	0.96
9	0.18	0.34		0.25	0.18	0.33	0.29	0.5	0.97	0.65	0.51	0.37
10	0.03	0.08		0.08	0.07	0.13	0.11	0.15	0.20	0.14	0.10	0.12
11	0.02	0.04		0.02	0.04	0.06	0.05	0.04	0.04	0.06	0.06	0.04
12	0.01	0.02		0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01
13	0.00	0.01		0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.01
14	0.00	0.01		0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.01
15	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0	0.01	0.01	0.00
16	0.00	0.00		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
17	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ages 0-20	107.89	109.64		115.73	148.03	151.55	76.67	83.94	103.67	74.27	94.20	90.49
Ages 1-4	76.42	78.70		89.59	114.45	125.96	45.02	51.38	68.42	54.06	68.08	72.79
Ages 5+	27.72	28.73		20.65	14.04	20.78	26.49	32.46	32.15	19.72	15.54	11.21
Ages 6-9	14.62	19.00		10.63	7.16	10.24	15.31	21.31	23.89	12.66	10.50	5.25

Table 4. Greenland halibut stratified mean number per set at age from Canadian spring surveys conducted in Div. 3LNO combined during 1996-2017. Only otoliths collected in 3L, 3N, or 3O are used in the analysis.

Age (yrs)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	No Survey
1	1.62	1.16	0.23	0.29	0.79	0.57	0.64	0.93	0.66	0.35	
2	4.24	3.92	0.84	0.55	1.07	0.71	0.57	2.14	0.57	0.31	
3	4.60	5.16	3.89	1.15	1.07	0.74	0.60	1.66	1.18	1.09	
4	2.18	3.23	6.21	1.98	1.51	0.68	0.58	1.57	1.18	0.95	
5	0.83	1.46	4.96	3.39	1.95	0.80	0.61	1.06	1.16	1.37	
6	0.28	0.51	1.24	1.09	2.04	0.72	0.21	0.21	0.26	0.82	
7	0.06	0.10	0.33	0.24	0.56	0.28	0.05	0.05	0.04	0.21	
8	0.00	0.01	0.07	0.05	0.03	0.02	0.01	0.01	0.02	0.03	
9	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Ages 1-4	12.64	13.47	11.18	3.98	4.44	2.69	2.40	6.30	3.60	2.70	
Ages 5+	1.17	2.08	6.61	4.78	4.59	1.81	0.87	1.32	1.48	2.43	
Ages 1-10	13.81	15.56	17.79	8.75	9.03	4.51	3.27	7.62	5.08	5.13	

Age (yrs)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	No Survey	0.08	No Survey
1	1.60	0.44	0.27	0.77	1.96	0.32	1.28	1.62		0.42	
2	0.52	0.77	0.22	0.66	1.40	0.80	0.68	1.19		0.56	
3	0.80	0.96	0.19	0.52	0.92	2.48	0.05	0.32		0.37	
4	0.40	0.71	0.39	0.40	0.65	1.40	0.38	0.20		0.46	
5	1.41	1.25	0.45	0.84	0.62	1.16	0.61	0.24		0.30	
6	1.49	0.75	0.26	1.08	0.29	0.50	0.23	0.24		0.20	
7	1.12	0.64	0.13	0.35	0.16	0.18	0.11	0.14		0.08	
8	0.18	0.28	0.07	0.14	0.10	0.06	0.04	0.06		0.05	
9	0.02	0.02	0.01	0.02	0.01	0.02	0.00	0.01		0.01	
10	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00		0.01	
Ages 1-4	3.31	2.89	1.06	2.34	4.92	5.01	2.40	3.33		1.81	
Ages 5+	4.22	2.96	0.92	2.45	1.18	1.92	1.00	0.68		0.65	
Ages 1-10	7.54	5.85	1.99	4.79	6.10	6.94	3.39	4.01		2.46	

Table 5. Greenland halibut stratified mean number per set at age from Canadian autumn surveys conducted in Div. 3LNO combined during 1996-2017. Only otoliths collected in 3L, 3N, or 3O are used in the analysis.

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0.25	0.24	0.06	0.22	0.12	0.49	0.13	0.17	0.06	0.08	0.16
1	5.27	1.22	0.53	0.04	1.76	1.40	1.28	1.79	1.18	0.60	0.85
2	4.92	3.33	1.76	0.62	1.24	0.62	0.90	1.07	1.32	0.89	0.49
3	3.84	4.46	1.86	0.73	0.39	0.68	1.04	1.55	1.56	0.50	0.12
4	1.41	3.63	2.99	1.04	0.78	1.39	1.01	1.87	1.69	1.76	0.68
5	1.00	1.88	4.10	1.97	1.21	0.75	0.91	0.91	1.51	1.58	1.33
6	0.40	0.47	1.50	1.67	1.35	1.15	0.39	0.28	0.39	1.14	1.35
7	0.08	0.11	0.32	0.39	0.47	0.61	0.17	0.05	0.10	0.56	0.59
8	0.00	0.04	0.08	0.04	0.04	0.05	0.04	0.02	0.01	0.06	0.13
9	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ages 1-4	15.44	12.65	7.15	2.43	4.17	4.08	4.23	6.27	5.75	3.76	2.13
Ages 5+	1.49	2.51	6.02	4.08	3.07	2.56	1.51	1.25	2.01	3.36	3.41
Ages 1-10	16.93	15.15	13.17	6.50	7.24	6.64	5.75	7.53	7.76	7.11	5.54

Age	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0	0.09	0.25	0.23	0.44	0.33	0.33	0.08		0.05	0.98	0.16
1	0.83	0.95	2.15	1.95	1.30	0.62	2.77		0.78	1.30	2.60
2	0.47	0.28	0.24	0.62	4.13	0.20	1.00		0.60	0.44	0.86
3	0.27	0.82	0.42	0.86	1.20	0.45	0.37		0.33	0.56	1.32
4	0.81	1.13	0.47	0.67	2.02	1.18	0.41		0.31	0.50	0.55
5	0.61	0.90	0.88	0.68	0.93	0.93	1.02		0.25	0.63	0.57
6	1.24	1.00	0.61	0.67	0.67	0.70	1.06		0.34	0.38	0.34
7	0.75	0.76	0.30	0.31	0.32	0.27	0.62		0.17	0.21	0.16
8	0.21	0.44	0.14	0.11	0.06	0.08	0.26		0.10	0.09	0.09
9	0.02	0.04	0.03	0.02	0.02	0.01	0.01		0.01	0.03	0.02
10	0.01	0.00	0.01	0.01	0.00	0.00	0.01		0.00	0.01	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.01		0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.01		0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Ages 1-4	2.37	3.17	3.28	4.10	8.66	2.45	4.55		2.02	2.81	5.34
Ages 5+	2.84	3.13	1.96	1.79	2.00	2.01	2.98		0.87	1.35	1.18
Ages 1-10	5.21	6.31	5.24	5.89	10.65	4.46	7.52		2.89	4.16	6.51

Table 6. Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 2J 1978-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
101 - 200	1427	633	201	257	91	486	439	1620	524	913	91	206	42	21	171	103	34	0	6	27
	1823	1594	205	1753	2385	1007	2591	4878	2748	1521	502	283	113	168	126	87	104	16	6	14
	2582	1870	206	3384	2279	3315	9691	5703	2647	3370	1545	1399	250	590	217	335	99	75	28	132
	2246	2264	207	6538	2707	2153	4177	2601	1921	1526	627	352	93	58	14	0	0	0	0	33
		733	237	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0
	778	238	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	7
	Sub-Total			11931	7462	6960	16898	14801	7840	7330	2765	2240	499	838	528	526	237	90	40	213
201 - 300	440	621	202	1007	1437	1673	1778	1915	1307	4167	563	448	867	.	32	246	164	79	8	307
	1608	680	209	4481	15830	15100	8547	19662	8897	5183	6062	2398	1491	1997	2003	1488	574	454	384	123
	774	1035	210	956	782	960	549	1845	3694	2268	566	374	281	786	654	908	266	373	589	121
	1725	1583	213	2686	1921	4701	5070	6550	4853	3547	6427	3754	1918	1146	494	609	84	301	302	422
	1171	1341	214	5954	2893	1904	6928	9277	5862	7527	7489	1398	1923	2598	862	883	176	425	1064	507
301 - 400	1270	1302	215	3247	1181	2407	1842	5350	1967	5528	2829	2056	1920	1265	896	1445	750	869	1349	855
	1428	2196	228	528	1406	3057	1289	1643	1817	2615	1119	1392	889	330	1034	1517	475	424	967	2749
	508	530	234	7009	4357	3916	3492	5306	2665	4868	1143	922	454	1426	853	386	226	141	895	129
		Sub-Total		25868	29807	33717	29495	51548	31060	35703	26199	12741	9743	9549	6827	7482	2715	3066	5557	5214
	480	487	203	2311	4188	1296	2925	3502	11077	12390	1400	6043	1586	2104	4732	2108	2424	587	1856	1404
401 - 500	448	588	208	7045	4799	6542	10304	15563	5125	19043	17885	8229	4397	3640	9245	8660	2572	2006	1025	4820
	330	251	211	3152	1736	2734	1256	1821	4216	1912	5424	3300	1992	3049	1016	6051	922	352	1628	871
	384	360	216	2832	6574	6969	2551	7456	4258	6788	3213	1460	2197	170	487	447	166	167	331	392
	441	450	222	3064	3243	3729	2527	7887	5835	2964	1850	128	1506	1847	407	865	70	154	170	535
	567	536	229	1024	1412	1464	2017	1261	2235	681	1021	985	371	208	233	152	545	783	246	1202
	Sub-Total		52306	56116	60367	54567	94344	66470	84349	58134	33808	22247	21992	23799	26153	9640	7257	5255	9223	
501 - 750	354	288	204	21544	12476	.	9195	11739	9016	8750	728	8930	6466	6227	20968	5584	3045	2276	2512	3442
	268	241	217	4717	1845	3767	1192	1694	1595	.	3480	2589	1325	1349	181	1012	164	100	270	226
	180	158	223	1711	1208	2623	1635	1622	1106	1893	1358	2065	462	1134	306	574	72	75	130	168
	686	598	227	6618	2186	5935	3056	3822	2768	2565	2912	1652	3068	2352	4044	3232	1101	1937	1648	2009
	420	414	235	5146	4006	5923	2000	4265	10840	3224	3269	7547	4825	2789	6721	8779	661	609	810	1042
	Sub-Total		93066	79248	80079	73661	118746	94029	101463	70902	57577	38765	36051	56253	45486	15229	13036	5455	7004	
751 - 1000	664	557	212	11338	15580	7520	9579	9423	3113	4609	7201	23242	21891	4953	2937	5488	1658	2331	5048	1485
	420	362	218	11403	.	5223	6388	1767	1695	.	1461	3151	2308	2513	859	2077	1096	174	248	136
	270	228	224	2250	3012	1067	2825	1182	1438	1167	847	5782	1554	1661	89	374	248	191	85	309
	237	185	230	2124	.	4016	1823	769	2452	629	766	2386	1369	1273	1063	1268	903	1647	135	379
	120	239	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1917	1411
	Sub-Total		125327	101845	103828	96277	136152	113568	111092	84446	99685	70712	49240	67921	63471	19795	17988	7434	3720	
1001 - 1250	213	283	219	.	.	.	1005	.	2120	.	1664	6187	1872	1104	791	2015	293	253	639	1579
	182	186	231	2634	.	3261	.	1805	1117	1842	2372	580	791	2975	.	2131	574	730	613	604
	122	193	236	.	.	.	640	946	1287	718	1113	2478	1199	182	.	1390	1501	593	886	230
		Sub-Total		143739	104857	117396	108959	142620	123677	115448	92668	120250	79805	58949	70722	72726	24411	21575	2138	2413
	324	303	220	1571	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1251 - 1500	177	195	225	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	236	228	232	870	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		Sub-Total		274141	206702	224486	206882	281523	241769	229100	182262	229180	154378	112451	139433	141733	46575	41139	0	0
	286	330	221	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	180	201	226	99	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sub-Total		420420	311559	341882	315841	424143	365446	344547	274931	349430	234183	171401	210155	214459	70986	62714	0	0	
Total Biomass (t)				855633	685571	729580	694050	982607	788606	796691	604302	657198	445571	338988	426916	417792	139570	122273	25880	27786



Table 6 cont'd. Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 2J 1978-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
101 - 200	1427	633	201	.	82	26	91	0	65	27	133	11	135	50	27	491	33	79	87	507	154	159	22	15	109	84	
	1823	1594	205	.	514	35	502	532	281	863	754	706	1055	990	245	1769	530	469	630	1051	343	4504	860	856	692	771	
	2582	1870	206	399	1120	404	349	403	357	1367	1586	890	813	1079	404	617	835	384	2870	2184	587	1869	239	230	896	1120	
	2246	2264	207	1	56	51	74	192	16	208	35	192	118	30	15	160	51	5	717	754	3570	207	239	1157	200	375	
	.	733	237	0	1	4	19	320	0	5	42	3	0	37	0	280	17	0	111	.	5	96	0	10	129	83	
	778	238	.	.	15	0	79	0	53	27	6	54	81	18	8	696	43	8	62	713	.	1	44	83	2	112	44
	Sub-Total			400	1789	519	1115	1447	771	2498	2556	1856	2202	2205	697	4012	1508	946	4478	5210	4659	6880	1444	2270	2138	2476	
201 - 300	440	621	202	95	89	157	593	1685	574	2215	491	871	2260	898	797	901	876	164	947	2996	2909	1711	7724	1557	3611	671	
	1608	680	209	360	1059	424	282	2204	694	291	1061	1475	811	379	2560	1775	250	1204	790	1153	1115	223	3308	717	1186	445	
	774	1035	210	2708	3904	893	1047	613	661	1140	3314	1861	626	285	828	981	443	1397	1281	3088	2746	4573	3596	1289	432	1209	
	1725	1583	213	236	1338	1146	1962	1426	893	2332	1336	1950	1163	1325	3620	2343	2776	952	1911	2730	2031	2704	2932	928	932	259	
	1171	1341	214	327	4057	1258	1502	1883	1204	1930	485	1337	2500	2520	3241	2087	1904	1631	1690	2633	2154	8797	2875	1302	1281	360	
	1270	1302	215	1370	1247	1448	1889	1986	1139	1967	3499	1360	1592	3091	1633	1920	909	2691	4767	1983	7065	2087	5366	2385	806	1172	
	1428	2196	228	2219	5478	3666	4356	2566	2870	2803	1850	1175	2858	3626	3389	3339	891	2473	1452	1735	1478	762	1589	525	515	274	
	508	530	234	.	163	753	352	311	122	349	75	1237	54	1367	327	671	337	304	363	16749	1449	2987	583	463	2062	357	
	Sub-Total			7315	17335	9744	11982	12675	8157	13026	12111	11267	11864	13491	16394	14017	8387	10816	13200	33066	20945	23846	27973	9166	10825	4747	
301 - 400	480	487	203	387	946	2233	3303	2553	2200	4090	1134	2846	6523	1792	2581	2064	1548	4950	6055	13207	3089	12619	5620	5720	1818	2458	
	448	588	208	4799	3707	12593	6479	11101	9423	5230	7812	2894	8453	5500	20207	3983	2086	4542	10744	11136	8229	31005	22176	7541	516	1952	
	330	251	211	1400	1343	1875	870	3541	640	2964	2336	2016	2414	5397	3626	1353	615	1388	1752	3960	4575	2129	10983	6655	237	655	
	384	360	216	64	506	1090	1631	881	1103	1076	397	957	697	641	1457	348	1274	1192	1376	890	2534	1222	1781	416	569	341	
	441	450	222	122	1672	930	382	751	995	1151	1086	322	371	164	593	289	637	404	86	155	1252	2319	1317	230	390	142	
	567	536	229	1799	3900	1940	2514	1206	1639	1591	1123	2336	439	728	3408	625	1607	1041	1552	360	188	1277	700	475	147	146	
	Sub-Total			8571	12074	20660	15179	20032	16001	16101	13888	11371	18897	14222	31873	8662	7766	13516	21566	29708	19866	50571	42577	21039	3677	5694	
401 - 500	354	288	204	1437	3823	7941	6171	3707	4652	5240	1762	7283	8250	8979	5950	2949	4064	4711	5412	3633	8443	3548	6119	6035	5559	6023	
	268	241	217	131	932	676	621	704	628	1983	458	395	433	1027	444	190	234	716	210	307	676	264	924	567	505	220	
	180	158	223	162	438	425	598	505	.	346	419	179	699	424	475	224	161	116	135	91	367	212	323	333	888	128	
	686	598	227	909	5850	9244	1793	13071	3628	4226	1316	6852	1325	6381	31416	4173	1936	1043	4561	915	2293	1446	1875	912	865	2769	
	420	414	235	3895	4373	8365	3256	4183	3929	4170	4733	5739	1990	2852	3286	3384	477	1387	2354	1218	3053	2694	10860	5100	6733	1138	
	.	133	240	632	537	501	251	643	204	413	552	178	194	186	629	190	136	334	325	283	132	121	33	338	129	136	
	Sub-Total			7167	15953	27152	12692	22813	13041	16379	9240	20626	12891	19849	42200	11110	7008	8305	12997	6447	14964	8286	20134	13285	14679	10415	
501 - 750	664	557	212	5499	4940	10735	4375	14447	4366	3802	7126	4898	3595	4086	4733	6766	6429	12166	7310	3818	4583	3677	3574	992	14686	2432	
	420	362	218	693	1783	1207	1319	1019	690	1413	732	456	844	661	731	237	100	1489	407	455	491	687	694	1686	574	446	
	270	228	224	214	702	625	401	293	701	360	130	205	356	538	372	190	248	764	612	206	193	873	900	435	815	233	
	237	185	230	652	1350	1589	547	2230	786	569	560	383	356	242	629	502	442	1405	458	552	348	786	580	847	300	124	
	.	120	239	1676	2586	2725	4867	4064	1959	1945	867	3470	3389	1776	3456	2219	2746	2165	2337	1460	4572	2766	2086	3001	5500	3093	
	Sub-Total			8734	11360	16880	11508	22052	8501	8088	9415	9413	8540	7302	9922	9914	9965	17989	11124	6491	10188	8789	7835	6961	21874	6328	
751 - 1000	213	283	219	2021	405	1727	2249	1402	1731	1297	621	1248	1156	374	761	1083	.	1703	687	1081	132	866	426	1678	1201	1555	
	182	186	231	376	1013	651	1635	1744	2828	2820	1603	432	720	612	1561	1865	1384	1284	433	924	468	625	667	273	491	544	
	122	193	236	1007	698	381	725	1107	592	937	881	533	344	468	642	925	.	749	221	697	230	805	375	322	561	388	
	Sub-Total			3405	2116	2758	4609	4252	5151	5054	3105	2213	2220	1454	2963	3873	1384	3737	1341	2702	830	2296	1469	2272	2252	2487	
1001 - 1250	324	303	220	.	1296	503	1196	.	568	786	749	1480	1116	871	472	3420	.	353	374	480	306	154	495	805	1466	615	
	177	195	225	.	835	693	655	478	175	1219	65	171	112	481	186	408	319	563	111	446	51	126	0	340	338	640	
	236	228	232	.	717	935	627	1787	1063	1146	626	56	714	502	300	1001	666	1276	440	374	32	267	367	281	1154	381	
	Sub-Total			0	2848	2132	2478	2265	1805	3151	1440	1706	1942	1854	958	4829	984	2192	925	1300	389	547	862	1425	2958	1635	
1251 - 1500	286	330	221	.	131	1246	692	567	401	268	654	124	166	249	17	469	.	488	725	237	192	34	472	1070	307	60	
	180	201	226	.	277	407	1313	626	400	368	243	756	217	217	334	185	.	326	96	138	54	91	132	104	122	623	
	180	237	233	.	889	596	542	418	628	844	938	438	195	233	566	662	442	273	289	237	78	52	146	131	398	264	
	Sub-Total			0	1298	2249	2548	1611	1430	1480	1835	1317	578	699	916	1316	442	1087	1109	612	324	177	750	1306	826	947	
Total Biomass (t)				35591	64772	82095	62111	87147	54858	65777	53590	59769	59135	61078	105925	57733	37444	58589	66740	85535	72165	101392	103044	57722	59230	34729	

Table 7 Biomass (tons) by stratum (converted to Campelen units from 1978-94) from Canadian fall surveys in Div. 3K 1978-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
101 - 200	.	798	608	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	445	612	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	250	616	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1455	1347	618	.	.	.	.	.	.	.	263	874	49	17	31	70	0	0	0	0	8
1588	1753	619	.	.	.	.	.	.	.	685	401	108	41	26	78	0	0	0	0	0
Sub-Total				0	0	0	0	0	0	948	1275	157	58	57	148	0	0	0	0	8
201 - 300	.	342	609	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	573	611	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	251	615	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2709	2545	620	.	18712	9129	9090	9404	7175	6302	4074	5095	4164	2108	3737	583	451	899	152	53	1113
2859	2537	621	.	41597	36475	15203	11844	6287	12035	6600	12389	2323	4458	3166	4278	485	1151	2264	972	1021
668	1105	624	.	837	878	491	305	467	232	527	434	298	445	196	310	288	335	413	1017	754
447	.	632	.	204	147	620	344	426	187	.	394	133	86	49	81	384	111	267	.	.
1618	1555	634	.	1482	1819	1196	1233	3348	1410	1293	1157	877	1919	776	587	707	526	296	990	962
1274	1274	635	.	1548	960	3092	2074	3013	1388	1668	773	1924	1932	910	1335	307	46	88	99	41
1455	1455	636	.	1650	872	2155	2163	3642	792	1299	861	806	353	852	701	401	240	282	829	398
1132	1132	637	.	723	575	907	1180	1366	2275	662	1780	1441	1349	700	466	818	293	144	435	119
Sub-Total				66753	50855	32753	28545	25722	24620	16123	22883	11965	12649	10386	8341	3842	3601	3905	4395	4407
301 - 400	.	256	610	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	263	614	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	593	617	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1027	494	623	.	16992	3898	9646	10319	16038	24364	29298	8090	18912	14251	17661	11384	4603	5417	2598	5604	2993
850	888	625	.	1915	1387	1530	3242	822	5794	3856	4936	3449	5773	3204	847	3881	2176	484	1672	1931
919	1113	626	.	7394	4470	14225	6023	11576	11302	20810	13944	16278	8319	12970	11682	3365	3698	5003	3469	4263
1085	1085	628	.	4700	4183	8400	2305	1867	5126	4652	9824	9477	5858	6368	4150	2513	902	590	1438	1372
499	495	629	.	532	834	1790	2004	4063	3706	1779	1335	2978	5191	7176	4634	1053	385	1058	1324	1337
544	332	630	.	2056	800	1368	7048	.	4258	485	2244	1861	4436	4313	3075	2065	2188	917	1274	1331
2179	2067	633	.	2393	2472	4271	2834	2296	3115	3219	3432	4445	5532	3380	5842	5285	3440	2813	4511	2868
2059	2059	638	.	4198	3427	2615	4854	4801	4371	2922	7321	5983	4382	3057	2972	6809	1993	2625	2804	1908
1463	1463	639	.	1031	1254	1385	1266	3321	2174	436	872	1288	703	653	511	854	766	1175	1718	872
Sub-Total				41211	22724	45229	39896	44783	64210	67457	51996	64670	54445	58782	45096	30427	20964	17263	27042	21258
401 - 500	.	30	613	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
632	691	622	.	16724	8517	3448	10766	7914	14953	8922	4742	36448	12755	17950	13695	30531	6256	4326	6993	3921
1184	1255	627	.	11452	5878	9820	24040	16903	27637	38222	18219	33516	21372	21502	37862	18637	10870	4355	31882	7308
1202	1321	631	.	8523	3909	4910	8787	5115	8693	12698	9456	8334	15010	11317	17190	4993	16791	3570	9779	9453
198	69	640	.	835	.	1177	756	531	.	344	398	204	417	163	225	367	310	130	77	111
204	216	645	.	462	.	336	534	434	97	1157	1055	.	613	351	81	460	103	213	110	108
.	134	650	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	193	338
Sub-Total				37996	18304	19692	44883	30898	51380	61344	33870	78502	50166	51283	69053	54988	34330	12595	49034	21238
501 - 750	584	230	641	776	1647	2245	1521	1622	3609	3924	1384	.	1367	.	.	2661	651	440	411	109
333	325	646	.	2231	3156	1852	2656	590	2959	3167	2337	.	1143	.	.	449	1083	375	105	463
.	359	651	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	704	894
Sub-Total				3008	4802	4097	4177	2212	6568	7091	3721	0	2510	0	0	3110	1734	816	1219	1467
751 - 1000	931	418	642	2417	.	3824	1134	3305	.	8496	3279	.	2722	.	.	4475	4484	9225	1541	2336
409	360	647	.	7096	2019	3855	3634	1817	.	.	4473	.	.	.	.	3857	1197	655	2413	1829
.	516	652	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2242	1445
Sub-Total				9513	2019	7679	4768	5122	0	8496	7753	0	2722	0	0	8332	5680	9880	6196	5610
1001 - 1250	1266	733	643	1254	1364	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
232	228	648	.	406	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	531	653	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				1660	1364	0	0	0	0	0	0	0	0	0	0	0	0	0	1718	0
1251 - 1500	954	474	644	1890	783	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
263	212	649	.	366	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	479	654	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				2256	783	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total biomass (t)				162396	100851	109450	122269	108737	146777	161458	121498	155294	122551	120508	122638	100699	66310	44458	89603	53988

Table 7 cont'd

Depth Range (m)	V1 Area	V4 Area	Stratum	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
101 - 200	.	798	608	.	0	44	37	.	0	8	4	0	5	14	0	.	.	.	79	
	.	445	612	.	0	135	0	.	1	0	38	0	0	2	0	.	.	.	65	
	.	250	616	.	0	4	23	.	0	0	0	0	0	0	0	.	.	.	.	
	1455	1347	618	286	19	11	15	1	59	0	49	109	55	2	3	39	0	6	113	
	1588	1753	619	18	29	57	0	0	13	0	30	109	62	1	2	1	0	1	149	
Sub-Total				304	48	250	74	2	72	8	122	218	122	19	4	39	0	7	406	
201 - 300	.	342	609	.	117	386	202	.	177	8	8	86	96	43	68	.	.	42	135	
	.	573	611	.	113	265	162	.	41	43	164	465	144	34	372	.	.	.	469	
	.	251	615	.	39	67	176	.	23	20	0	37	1	34	22	.	.	.	222	
	2709	2545	620	790	4213	1275	1171	1367	3389	992	1280	594	1012	794	905	673	61	2247	3829	
	2859	2537	621	1068	3967	1320	2524	858	1495	113	1149	1870	1856	185	639	1221	565	1361	4305	
	668	1105	624	508	2516	1610	1752	1805	1186	2358	1027	258	1950	2825	723	1112	420	451	852	
	447	.	632	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	1618	1555	634	727	2370	2144	1321	1933	1197	2195	1493	455	497	1930	3313	2820	1813	1808	770	
	1274	1274	635	128	1344	1545	1266	971	491	215	125	167	0	1052	.	1008	334	431	428	
	1455	1455	636	1393	2336	1171	1054	1002	1015	641	699	303	747	1138	1948	2052	5157	487	360	
	1132	1132	637	179	1722	869	2008	1145	.	526	393	403	1095	983	1138	734	472	1442	323	
Sub-Total				4794	18736	10651	11636	9082	9013	7111	6339	4637	7398	9017	9127	9620	8822	8268	11691	
301 - 400	.	256	610	.	344	630	1638	.	1000	1924	183	796	483	521	241	.	.	.	2925	
	.	263	614	.	154	399	184	.	164	16	12	120	683	274	303	.	.	.	256	
	.	593	617	3844	2464	4941	3865	2919	2227	7873	1476	3044	3603	2680	6949	12226	3141	1199	1811	
	1027	494	623	308	3588	1938	6167	3346	4322	5040	3698	1732	4159	1152	591	2533	2215	2496	3906	
	850	888	625	1437	4381	3075	3944	6783	3649	6294	917	649	6723	3701	1394	3747	1935	2479	2689	
	919	1113	626	1962	5453	10283	9604	18305	3890	2111	3683	4768	6046	2328	5332	28371	15373	6645	6899	
	1085	1085	628	529	1799	2685	3116	10764	5142	2763	719	1366	2837	4019	4444	5761	7311	891	8831	
	499	495	629	2682	6569	2179	6214	5900	4291	1429	622	354	518	3839	7928	5502	4226	1846	537	
	544	332	630	858	4800	3261	1561	5114	3821	4474	1429	1226	1100	3012	2633	2286	2900	3146	1228	
	2179	2067	633	4649	3487	6739	4178	7634	3474	6544	3178	3528	2288	6802	7941	8104	3911	2343	3587	
	2059	2059	638	1750	3952	7031	8115	2400	4792	2535	1686	2512	3399	5441	2775	9432	3905	4335	1272	
	1463	1463	639	1520	1381	1556	1266	1183	2362	2114	1330	1120	1667	937	862	1830	5228	1179	404	
Sub-Total				19538	38372	44717	49851	64348	39135	43117	18932	21215	33506	34705	41393	79791	50144	26559	34344	
401 - 500	.	30	613	.	51	192	92	.	64	6	6	47	511	43	72	.	.	.	59	
	632	691	622	2638	6896	11901	10364	13165	10064	11830	4285	5965	12425	7972	5578	12750	21597	6792	5107	
	1184	1255	627	18946	15576	22176	25568	45497	42775	11732	11721	12754	18257	22914	21080	36798	22020	23204	23619	
	1202	1321	631	10094	25499	14500	13683	18514	23958	20494	15856	13580	8550	17899	15925	20469	14880	17306	11464	
	198	69	640	179	105	59	37	39	144	103	44	96	39	25	165	56	54	39	11	
501 - 750	204	216	645	357	192	162	75	114	446	253	242	140	180	186	387	123	80	151	107	
	.	134	650	252	147	242	224	39	.	18	109	162	20	193	188	64	167	40	28	
Sub-Total				32466	48465	49232	50042	77367	77451	44436	32263	32743	39982	49232	43395	70261	58798	47532	40396	
501 - 750	584	230	641	227	394	197	369	1020	.	558	62	602	192	151	1382	329	280	993	1030	
	333	325	646	327	564	1180	158	84	436	811	205	323	239	122	291	717	130	134	514	
751 - 1000	.	359	651	1222	321	1361	1016	734	.	2603	899	754	199	508	1104	1595	407	788	493	
	Sub-Total				1777	1278	2739	1543	1838	436	3973	1166	1679	630	781	2777	2641	817	1916	2037
	931	418	642	1741	760	2036	2513	3081	2134	2677	892	1074	942	4877	1962	1991	1268	3535	1336	
	409	360	647	1087	749	2025	2961	2191	2465	3228	1301	1503	819	4436	1835	1434	.	2029	1135	
	.	516	652	2366	3585	2575	4843	3246	2591	6162	1366	2990	2034	3554	1247	2807	1169	2343	2480	
1001 - 1250	Sub-Total			5193	5094	6636	10317	8518	7190	12067	3560	5567	3794	12868	5044	6232	2438	7907	4951	
	1266	733	643	1487	2121	6830	5453	3480	1537	4660	2815	890	1865	2469	5074	3120	.	1935	2059	
	232	228	648	.	1641	1118	1687	1552	624	2891	763	475	376	186	422	1274	.	1628	868	
	.	531	653	1583	2306	1643	3660	3927	3045	2514	477	933	668	542	1344	1787	937	3309	654	
1251 - 1500	Sub-Total			3071	6068	9590	10800	8959	5207	10064	4055	2298	2910	3197	6839	6181	937	6872	3581	
	954	474	644	688	870	2036	2845	1480	1917	2084	137	998	760	1082	735	2436	.	2507	1158	
	263	212	649	.	387	1083	282	681	622	908	174	1125	427	437	87	172	.	209	15	
	.	479	654	1376	1016	3612	4808	3358	2287	4953	252	973	981	1241	773	1722	.	2253	911	
	Sub-Total			2063	2274	6732	7934	5519	4825	7944	563	3095	2168	2761	1595	4331	0	4969	2084	
Total biomass (t)				69206	120336	130547	142196	175632	143329	128721	67000	71453	90509	112580	110175	179096	121955	104031	99490	

Table 7 cont'd

Depth Range (m)	V1 Area	V4 Area	Stratum	2011	2012	2013	2014	2015	2016	2017
101 - 200	.	798	608	.	.	.	.	.	.	.
	.	445	612	.	.	1	.	.	.	.
	.	250	616	.	.	.	.	.	.	.
	1455	1347	618	481	35	50	20	27	134	136
	1588	1753	619	1855	98	40	22	28	125	87
Sub-Total				2337	134	90	42	54	259	223
201 - 300	.	342	609	.	.	.	.	.	.	.
	.	573	611	.	.	.	.	.	.	.
	.	251	615	.	.	323	.	.	.	.
	2709	2545	620	13352	1187	3393	1874	1942	1620	2384
	2859	2537	621	14581	5218	4733	3353	3613	3192	4380
	668	1105	624	2185	375	394	899	515	193	484
	447	.	632	.	.	.	.	.	.	.
	1618	1555	634	912	1117	581	1438	633	695	1459
	1274	1274	635	658	962	1732	1053	657	520	1036
	1455	1455	636	429	299	1987	1031	602	175	1882
	1132	1132	637	1879	1186	740	1379	521	1115	1742
Sub-Total				33996	10344	13883	11026	8481	7511	13367
301 - 400	.	256	610	.	.	.	.	.	.	.
	.	263	614	.	.	2322	.	.	.	.
	.	593	617	8302	6474	7237	3067	6994	504	545
	1027	494	623	4008	8985	8145	1929	6448	4455	12999
	850	888	625	4128	3821	1648	9312	4417	836	873
	919	1113	626	5429	6165	19534	28639	3940	11326	8768
	1085	1085	628	2593	922	6370	2596	2489	2829	2353
	499	495	629	1628	4396	774	8859	3757	4471	422
	544	332	630	2660	4137	6418	5286	2037	2309	1715
	2179	2067	633	2335	3688	856	881	981	1997	492
	2059	2059	638	3479	1513	5616	6950	2708	576	1718
	1463	1463	639	405	111	1024	864	650	469	1125
Sub-Total				34967	40213	59945	68383	34420	29772	31010
401 - 500	.	30	613	.	.	195	.	.	.	.
	632	691	622	5238	23531	13563	17532	28859	6211	15586
	1184	1255	627	28132	16741	29604	42129	22689	14161	14968
	1202	1321	631	15341	20091	18444	17316	19111	18571	5207
	198	69	640	38	45	17	34	112	64	19
	204	216	645	372	137	78	80	208	206	243
	.	134	650	132	36	38	53	56	.	53
Sub-Total				49252	60580	61938	77144	71033	39213	36075
501 - 750	584	230	641	112	37	216	414	583	188	246
	333	325	646	251	129	331	298	712	632	382
	.	359	651	1118	474	1239	872	1213	667	759
Sub-Total				1481	639	1787	1584	2508	1487	1387
751 - 1000	931	418	642	448	585	492	873	860	1178	491
	409	360	647	1360	1312	1065	770	343	1415	523
	.	516	652	1049	1293	674	1885	1369	1533	1214
Sub-Total				2856	3190	2232	3527	2573	4127	2229
1001 - 1250	1266	733	643	288	1096	1060	2844	1294	2398	1583
	232	228	648	601	761	1105	258	632	1737	608
	.	531	653	703	84	557	1622	459	1305	385
Sub-Total				1592	1941	2723	4725	2385	5440	2576
1251 - 1500	954	474	644	1021	646	94	635	1046	1111	317
	263	212	649	430	22	140	324	426	1065	584
	.	479	654	1251	1261	881	653	612	.	325
Sub-Total				2702	1930	1115	1612	2085	2175	1226
Total biomass (t)				129183	118971	143712	168044	123539	89984	88094

Table 8 Biomass (tons) by stratum from Canadian spring surveys in Div. 3L 1996-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
30 - 56	268	784		.	.	0	0	.	0	0	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
57 - 92	2071	2071	350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	1780	1780	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1121	1121	371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2460	2460	372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1120	1120	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	465	785		.	.	0	0	.	0	0	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
93 - 183	1519	1519	328	0	0	0	0	18	0	0	0	1	13	0	0	0	0	0	0	0	8	5		23	
	1574	1574	341	2	0	14	0	26	0	0	0	0	0	0	0	0	2	0	8	0	216			0	
	585	585	342	0	0	5	0	0	0	0	0	0	0	0	1	0	2	0	0	0	46			4	
	525	525	343	0	0	2	0	0	0	0	0	0	30	0	0	0	0	7	0	0	4			0	
	2120	2120	348	1	9	0	0	0	0	0	0	0	1	5	0	0	5	1	0	6	6			3	
	2114	2114	349	1	0	11	0	14	2	0	0	0	5	0	0	0	3	41	0	4			25		
	2817	2817	364	0	6	0	0	0	1	0	1	0	0	0	0	0	0	0	0	7			0		
	1041	1041	365	1	0	0	14	0	0	0	0	0	45	41	0	1	0	6	6	0	14	10		0	
	1320	1320	370	0	0	0	0	0	0	0	0	0	0	0	43	0	1	0	1	0	1	1		0	
	2356	2356	385	0	0	0	0	0	0	0	0	12	0	0	0	4	0	0	0	2	5			0	
	1481	1481	390	0	24	0	0	6	0	0	0	0	9	0	0	0	0	0	0	1	0			0	
	84	786		.	.	0	0	.	0	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.
	613	787		.	.	0	0	.	0	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.
	261	788		.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	89	790		.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	72	793		.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	216	794		.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	98	797		.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	72	799		.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				5	39	32	26	64	4	0	2	13	103	42	49	6	3	13	19	50	32	303	0	55	0
184 - 274	1494	1582	344	3	59	0	21	24	3	0	31	34	23	0	2	44	0	0	7	93	19	6		1	
	983	983	347	1	5	0	0	1	0	0	0	0	32	0	665	3	0	1	63	9	8	20		7	
	1394	1394	366	6	169	10	30	0	1	48	148	255	236	44	861	10	209	9	80		20	13		25	
	961	961	369	1	2	79	17	0	1	0	464	0	199	943	1078	48	4	70	12	85	46	12		3	
	983	983	386	1	84	11	633	0	0	0	0	115	494	2078	309	5	0	151	96	95	185	115		53	
	821	821	389	38	435	122	435	1070	143	3	2	36	994	909	1595	692	1	295	379	1042	2	75		1	
	282	282	391	9	3	43	0	4	3	16	58	0	238	274	872	65	3	33	6	68	33	8		2	
	164	795		.	.	.	0	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	72	789		.	.	.	18	.	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
	227	791		.	.	.	113	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				58	758	267	1268	1099	150	67	702	440	2214	4249	5381	866	217	559	644	1392	313	249	0	90	0
275 - 366	1432	1432	345	335	892	302	926	891	495	566	441	1953	429	333	3510	347	533	208	2495	1426	1450	864		417	
	865	865	346	354	1372	639	338	366	513	245	307	469	789	645	2372	100	662	273	592	2384	507	726		563	
	334	334	368	137	216	263	228	456	311	327	703	241	362	1826	638	147	894	169	127	1396	189	62		70	
	718	718	387	208	2514	2585	2026	4356	439	97	359	724	2967	2600	3783	3905	390	546	380	5341	513	410		370	
	361	361	388	304	382	1404	464	482	220	223	608	989	332	483	1413	894	433	432	147	793	100	135		755	
	145	145	392	288	117	464	100	143	85	74	248	111	356	122	303	157	20	59	25	118	34	27		52	
	175	796		.	.	.	7	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	100	798		.	.	.	23	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	81	800		.	.	.	210	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				1626	5494	5658	4322	6694	2064	1532	2667	4488	5235	6009	12019	5549	2932	1686	3766	11458	2793	2224	0	2227	0
367 - 549	186	186	729	803	236	3921	1351	1286	555	407	589	724	292	187	802	798	164	.	203	157	556	127		247	
	216	216	731	897	299	3531	1284	1725	664	217	1336	496	288	507	437	367	296	488	302	266	180	32		226	
	468	468	733	3016	3003	7556	3311	2290	1139	847	3444	1138	2315	943	2067	2456	8	1446	283	1562	745	413		361	
	272	272	735	302	4063	5100	4332	4656	2186	939	598	1207	1685	977	1027	1658	374	2128	220	1835	444	1125		353	
	50	792		.	.	.	533	.	903	.	148	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sub-Total				5019	7601	20108	10810	9958	5447	2410	6115	3566	4580	2614	4334	5279	843	4062	1008	3821	1925	1698	0	1186	0
550 - 731	170	170	730	245	0	1693	292	745	772	177	53	54	129	160	120	559	1157	683	50	31	87	78		254	
	231	231	732	462	1420	3220	1219	996	1173	533	465	560	354	105	560	957	331	731	.	361	89	357		1128	
	228	228	734	1327	1361	4169	1324	2887	621	362	367	592	459	255	466	.	81	5239	453	622	123	47		181	
	175	175	736	791	1793	5037	3463	4372	2804	1378	1747	259	1923	915	5514	4945	35	1976	2582	450	994	786		652	
Sub-Total				2826	4574	14118	6297	9001	5370	2449	2632	1466	2865	1434	6659	6461	1604	8629	3086	1463	1293	1269	0	2215	0
732 - 1463	Deepwater Strata not sampled during spring surveys.																								
Total Biomass (t)	9533	18467	40182	22724	26815	13035	6459	12118	9973	14997	14348	28442	18162	5599	14949	8523	18184	6355	5743					5777	



Table 9. Biomass (tons) by stratum from Canadian spring surveys in Div. 3N 1996-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<=56	1593	1593	375	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1499	1499	376	12	0	0	0	0	1	0	0	0	70	0	1	0	0	0	0	0	0	0	0	0	
				12	0	0	0	0	1	0	1	0	70	0	1	0	0	0	0	0	0	0	0	0	
	Sub-Total																								
57 - 92	2992	2992	360	19	349	130	471	183	23	0	0	71	62	0	0	0	0	0	5	0	3	0	0	0	
	1853	1853	361	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2520	2520	362	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0		
	2520	2520	373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
	931	931	374	9	0	0	0	0	0	73	0	0	0	0	0	0	0	0	0	0	0	0	0		
	674	674	383	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
				53	349	131	471	183	29	73	3	71	202	0	2	0	0	0	5	0	3	2	0	0	
	Sub-Total																								
93 - 183	421	421	359	145	133	31	165	96	19	0	2	4	133	.	0	30	0	58	17	17	0	5	1	0	
	100	100	377	6	4	0	321	0	0	0	0	0	25	.	51	12	1	0	4	3	0	0	0		
	647	647	382	0	0	76	0	20	0	0	0	1	356	.	0	49	0	0	1	0	3	3	0		
	Sub-Total			151	136	107	486	116	19	0	2	6	514	0	51	91	1	58	22	20	4	8	0	1	
184 - 274	225	225	358	259	677	413	458	46	17	29	118	51	27	.	5	0	0	31	80	1	4	30	0	0	
	139	139	378	48	37	49	719	4	14	6	82	7	15	.	120	21	8	12	31	6	36	0	0		
	182	182	381	178	90	10	217	33	7	0	41	0	92	.	610	285	35	71	0	5	9	49	2		
	Sub-Total			485	805	471	1394	82	38	35	240	58	133	0	734	306	43	113	111	12	48	78	0	2	
275 - 366	164	164	357	57	82	375	17	4	43	0	13	134	26	.	12	2	17	179	325	113	0	3	0		
	106	106	379	85	183	170	1047	312	28	88	736	16	29	.	297	6	1	10	2	80	15	25	1		
	116	116	380	117	162	58	43	53	28	19	287	72	220	.	176	135	21	4	9	37	9	1	15		
	Sub-Total			260	427	603	1107	368	98	107	1036	221	275	0	484	144	39	193	337	230	24	28	0	17	
367 - 549	155	155	723	333	134	300	68	173	71	24	60	27	25	.	35	15	0	61	12	19	165	36	0		
	105	105	725	242	952	130	37	289	150	68	153	15	201	.	148	14	53	37	439	97	14	71	0		
	160	160	727	389	1482	1499	328	843	358	22	315	219	174	.	348	431	0	45	34	106	218	192	279		
	Sub-Total			964	2568	1928	433	1305	578	114	527	261	400	0	531	461	53	143	484	221	397	299	0	279	
550 - 731	124	124	724	196	142	368	575	114	95	201	142	72	24	.	92	0	308	107	210	.	73	52	19		
	72	72	726	93	254	1463	63	257	139	52	125	91	45	.	36	61	90	553	176	203	21	126	231		
	156	156	728	1226	.	576	1475	1804	1088	222	686	642	79	.	428	1082	543	787	193	363	307	185	357		
	Sub-Total			1514	396	2407	2113	2175	1323	475	954	805	149	0	556	1143	941	1447	579	566	400	363	0	607	
732 - 1463	Deepwater Strata not sampled during spring surveys.																								
Total Biomass (t)				3428	4681	5647	6003	4228	2084	805	2762	1422	1673	0	2358	2144	1078	1955	1538	1050	875	779		907	

Table 10 Biomass (tons) by stratum from Canadian spring surveys in Div. 30 1996-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
57 - 92	2089	2089	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
	456	456	331	0	0	16	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0		0	
	1898	1898	338	478	40	62	0	0	0	2	0	13	0	9	0	0	0	0	9	0	0	0		0	
	1716	1716	340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
	2520	2520	351	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		0	
	2580	2580	352	114	48	0	0	0	0	3	0	0	0	0	0	0	0	0	0	75	1	0		0	
	1282	1282	353	119	146	331	2	25	0	3	0	1	84	57	0	0	1	0	16	0	0	8		0	
Sub-Total			710	234	409	2	25	0	8	0	14	84	66	1	0	1	0	26	75	2	8	0	1	0	
93 - 183	1721	1721	329	1	13	0	0	1	1	0	0	0	14	.	0	0	28	0	0	1	12	44		0	
	1047	1047	332	148	376	475	0	4	0	1	6	24	62	.	0	0	0	2	47	0	0	17		1	
	948	948	337	179	139	4	0	3	31	1	91	17	37	.	13	1	0	0	15	0	0		10		
	585	585	339	0	2	8	0	0	33	0	0	0	0	21	26	17	4	0	4	0	10	1		0	
	474	474	354	807	122	330	3	0	11	22	8	25	43	.	1	6	5	2	29	0	6	0		9	
Sub-Total			1135	651	817	3	8	76	24	106	67	157	21	39	24	37	4	80	16	28	63	0	21	0	
184 - 274	151	147	333	5	62	23	0	9	0	8	0	2	12	.	0	10	1	5	0	0	1	0		0	
	121	121	336	100	168	11	0	7	3	8	11	6	15	.	0	16	0	7	2	0	0	0		1	
	103	103	355	249	168	20	0	3	84	5	46	42	13	.	26	12	11	12	12	0	0	2		29	
	Sub-Total			355	398	54	0	18	87	21	57	50	40	0	26	38	12	24	14	0	1	2	0	31	0
275 - 366	92	96	334	20	39	6	2	1	0	1	0	0	3	.	0	1	2	1	1	0	0	1		0	
	58	58	335	9	92	15	0	2	0	0	0	1	1	.	1	0	0	4	0	0	0	0		0	
	61	61	356	161	68	47	1	0	3	1	7	1	3	.	34	17	6	1	1	2	0	0		0	
	Sub-Total			190	199	68	3	3	3	3	7	2	7	0	34	17	8	5	1	2	0	2	0	0	0
367 - 549	93	166	717	42	165	55	0	0	1	0	0	6	0	.	0	0	18	1	19	25	0	0		.	
	76	76	719	9	24	29	1	8	0	21	0	23	18	.	0	14	5	1	45	0	1	1		0	
	76	76	721	161	59	112	5	30	1	8	2	7	3	.	0	0	28	2	67	20	2	14		0	
	Sub-Total			212	248	196	7	39	3	30	2	36	20	0	0	14	51	4	131	45	3	15	0	0	0
550 - 731	111	134	718	70	116	154	11	26	8	41	60	73	56	.	35	338	45	27	136	35	63	92		.	
	105	105	720	29	61	111	4	45	23	3	12	63	122	.	36	148	117	27	.	45	0	7		0	
	93	93	722	57	176	203	23	120	23	43	3	86	51	.	240	187	42	160	368	116	188	126		13	
	Sub-Total			156	353	467	37	191	55	87	74	222	230	0	310	673	204	213	504	195	251	226	0	13	0
732 - 1463	Deepwater Strata not sampled during spring surveys.																								
Total Biomass (t)				2757	2084	2010	53	284	224	173	245	391	538	88	412	766	313	250	755	333	284	315		66	

Table 11. Biomass (tons) by stratum from Canadian autumn surveys in Div. 3L 1996-2017

Depth Range (m) V1 Area V4 Area Stratum			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
30 - 56	268	784	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
			57 - 92	2071	2071	350	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	1	0	0	0	
93 - 183	1780	1780	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		
	1121	1121	371	3	0	0	24	0	0	0	0	0	0	0	0	0	0	20	0	0	1	0	0	0		
	2460	2460	372	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	1	0	0	0	0	0		
	1120	1120	384	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		
	465	785	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7		
	Sub-Total			3	0	0	24	0	0	1	0	0	4	0	3	0	0	20	0	1	0	0	0	8		
	1519	1519	328	1	6	1	11	18	0	1	0	0	2	0	0	2	0	3	4	36	49	11	18	35		
	1574	1574	341	2	249	184	0	6	0	13	0	22	0	20	0	0	2	4	0	154	477	34	6	50		
	585	585	342	1	84	16	0	6	0	0	0	4	28	0	0	0	0	0	0	0	0	19	26	6		
	525	525	343	0	34	45	0	1	0	0	0	43	0	17	0	0	0	0	0	0	0	0	3	22		
	2120	2120	348	2	129	177	216	22	2	23	0	162	427	336	3	77	0	2	374	87	1640	35	69	57		
	2114	2114	349	2	60	252	416	0	0	0	2	47	182	21	0	0	4	31	195	17	13	2	1	22		
	2817	2817	364	0	103	414	30	0	1	6	0	56	64	0	2	82	6	14	90	68	171	32	0	11		
	1041	1041	365	0	169	140	55	.	0	0	0	0	444	258	2	41	0	15	574	427	244	0	12	127		
	1320	1320	370	14	48	871	555	19	1	55	23	.	0	277	0	141	0	39	168	192	458	0	294	275		
	2356	2356	385	64	502	334	253	29	47	190	69	348	273	233	554	565	17	107	833	871	262	43	68	178		
	1481	1481	390	67	200	625	310	69	497	222	13	193	332	118	350	127	64	264	311	12	52	126	115	35		
	184 - 274	84	786	67	2	4	.	0	0	0	0	0	1	.	.	.	.	.	.	.	.	.	.	.	.	
		613	787	1	86	0	.	0	0	0	0	0	59	0	1	.	.	.	.	.	.	.	.	.	.	
		261	788	0	45	31	.	0	0	0	0	0	0	4	10	.	.	.	4	.	.	.	.	.	.	
89		790	0	6	6	.	25	0	0	0	0	29	14	.	.	.	25	.	.	.	.	.	.	.		
72		793	0	4	4	.	0	0	5	0	0	0	53	.	.	.	0	.	.	.	.	.	.	.		
216		794	0	15	4	.	0	0	0	0	0	0	32	0	.	.	0	.	.	.	.	.	.	.		
98		797	0	3	14	.	0	0	0	0	0	23	0	0	.	.	0	.	.	.	.	.	.	.		
72		799	0	0	4	.	0	0	0	0	0	0	6	0	.	.	0	.	.	.	.	.	.	.		
Sub-Total				220	1745	3125	1846	193	549	516	108	985	1862	1292	911	1035	92	510	2549	1862	3367	0	300	612	819	
1494		1582	344	11	96	885	181	42	0	7	17	918	761	796	661	1783	65	14	678	1270	1716	84	219	316		
983		983	347	0	37	1021	297	160	88	28	0	476	338	1123	281	1903	23	206	1444	1358	1273	110	67	186		
1394		1394	366	338	878	2172	2108	62	265	689	119	.	2545	2185	2261	2365	496	277	1843	659	1605	87	359	959		
961		961	369	108	888	2347	719	85	296	55	278	.	3319	1720	829	2690	195	384	2567	1932	2070	289	529	817		
983		983	386	447	1010	1683	1129	473	337	998	453	.	3490	1741	652	758	1076	835	2223	1704	1719	550	2542	544		
821		821	389	900	875	474	673	727	1143	531	563	706	244	644	416	601	662	681	211	979	531	581	346	1010		
282		282	391	344	892	257	135	379	89	135	448	144	192	262	68	170	137	77	36	126	267	140	458	308		
791		791	391	193	151	.	201	2	10	12	81	182	.	.	.	.	130	.	.	.	.	.	.	.	.	
164		795	5	35	6	.	11	8	0	0	0	664	58	65	.	.	0	.	.	.	.	.	.	.	.	
Sub-Total				2153	4904	8997	5242	2140	2227	2453	1890	2989	11129	8537	5168	10269	2653	2604	9002	8028	9182	0	1842	4521	4140	
275 - 366		1432	1432	345	3747	1775	4359	1665	2659	1248	2343	2052	3998	2281	2488	2996	5552	2203	5051	5975	1638	7300	948	995	568	
	865	865	346	5483	2378	2062	1312	1020	1224	1045	4602	3555	3909	2960	2027	3288	1998	1350	1341	1567	1186	1048	1586	2186		
	334	334	368	690	338	2272	860	857	871	1829	1059	.	1106	581	968	2950	982	493	423	435	207	72	283	191		
	718	718	387	1765	1613	1609	5284	4896	4503	661	1147	.	586	2336	3862	1246	613	1462	435	607	1909	1344	2316	329		
	361	361	388	711	814	380	270	704	993	309	554	431	317	582	1047	388	542	29	97	186	71	110	106	115		
	145	145	392	500	618	215	170	234	116	53	266	165	137	77	93	61	107	59	57	25	35	31	40	270		
	72	789	0	14	10	.	12	1	0	1	67	18	2	.	.	.	.	.	.	.	.	.	.	.		
	227	791	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	175	796	37	355	289	.	154	96	41	2	318	385	380	.	.	.	383	.	.	.	.	.	.	.		
	100	798	76	108	152	.	226	19	50	38	806	1096	.	.	.	.	32	.	.	656	.	.	.	.		
	81	800	0	313	517	.	233	191	215	52	636	725	.	.	.	125	286	.	.	.	.	.	.	.		
	Sub-Total			13075	8325	11864	9560	10995	9262	6547	9773	9977	10562	9406	10994	13486	6570	9147	8328	4458	11364	0	3553	5326	3659	
	367 - 549	186	186	729	648	496	242	239	1002	438	100	218	139	13	103	149	81	52	85	38	38	130	88	30	29	
		216	216	731	0	713	305	1795	891	407	318	306	262	150	227	145	55	170	52	76	14	27	74	61	60	
		468	468	733	706	752	2535	1511	1321	906	312	949	364	1216	2248	488	172	317	115	198	335	582	108	311	31	
		272	272	735	1111	938	2093	2465	728	1504	1177	412	.	808	1457	1368	1125	1615	1578	.	346	389	646	471	246	
		50	792	186	349	608	0	316	69	31	200	1021	602	.	.	.	.	254	.	.	.	.	.	.	.	
		Sub-Total			2651	3247	5783	6011	4258	3324	1938	2085	1785	2790	4035	2149	1433	2153	2085	312	734	1128	0	916	873	366
		550 - 731	170	170	730	37	330	44	224	125	627	200	183	74	32	196	294	30	151	40	0	125	116	97	25	21
			231	231	732	463	590	705	519	858	319	152	430	130	226	123	377	152	244	437	86	60	95	71	233	346
228			228	734	642	604	515	184	554	671	214	124	.	34	136	131	205	928	126	407	126	41	321	424	234	
175			175	736	1117	951	1285	498	4028	1038	910	214	.	195	445	1862	864	721	593	186	851	450	486	233	470	
Sub-Total					2259	2476	2549	1425	5566	2655	1476	951	204	487	900	2664	1251	2044	1196	679	1162	702	0	975	916	1260
732 - 1463					Deepwater Strata not included.																					
Total Biomass (t)					20361	20697	32318	24108	23151	18018	12931	14808	15940	26829	24174	21886	27476	13512	15542	20890	16244	25745	7586	12249	10253	



Table 12. Biomass (tons) by stratum from Canadian autumn surveys in Div. 3N 1996-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<=56	1593	1593	375	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0		0	1	0
	1499	1499	376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1
	Sub-Total			0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0		0	1	1
57 - 92	2992	2992	360	744	1230	808	144	165	0	0	32	0	260	0	0	12	91	0	290	35	1		0	37	2
	1853	1853	361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
	2520	2520	362	0	0	0	0	0	0	2	0	12	0	0	0	0	0	0	0	0	0		0	0	1
	2520	2520	373	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1		0	0	0
	931	931	374	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	2
	674	674	383	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	48		0	0	0
Sub-Total			744	1245	808	144	165	0	2	33	12	260	0	3	12	105	0	290	35	50		0	40	7	
93 - 183	421	421	359	0	160	724	67	28	81	0	0	2	1	22	57	29	60	118	5	0	2		0	0	7
	100	100	377	4	166	30	21	30	1	0	10	7	58	0	11	0	43	52	26	9	0		0	0	17
	647	647	382	0	24	111	0	0	0	96	0	1	42	0	297	5	105	39	73	52	0		0	1	242
Sub-Total			4	350	865	88	57	83	96	10	10	102	22	366	34	208	209	104	61	2		0	1	266	
184 - 274	225	225	358	140	94	42	13	5	488	1	8	4	4	12	0	6	7	7	2	0	0		0	0	107
	139	139	378	112	262	2198	257	5	237	206	20	135	1	274	36	0	20	.	1	1	7		209	1	7
	182	182	381	802	615	1622	590	253	138	73	67	114	146	170	109	47	94	195	246	357	1		213	203	92
Sub-Total			1053	971	3862	860	263	864	280	95	253	151	456	145	53	121	202	249	358	8		423	204	207	
275 - 366	164	164	357	40	58	7	.	6	8	20	21	8	228	0	29	27	29	9	1	4	0		24	0	13
	106	106	379	581	41	31	22	36	404	98	59	629	26	15	21	172	12	51	242	14	2		22	1	43
	116	116	380	178	516	794	330	151	141	95	130	362	138	201	56	19	119	74	26	55	49		10	38	11
Sub-Total			800	614	832	352	193	553	214	210	998	391	217	106	218	159	134	270	73	51		57	39	66	
367 - 549	155	155	723	115	109	336	14	48	70	8	31	11	64	0	53	37	29	189	42	0	35		186	52	54
	105	105	725	165	1646	65	95	171	58	54	42	.	52	16	104	30	251	.	59	42	64		252	33	501
	160	160	727	1006	371	509	494	391	570	211	209	342	224	19	167	183	174	200	66	259	38		66	39	359
Sub-Total			1285	2127	910	602	610	699	273	282	354	341	35	324	250	455	389	167	302	136		505	123	913	
550 - 731	124	124	724	160	589	374	126	67	62	154	.	122	99	193	250	156	194	89	46	12	45		52	30	234
	72	72	726	296	448	765	55	30	517	214	136	52	74	104	80	72	510	63	146	58	36		73	496	441
	156	156	728	1035	455	675	511	201	299	510	291	1084	38	54	451	359	353	126	55	103	71		86	215	214
Sub-Total			1490	1491	1814	692	299	878	878	428	1257	211	352	781	586	1057	278	247	172	152		212	741	889	
732 - 1463				Deepwater Strata not included.																					
Total Biomass (t)				5377	6798	9091	2738	1587	3077	1743	1058	2885	1456	1081	1724	1153	2106	1212	1325	1003	399		1196	1147	2348

Table 13. Biomass (tons) by stratum from Canadian autumn surveys in Div. 30 1996-2017

Depth Range (m)	V1 Area	V4 Area	Stratum	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
57 - 92	2089	2089	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	3
	456	456	331	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	0	0
	1898	1898	338	39	195	38	39	0	0	0	26	16	0	0	2	5	2	0	4	0	0		0	0	0
	1716	1716	340	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1
	2520	2520	351	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
	2580	2580	352	4	21	46	0	0	4	0	0	0	0	0	0	9	0	0	0	0	0		0	0	28
	1282	1282	353	472	769	544	108	0	0	3	0	180	40	0	88	96	0	102	4	3	8		0	19	4
	Sub-Total			514	985	638	164	0	4	3	26	196	40	0	90	110	2	102	8	3	8		4	19	37
93 - 183	1721	1721	329	28	57	11	50	46	3	0	0	0	0	0	0	0	0	0	0	66	0		4	1	29
	1047	1047	332	25	81	74	0	0	0	0	16	26	0	0	7	0	0	0	0	0	2		2	19	5
	948	948	337	48	30	21	67	0	0	0	7	0	17	0	6	22	0	2	3	18	0		3	0	8
	585	585	339	0	103	8	.	46	16	0	1	0	0	0	181	60	0	4	0	0	264		16	6	1
	474	474	354	5	59	15	1094	95	71	24	84	39	6	77	5	0	6	0	0	0	0		0	0	29
	Sub-Total			106	329	130	1210	187	90	24	109	66	22	77	198	82	6	7	3	84	266		25	27	73
	184 - 274	151	147	333	.	10	0	0	3	0	0	0	5	0	0	0	5	0	0	0	0	0		0	0
121		121	336	3	7	5	0	0	0	0	12	5	0	0	0	33	.	1	0	0	0		0	.	1
103		103	355	39	22	3	1	0	1	5	3	25	2	9	2	29	0	0	0	0	1		0	0	8
Sub-Total				42	39	7	1	3	1	5	14	35	3	9	2	66	0	1	0	0	1		0	0	11
275 - 366	92	96	334	.	6	6	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0		1	0	3
	58	58	335	7	2	0	3	3	0	0	5	0	0	1	1	3	0	0	0	0	0		0	0	0
	61	61	356	8	6	8	8	9	6	7	0	2	1	0	3	1	0	0	2	0	0		0	0	0
	Sub-Total			16	14	14	12	12	6	7	5	2	1	2	4	4	0	0	3	2	0		1	0	3
367 - 549	93	166	717	.	42	27	6	0	72	0	27	1	3	0	51	25	0	6	0	54	0		0	1	39
	76	76	719	11	4	14	36	18	10	1	0	31	0	0	0	0	46	8	0	17	23		0	0	0
	76	76	721	50	35	47	26	23	42	5	25	0	6	1	34	15	0	72	22	11	0		0	0	0
	Sub-Total			61	82	89	67	41	124	5	52	33	9	1	85	40	46	86	22	82	23		0	1	40
550 - 731	111	134	718	.	131	158	186	20	26	107	355	35	82	.	265	432	77	76	193	87	19		13	11	3
	105	105	720	82	.	92	105	181	141	152	131	17	79	34	101	60	35	108	145	64	174		66	1	39
	93	93	722	153	490	124	160	73	106	40	437	23	109	84	100	93	494	291	51	53	71		55	44	.
	Sub-Total			235	621	374	451	274	273	299	923	76	271	119	466	585	606	476	390	204	264		133	56	42
732 - 1463	Deepwater Strata not included																								
Total Biomass (t)	974	2070	1253	1905	518	497	343	1129	407	346	208	845	886	660	671	426	375	562				163	102	205	

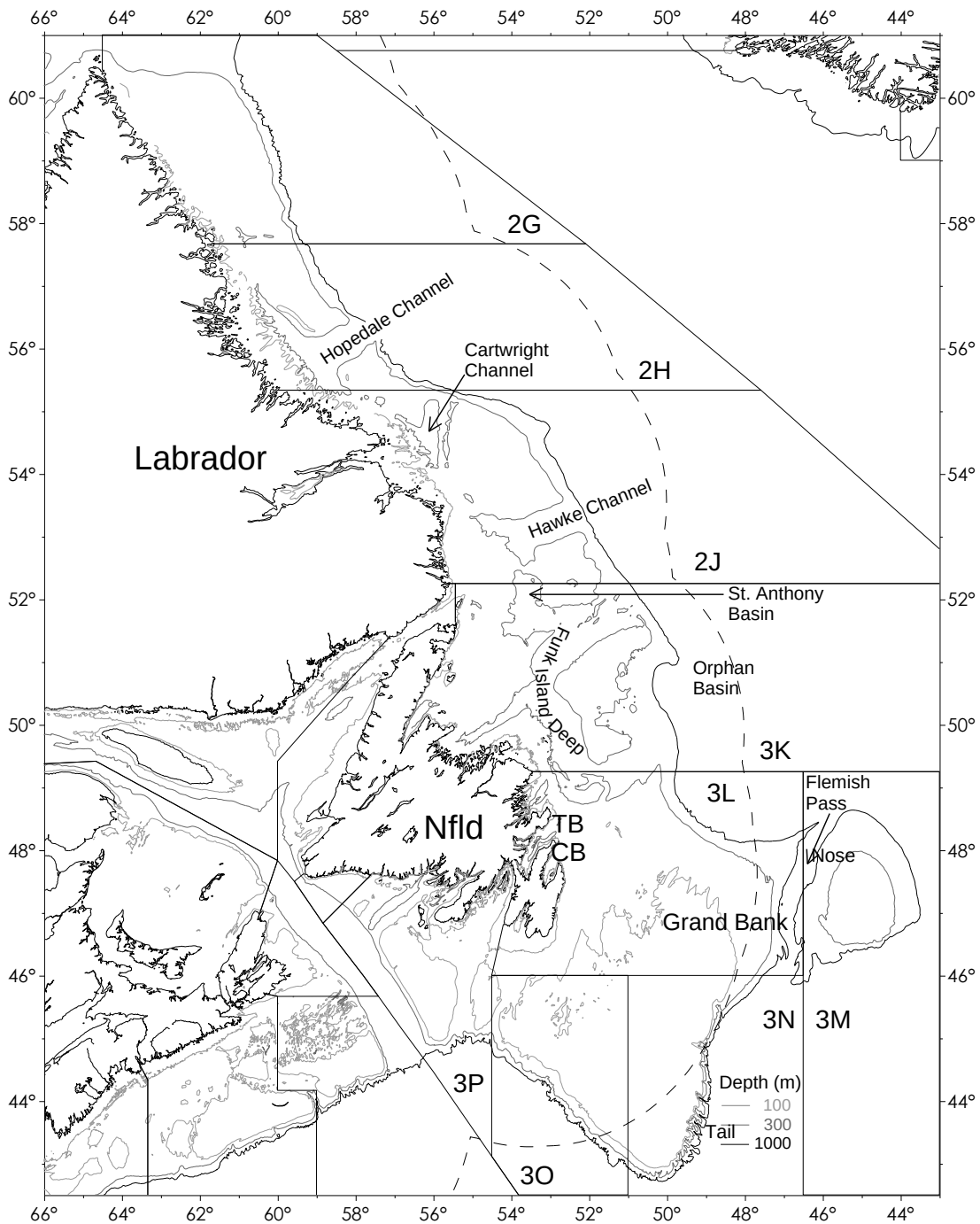


Fig. 1. Map of stock area, with NAFO dividing lines, select isobaths. TB and CB refer to Trinity and Conception Bays, respectively.

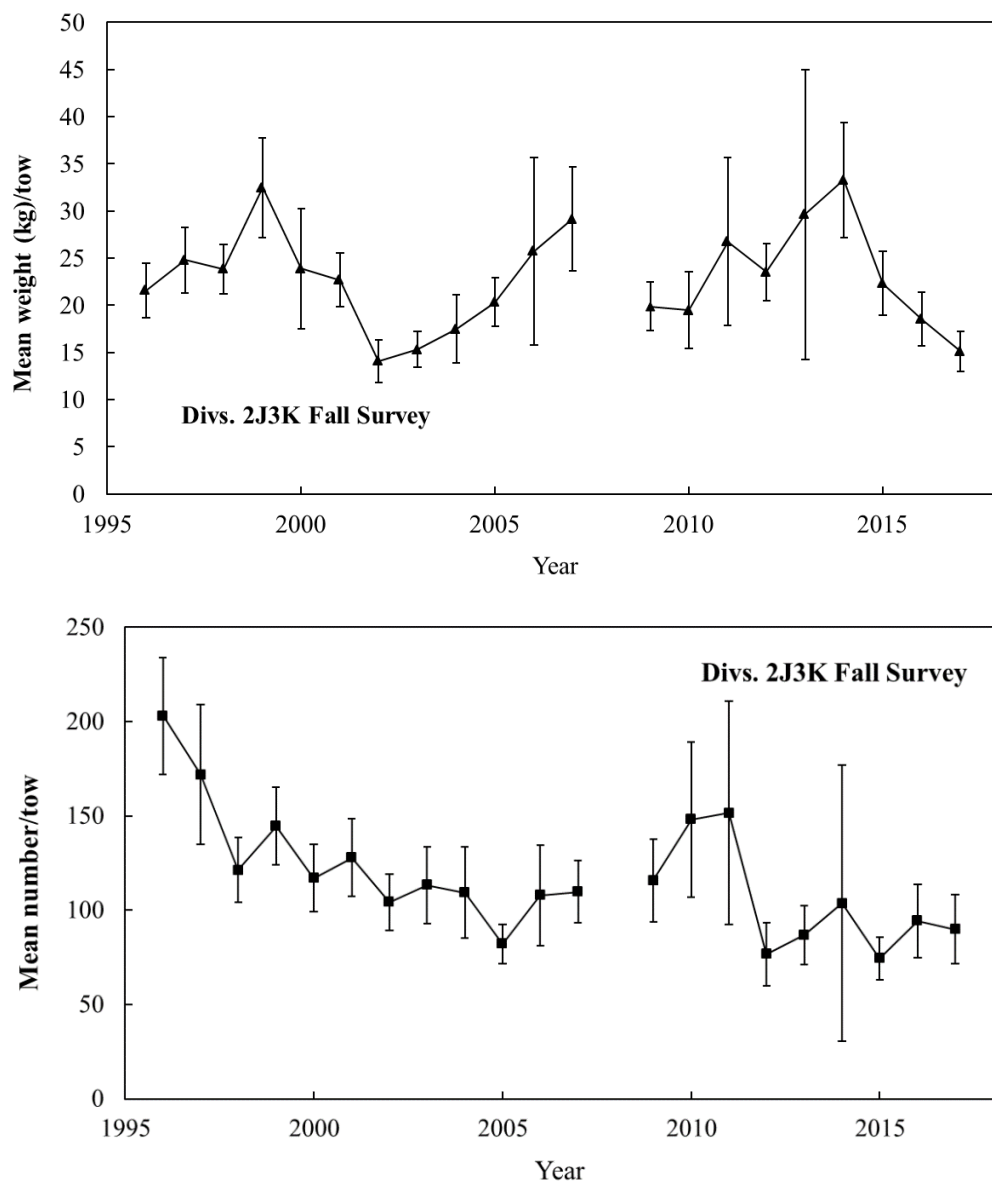


Fig. 2. Mean weight (Kg) and mean number per tow from Canadian autumn surveys of Div. 2J3K from 1996-2017.

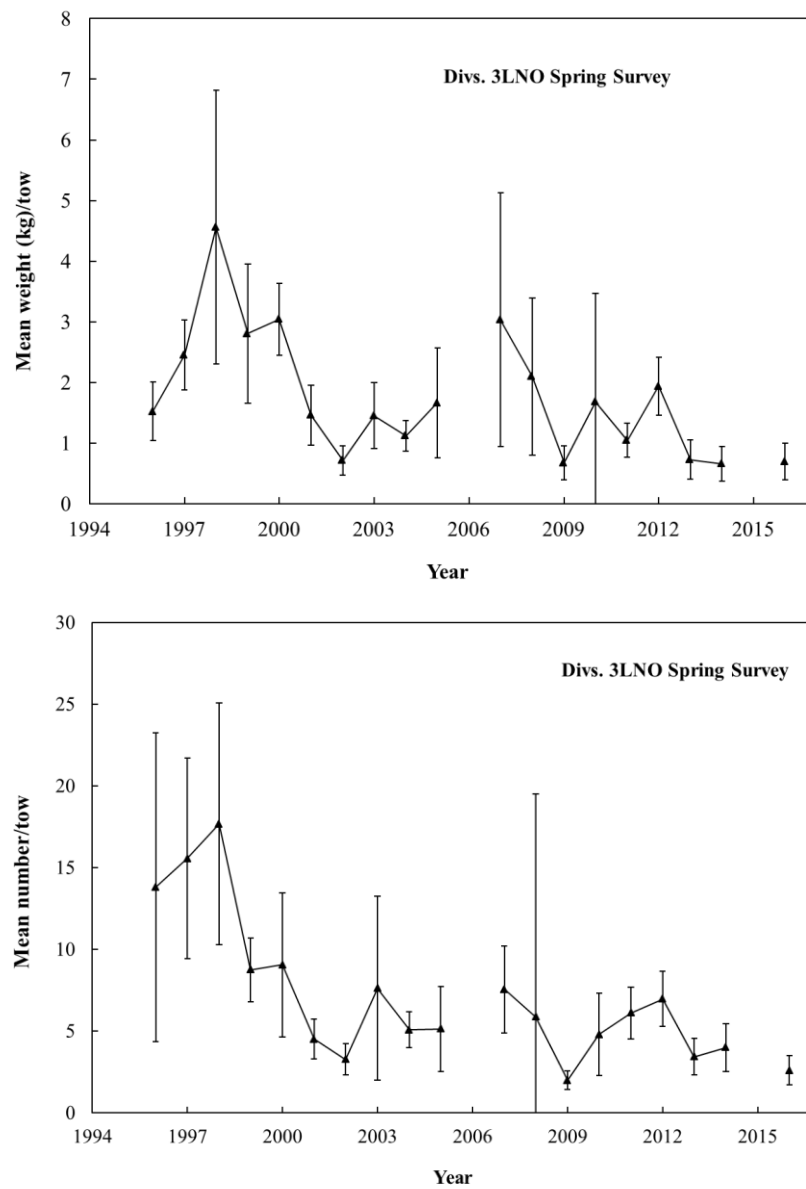


Fig. 3. Mean weight (Kg) and mean number per tow from Canadian spring surveys of Div. 3LNO from 1996-2017. Note survey in 2017 incomplete and not shown on graph.

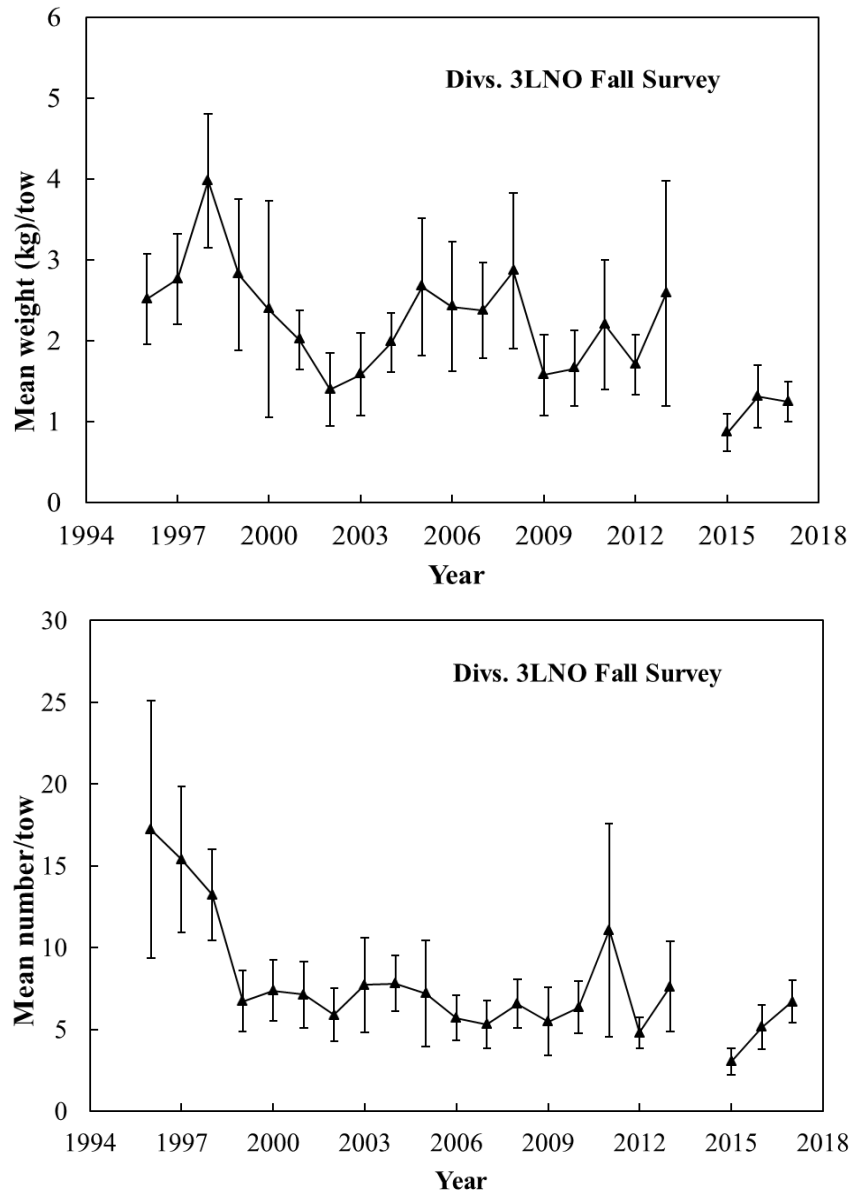


Fig. 4. Mean weight (Kg) and mean number per tow from Canadian autumn surveys of Div. 3LNO from 1996-2017.

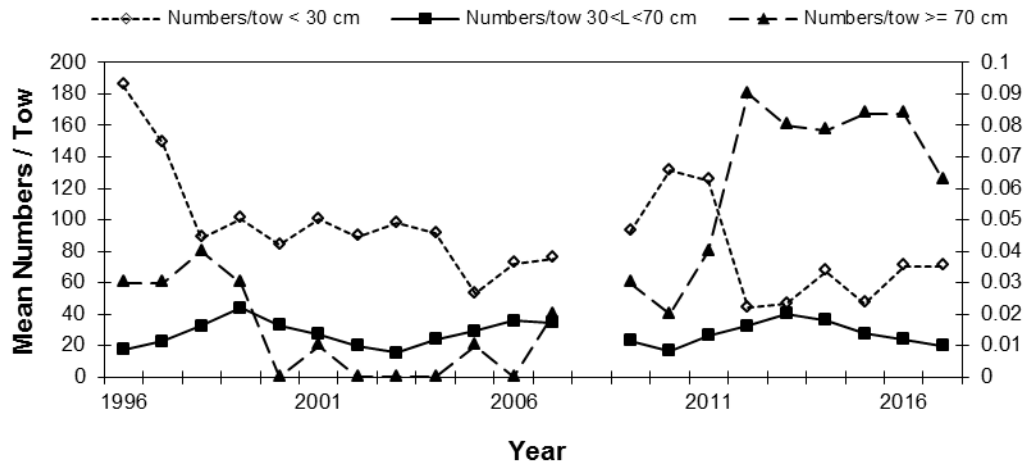


Fig. 5. Mean number per tow by size class from Canadian autumn surveys of Div. 2J3K from 1996-2017. Mean number per tow for the ≥ 70 cm category is given on the right y-axis.